ORIGINAL

LAW OFFICES

ROSE, SUNDSTROM & BENTLEY, LLP

2548 BLAIRSTONE PINES DRIVE
TALLAHASSEE, FLORIDA 32301

(850) 877-6555
Fax (850) 656-4029
www.rsbattorneys.com

CHRIS H. BENTLEY, P.A.
ROBERT C. BRANNAN
F. MARSHALL DETERDING
MARTIN S. FRIEDMAN, P.A.
JOHN R. JENKINS, P.A.
STEVEN T. MINDLIN, P.A.
DAREN L. SHIPPY
WILLIAM E. SUNDSTROM, P.A.
DIANE D. TREMOR, P.A.
JOHN L. WHARTON

ROBERT M. C. ROSE, *OF COUNSEL*
WAYNE L. SCHIEFELBEIN, *OF COUNSEL*

CENTRAL FLORIDA OFFICE
650 S. NORTH LAKE BLVD., SUITE 420
ALTAMONTE SPRINGS, FLORIDA 32701
(407) 830-6331
FAX (407) 830-8522

October 18, 2002
VIA HAND DELIVERY

02 OCT 18 PM 4:20
COMMISSION CLERK
RECEIVED -FPSC

Blanca S. Bayo, Director
Division of the Commission Clerk
and Administrative Services
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, Florida 32399-0850

Re: Aloha Utilities, Inc.; PSC Docket No. 010503-WU - Water Rate Case
Our File No. 26038.35

PSC Docket No. 960545-WS - Water Quality Investigation
Our File No. 26038.17

Dear Ms. Bayo:

Attached are the original and fifteen copies of the 2002 Water Facilities Upgrade Report for Aloha Utilities, Inc.'s Seven Springs water system as required pursuant to the provisions of Order No. PSC-02-0593-FOF-WU and Order No. PSC-02-1056-PCO-WU in Docket No. 010503-WU.

Appendix A to this report is the final report through the investigation, bench tap and pilot scale testing of the pilot project undertaken to comply with the provisions of Order No. PSC-00-1285-FOF-WS issued in Docket No. 960545-WS on July 14, 2000. Unless and until additional requirements are imposed by DEP during any subsequent design and permitting of the plant to implement this treatment alternative, this constitutes the final report on the pilot project.

Based upon the above, this report is filed to comply not only with the requirements of Order Nos. PSC-02-0593-FOF-WU and PSC-02-1056-PCO-WU in Docket No. 010503-WU, but also to constitute what is expected to be the final report to be filed in Docket No. 960545-WS required by Order No. PSC-00-1285-FOF-WS.

If you have any questions in this regard, please let me know.

Sincerely,

ROSE, SUNDSTROM & BENTLEY

F. Marshall Deterding
For The Firm

AUS ___
CAF ___
CMP ___
COM ___
CTR ___
ECR ___
GCL ___
OPC ___
MMS ___
SEC 1
OTH ___

FMD/tms
cc: Ralph Jaeger, Esquire
Mr. Stephen Watford
Robert C. Nixon, CPA
David Porter, P.E.

RECEIVED & FILED
RLM
FPSC-BUREAU OF RECORDS

DOCUMENT NUMBER-DATE
11373 OCT 18 02
FPSC-COMMISSION CLERK

2002 Water Facilities Upgrade Report

for

Seven Springs Water System

Pasco County, Florida

Prepared for:

Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655
(727) 372-0115

Prepared by:

David W. Porter, P.E.
3197 Ryans Court
Green Cove Springs, FL 32043
(904) 291-2744

October 2002

10/17/02

Table of Contents

Executive Summary

A. Report Purpose

During the disposition of Florida Public Service Commission (PSC) Docket No. 010503-WU: Petition for Water Rate Increase for the Seven Springs Water System, the Commission ordered Aloha Utilities, Inc. to prepare a report, within 90 days, that would show how Aloha proposes to remove 98% of the hydrogen sulfide in the raw water provided by its wells. This report has been prepared to comply with the Commission's order.

B. Interpretation of the Order Requiring Hydrogen Sulfide Removal

The PSC Commission's Order requiring 98% raw water hydrogen sulfide reduction sets a new and very high standard. This level of removal is substantially greater then that which can consistently be obtained by all standard hydrogen sulfide removal technologies under the majority of real-world conditions. It is also greater then that required of any water system in the State.

When the raw water hydrogen sulfide concentration is 5 mg/L or greater, a 98% reduction would result in a finished water hydrogen sulfide concentration of only 0.1 mg/L. This is an extremely low hydrogen sulfide concentration, which is just barely high enough to be reliably measured utilizing generally accepted field testing methods. When the raw water hydrogen sulfide concentration is less then 5 mg/L, a very low, and largely unattainable finished water hydrogen sulfide concentration would be needed to meet the 98% reduction requirement. For instance, if the raw water hydrogen sulfide concentration was 0.5 mg/L, the finished water hydrogen sulfide concentration would need to be 0.01 mg/L to meet the 98% reduction required by the Commission's order. This is not technically feasible. In addition, it would be virtually impossible to reliably measure a 0.01 mg/L finished water hydrogen sulfide concentration.

Until recently, only the enhanced packed tower aeration process was considered capable of reducing hydrogen sulfide levels in raw water to a value even approaching the value required by the Commission. When the raw water hydrogen sulfide concentration is 5 mg/L or greater, the enhanced packed tower aeration is generally considered to be "capable" of achieving a maximum 95% reduction in raw water hydrogen sulfide concentration. When raw water hydrogen sulfide concentrations fall below 5 mg/L, meeting the 95% reduction is not feasible.

As will be discussed later in this report, a new technology, known as the MIEX® Process, is "capable" of reducing raw water hydrogen sulfide levels to the 98% required by the Commission when the raw water hydrogen sulfide concentration is greater then 5 mg/L. As with all hydrogen sulfide removal processes, as the raw water hydrogen sulfide concentration falls below 5 mg/L, the hydrogen sulfide removal percent will all also be reduced. However, the MIEX® Process will consistently outperform the enhanced packed tower aeration process in overall hydrogen sulfide removal "capability" and is a technologically superior process overall. The MIEX® Process is discussed in detail later in this report.

For the purposes of this report, we have interpreted the Commission's Order to require Aloha to design a system that is "capable" of reducing raw water hydrogen concentration by 98% when raw water hydrogen sulfide concentration is equal to or greater then 5 mg/L. When raw water hydrogen sulfide concentration is less then 5 mg/L, hydrogen sulfide reductions of 98% are not technically possible. Even when raw water hydrogen sulfide is greater then 5 mg/L, numerous variables affect the performance of hydrogen sulfide reduction process equipment (such as air and water temperature, raw water pH, etc.). Therefore, it is further understood that no cost-effectively designed hydrogen sulfide reduction process is "capable" of meeting the 98% raw water hydrogen sulfide reduction requirement 100% of the time.

C. History

This report is actually the second major report to be prepared and submitted to the PSC related to hydrogen sulfide removal. On March 12, 1997, the PSC issued Order Number PSC-97-0280-FOF-WS pertaining to Dockets Number 950615-SU and 960545-WS. Section VI of the Order titled: Quality of Service Conclusion, states "The Utility shall evaluate the best available treatment technologies for removal of hydrogen sulfide. The Utility shall evaluate, as a minimum, the following types of treatment: tray aeration, packed tower aeration, ion exchange and reverse osmosis. This list is not meant to preclude Aloha from considering other treatments. For each treatment option which is analyzed the utility shall, at a minimum, calculate the expected hydrogen sulfide removal efficiency of the process, estimate the capital costs, estimate any additional annual operation and maintenance expenses, estimate the impact on customers' rates, and provide a schedule for installation of the treatment. Aloha shall also provide the capital costs and expected annual operation and maintenance expenses which have been incurred for the corrosion control program which it has already implemented. Aloha shall also indicate which treatment option it recommends. This report shall be filed with the Commission within three months of the issuance of this Order. Mr. Porter stated he could prepare an engineering report within two months, but we shall allow an extra month to provide for the requested financial information."

The first report was submitted to the Commission in June of 1997 as required by the Order. In the report, Aloha provided a number of alternative means of removing hydrogen sulfide. Centralized treatment utilizing enhanced packed tower aeration was found to be the most feasible option at that time. This first report provides a great deal of data, such as a description of the service area, the need for centralized treatment, projections of future water demands, etc. Much of the system descriptive data provided in the June 1997 report is, to a great extent, sufficiently current for use today. However, cost estimates were updated to reflect current regulatory requirements and prices where that data was used in this report. Please reference the June 1997 report if additional background data is desired.

By letter dated June 5, 1998, the Utility proposed to the Public Service Commission that it was ready to move forward with the construction of the facilities recommended in the June 1997 report, upon approval of such facilities by the Commission. By Order No. PSC-99-0061 FOF-WS issued January 7, 1999, the Commission found "Since the customers clearly do not wish to pay the significantly higher rates required for Aloha's proposed treatment upgrade, we do not believe it is appropriate for us to issue an order declaring that it is prudent for Aloha to construct the treatment facilities." Because the Commission specifically declined to recognize the prudence of Aloha constructing those improvements, they were not constructed.

By Order PSC-00-1285-FOF-WS issued in Docket Number 960545-WS on July 14, 2000, the Commission ordered Aloha Utilities, Inc. to develop a pilot project to study and investigate methods/processes which, when fully implemented, would result in a reduction of hydrogen sulfide in the raw water pumped from the wells which provide raw water for the Seven Springs Water System.

Initially, Aloha had intended to pilot test the enhanced packed tower aeration method identified in the first report to the PSC as a means of reducing hydrogen sulfide at its wells as its base-line technology.

However, after spending several months preparing for the enhanced packed tower aeration pilot testing, Aloha's consulting engineer received a telephone call from a Florida Department of Environmental Protection (FDEP) staff member informing him that Pasco County was pilot testing a new and revolutionary ion exchange process (the MIEX® Process) that not only appeared to remove hydrogen sulfide to high levels, but in addition, was capable of removing trihalomethane (THM) and haloacetic acid (HAA) precursors as well as sulfate. Aloha's engineer was urged to look into this process because it held the promise of not only removing hydrogen sulfide, but, also positioning Aloha to comply with USEPA's First and Second Stage Disinfection Byproducts Rule while also greatly increasing the aesthetic quality of Aloha's water. It was also claimed that the MIEX® Process would effectively reduce the sulfate concentration of the raw water as well.

The claimed benefits of the MIEX® Process, if realized, would position the MIEX® Process as technical superior to enhanced packed tower aeration for a number of reasons that included:

1. Unlike the enhanced packed tower aeration process, the MIEX® Process does not require complex and expensive pH adjustment and control to be applied prior to or after that treatment stage.
2. THM and HAA formation potentials would be reduced by removing total organic carbon (TOC) from the raw water.
3. Unlike the enhanced packed tower aeration process, the MIEX® Process is capable of reducing the concentration of sulfate in the raw water in addition to the sulfide levels. This allows the MIEX® Process to produce finished water with sulfate concentrations considerably lower then that which can be obtained with the enhanced packed tower aeration process. Reducing the finished water sulfate concentration is very important because when the quantity of sulfate available for conversion to sulfide in the customer's home water piping systems is reduced, the chance that "black water" conditions will exist in the home are also reduced. As such, the MIEX® Process will produce finished water that will be less susceptible to the conditions within the customer's homes that lead to "black water" problems.
4. The number and quantity of chemicals used in the process that would remain in the finished water were greatly reduced lowering operating costs substantially and improving the quality of the finished water. Also, no strong acid or alkali would be used with the MIEX® Process decreasing the health related risks that

the plant operators would be required to assume.

5. The overall color and taste of the finished water would be more aesthetically pleasing.

Based on conversations with Pasco County Utility management and their consulting engineer regarding the MIEX® Process pilot work that they had undertaken, the MIEX® Process appeared to able to provide the benefits claimed. Therefore, Aloha, after consultation with its consulting engineer, decided to undertake pilot testing of the MIEX® Process first and either cancel or delay pilot testing of enhanced packed tower aeration method depending on the level of success obtained with the MIEX® Process. Immediately after the decision to do so was made, Aloha's attorney notified the FPSC on December 21, 2000 of its intent to pilot test the MIEX® Process before the enhanced packed tower aeration process. Attached to this letter was information describing the MIEX® Process. General MIEX® Process literature is provided here in Appendix A.

The MIEX® testing showed that the process was very effective in removing sulfide, THM/HAA precursors, color, and to a lesser extent sulfate. The aesthetic quality of the water was also greatly enhanced. A report was prepared which presented the results of the MIEX® bench-top and pilot testing. Peer review was completed and the report finalized in September 2002. A copy of this report is provided in Appendix A.

After the report was finalized, Aloha's management and consulting engineer (in two separate meetings) met with Mr. Jeffry Greenwell, P.E., Potable Water Program Manager for the Southwest District Office of the FDEP to discuss the findings presented in the report and to discuss design and permitting of MIEX® facilities. On one occasion, Mr. Greenwell toured all the Seven Springs water facilities to learn first-hand how the system is currently configured. During his inspection, Mr. Greenwell saw first-hand the available size of each of the existing well sites. In a later conversation Mr. Greenwell had with Aloha's engineer, both agreed that there was no available space to construct additional facilities for wells 1, 6, 7, 8 and 9 and that centralization of the treatment and storage facilities for these sites would need to be undertaken. In addition, wells 3 and 4 already provide water to the existing ground storage facility located on Mitchell Ranch Road (targeted to become one of the three centralized water plants; the Mitchell Road WTP) and therefore, on-site treatment for these two wells was also not advisable for technical and economic reasons. The one existing well site that is large enough to allow for the addition of the needed treatment and water storage equipment is Well 2. This well site is the recommended site for location of the new Industrial Park WTP. Aloha already holds title to a lot located adjacent to existing Wells 8 and 9; this site is the chosen location for the third centralized plant; the Wyndtree WTP. Regarding the permitting process, Mr. Greenwell stated that since the pilot program began, he and the Department had received considerable information about the MIEX® Process and that at this point, no additional "demonstration" testing of the process would be required as was originally envisioned. Therefore, he stated that he was prepared to begin the permitting process for the three recommended MIEX® facilities as soon as Aloha's engineers were able to prepare design drawings, specifications and the permit applications. Therefore, the recommendations presented in the MIEX® pilot testing report concerning constructing and operating a "demonstration" plant no longer appear to be necessary at this time.

In 2002, the Commission issued an Order in Docket No. 010503-WU: Petition for Water Rate Increase for the Seven Springs Water System requiring Aloha to prepare a report, within 90 days, that would show how Aloha proposes to remove 98% of the hydrogen sulfide in the raw water provided by its wells. As discussed in Section 1, B above, this Order set a new standard for targeted hydrogen sulfide removal for this system.

D. Centralized MIEX® Treatment Plants Option

The MIEX® Process consists of a magnetized ion exchange resin used in a continuous process to remove anions such as sulfides, sulfates and TOC from drinking water. It is revolutionary in that it allows ion exchange to be used in large-scale facilities for the removal of these contaminants which was not considered practical prior to the introduction of this technology. The MIEX® process is discussed in detail in the pilot testing report found in Appendix A.

Three centralized MIEX® plants are recommended to treat the water obtained from Aloha's existing wells. The locations for the three plants are the same as those recommended in the 1997 report: one at Mitchell Ranch Road (at the existing water storage facility), one adjacent to Wells 8 and 9 near the Wyndtree development and the third at existing Well 2 located in the Industrial Park. These locations allow for balancing raw water feeds to the three plants, balancing the water production capacity of the three plants and minimizing the time of travel between water production plant and user (to minimize THM and HAA formation potential).

In addition to the construction of the three water plants, a number of pipelines will need to be constructed to bring raw water from the existing wells to the water plants. Also, main water distribution system loop connections are needed to allow the finished water from the new water plants to be delivered where it is needed within the existing distribution system. The centralization of the water plants, and therefore the upgrade of the water system, can not be accomplished without the addition of these pipelines.

E. Centralized Enhanced Packed Tower Aeration Treatment Plants Option

The enhanced packed tower aeration process consists of a complex and costly pH adjustment system and forced draft aerator with packed media used in a continuous process to remove dissolved gas (hydrogen sulfide) from drinking water. It was studied previously and a report was submitted to the PSC in June of 1997 describing this process in detail. Please refer to that report for additional information.

Three centralized enhanced packed tower aeration plants would be required to treat the water obtained from Aloha's existing wells. The locations for the three plants are the same as those recommended in the 1997 report: one at Mitchell Ranch Road (at the existing water storage facility), one adjacent to Wells 8 and 9 near the Wyndtree development and the third at existing Well 2 located in the Industrial Park. In addition to the construction of the three water plants, a number of pipelines will need to be constructed to bring raw water from the existing wells to the water plants. Also, main water distribution system loop connections are needed to allow the finished water from the new water plants to be delivered where it is needed within the existing distribution system. The centralization of the water plants, and therefore the upgrade of the water system, can not be accomplished without the addition of these pipelines.

F. Cost Comparison: MIEX® Treatment Plants and Enhanced Packed Tower Aeration

The total estimated budget cost for the three centralized MIEX® plants, the piping modifications and engineering and permitting is $15,920,283. The estimated budget cost for the annual purchase and supply of chemicals, power and labor is $2,388,800.

In contrast, the estimated budget cost of the enhanced packed tower aeration option identified in the June 1997 report, with technology and prices brought current, is $14,950,718. The estimated budget cost for annual supply of chemicals, power and labor is $4,102,800.

The estimated budget cost of the MIEX® option is $969,565 greater in capital cost then the enhanced packed tower aeration option. However, the estimated annual budget cost for supply of chemicals, power and labor is $1,714,000 less than that for the enhanced packed tower aeration plants. Therefore, the increased one-time capital cost of the MIEX® option is more than offset in annual chemical, power and labor costs and it will produce a far superior finished water.

The MIEX® option also provides a number of benefits that the enhanced packed tower aeration option does not. As stated above, the MIEX® option provides greater hydrogen sulfide removal capabilities, THM/HAA precursor reduction, sulfate removal capability and will enhance the finished water aesthetics. It is also important to note that if the enhanced packed tower aeration option was chosen for implementation, additional treatment modifications may be required in the future when the USEPA/FDEP Second Stage Disinfection Byproduct Rule is promulgated. The MIEX® treatment process proposed will produce finished water that meets the currently proposed Second Stage Disinfection Byproduct Rules. Therefore, overall long-term capital costs are reduced by selecting the MIEX® option at this time. The enhanced packed tower option offers none of these benefits.

Aloha believes that the MIEX® option is technically and economically far superior to the enhanced packed tower option, and it will position the Utility to proactively meet current and proposed USEPA and FDEP regulations and is much more cost effective.

G. Recommendations

The following recommendations are offered:

1. That the MIEX® option be selected for implementation because it is the one process that has the capability to reduce not only raw water sulfides, but also, raw water sulfates, therefore lowering the chance that customers will experience "black water" conditions in their home plumbing systems.
2. That the PSC formally approve this report and the data contained herein and Issue and Order stating that it agrees that implementation of the MIEX® option is the best choice to meet the PSC goals and objectives in requiring the addition of hydrogen sulfide removal equipment at Aloha's Seven Springs Water System.
3. That the PSC, by Order, direct Aloha to begin implementation of the MIEX® option and deem this implementation as a prudent, cost effective investment being undertaken for the benefit of the customers.

4. That the PSC provide Aloha with a means of funding the design, permitting, construction and operation of the MIEX® option as described herein through approved increases to rates and charges in advance of the Utility undertaking any portion of this work.

Section 1 – Introduction

A. Report Purpose

During the disposition of Florida Public Service Commission (PSC) Docket No. 010503-WU: Petition for Water Rate Increase for the Seven Springs Water System, the Commission ordered Aloha Utilities, Inc. to prepare a report, within 90 days, that would show how Aloha proposes to remove 98% of the hydrogen sulfide in the raw water provided by its wells. This report has been prepared to comply with the Commission's order.

It is important to note that a number of factors greatly influence the selection of any water treatment process designed to meet the PSC's hydrogen sulfide removal requirements. When a water system is upgraded, any modifications to the system must be approved and permitted by the FDEP. As part of the permitting process, the FDEP requires the design engineer to evaluate the water system and all its components to determine if their sizing, treatment capabilities, reliability and many other factors meet the **current** USEPA and FDEP regulations. It is at the time of major rule changes and/or when upgrades and modifications are undertaken that water systems must "come up to all standards." Often, prior to one of these events, a water system is "grandfathered" and allowed to operate under the conditions that prevailed when the plants were originally permitted, or, a new rule would specifically state that a plant must upgrade when it is next permitted.

A number of upgrades must be undertaken when the Seven Springs Water System is modified to meet the PSC's hydrogen sulfide requirements. Pasco County, from whom Aloha purchases finished water to supplement its own supplies, will soon change the chemistry of its water. This change will require Aloha to change its method of disinfection to chloramination. System reliability components (emergency power) will also have to be added to each water plant and at the wells. System water storage must be upgraded and greatly increased to meet treatment process requirements, fire flow requirements, and the increased detention time required when disinfection by chloramination is practiced.

The equipment needed to comply with the PSC's hydrogen sulfide reduction goals, the new storage tanks and all the other equipment required to bring the system up to current standards will not physically fit on any of the existing well sites except Well Number 2 (the proposed site of the Industrial Park centralized water treatment plant). Also, the locations of the wells (largely in residential areas) is such that the existing well sites are not compatible with the operation of the new equipment.

Aloha's management and consulting engineer (in two separate meetings) met with Mr. Jeffry Greenwell, P.E., Potable Water Program Manager for the Southwest District Office of the FDEP to discuss the findings presented in the report and to discuss design and permitting of MIEX® facilities. On one occasion, Mr. Greenwell toured all the Seven Springs water facilities to learn first-hand how the system is currently configured. During his inspection, Mr. Greenwell saw first-hand the available size of each of the existing well sites. In a later conversation Mr. Greenwell had with Aloha's engineer, both agreed that there was no available space to construct additional facilities for wells 1, 6, 7, 8 and 9 and that centralization of the treatment and storage facilities for these sites would need to be undertaken. In addition, wells 3 and 4 already provide water to the existing ground storage facility located on Mitchell Ranch Road (targeted to become one of the three centralized water plants; the Mitchell Road WTP) and therefore, on-site treatment for these two wells was also not advisable for technical and economic reasons. The one existing well site that is large enough to allow for the addition of the needed treatment and water storage equipment is Well 2. This well site is the recommended site for location of the new Industrial Park WTP. Aloha already holds title to a lot located adjacent to existing Wells 8 and 9; this site is the chosen location for the third centralized plant; the Wyndtree WTP.

In order to facilitate the centralization of the water system, three plants are proposed. One of these plants will consist of an upgraded to an existing plant (the Mitchell Road WTP), the other two plants will be new facilities. The decision to provide three plants, as opposed to one, two, or more than three, was based on technical as well as economic considerations. The costs associated with constructing raw water lines from the existing wells to the centralized plant(s) and finished water from the plant(s) to the distribution system were minimized by choosing the proposed plant locations. The three sites are located in close proximity to the wells that will supply the plants with raw water, therefore, the line construction costs, although substantial, are much lower then they would be for any other option. In addition, the locations of the three plants are in the general geographic areas which they will primarily serve. This is important as the time required from production of the water to the time it is received by the customer has a direct effect on the quality of the water and the level of THM/HAA that will exist in the water. The shorter the time, the lower the THM/HAA concentration will be. In addition, the shorter the time, the higher the aesthetic quality of the water will be.

B. History

This report is actually the second major report to be prepared and submitted to the PSC related to hydrogen sulfide removal. On March 12, 1997, the PSC issued Order Number PSC-97-0280-FOF-WS pertaining to Dockets Number 950615-SU and 960545-WS. Section VI of the Order titled: Quality of Service Conclusion, states "The Utility shall evaluate the best available treatment technologies for removal of hydrogen sulfide. The Utility shall evaluate, as a minimum, the following types of treatment: tray aeration, packed tower aeration, ion exchange and reverse osmosis. This list is not meant to preclude Aloha from considering other treatments. For each treatment option which is analyzed the utility shall, at a minimum, calculate the expected hydrogen sulfide removal efficiency of the process, estimate the capital costs, estimate any additional annual operation and maintenance expenses, estimate the impact on customers' rates, and provide a schedule for installation of the treatment. Aloha shall also provide the capital costs and expected annual operation and maintenance expenses which have been incurred for the corrosion control program which it has already implemented. Aloha shall also indicate which treatment option it recommends. This report shall be filed with the Commission within three months of the issuance of this Order. Mr. Porter stated he could prepare an engineering report within two months, but we shall allow an extra month to provide for the requested financial information."

The first report was submitted to the Commission in June of 1997 as required by the Order. In the report, Aloha provided a number of alternative means of removing hydrogen sulfide. Centralized treatment utilizing enhanced packed tower aeration was found to be the most feasible option at that time. This first report provides a great deal of data, such as a description of the service area, the need for centralized treatment, projections of future water demands, etc. Much of the system descriptive data provided in the June 1997 report is, to a great extent, sufficiently current for use today. However, cost estimates were updated to reflect current regulatory requirements and prices where that data was used in this report. Please reference the June 1997 report if additional background data is desired.

By letter dated June 5, 1998, the Utility proposed to the Public Service Commission that it was ready to move forward with the construction of the facilities recommended in the June 1997 report, upon approval of such facilities by the Commission. By Order No. PSC-99-0061 FOF-WS issued January 7, 1999, the Commission found "Since the customers clearly do not wish to pay the significantly higher rates required for Aloha's proposed treatment upgrade, we do not believe it is appropriate for us to issue an order declaring that it is prudent for Aloha to construct the treatment facilities." Because the Commission specifically declined to recognize the prudence of Aloha constructing those improvements, they were not constructed.

By Order PSC-00-1285-FOF-WS issued in Docket Number 960545-WS on July 14, 2000, the Commission ordered Aloha Utilities, Inc. to develop a pilot project to study and investigate methods/processes which, when fully implemented, would result in a reduction of hydrogen sulfide in the raw water pumped from the wells which provide raw water for the Seven Springs Water System.

Initially, Aloha had intended to pilot test the enhanced packed tower aeration method identified in the first report to the PSC as a means of reducing hydrogen sulfide at its wells as its base-line technology.

However, after spending several months preparing for the enhanced packed tower aeration pilot testing, Aloha's consulting engineer received a telephone call from a Florida Department of Environmental Protection (FDEP) staff member informing him that Pasco County was pilot testing a new and revolutionary ion exchange process (the MIEX® Process) that not only appeared to remove hydrogen sulfide to high levels, but in addition, was capable of removing trihalomethane (THM) and haloacetic acid (HAA) precursors as well as sulfate. Aloha's engineer was urged to look into this process because it held the promise of not only removing hydrogen sulfide, but, also positioning Aloha to comply with USEPA's First and Second Stage Disinfection Byproducts Rule while also greatly increasing the aesthetic quality of Aloha's water. It was also claimed that the MIEX® Process would effectively reduce the sulfate concentration of the raw water as well.

The claimed benefits of the MIEX® Process, if realized, would position the MIEX® Process as technical superior to enhanced packed tower aeration for a number of reasons that included:

1. Unlike the enhanced packed tower aeration process, the MIEX® Process does not require complex and expensive pH adjustment and control to be applied prior to or after that treatment stage.
2. THM and HAA formation potentials would be reduced by removing total organic carbon (TOC) from the raw water.
3. Unlike the enhanced packed tower aeration process, the MIEX® Process is capable of reducing the concentration of sulfate in the raw water in addition to the sulfide levels. This allows the MIEX® Process to produce finished water with sulfate concentrations considerably lower then that which can be obtained with the enhanced packed tower aeration process. Reducing the finished water sulfate concentration is very important because when the quantity of sulfate available for conversion to sulfide in the customer's home water piping systems is reduced, the chance that "black water" conditions will exist in the home are also reduced. As such, the MIEX® Process will produce finished water that will be less susceptible to the conditions within the customer's homes that lead to "black water" problems.
4. The number and quantity of chemicals used in the process that would remain in the finished water were greatly reduced lowering operating costs substantially and improving the quality of the finished water. Also, no strong acid or alkali would be used with the MIEX® Process decreasing the health related risks that the plant operators would be required to assume.
5. The overall color and taste of the finished water would be more aesthetically pleasing.

Based on conversations with Pasco County Utility management and their consulting engineer regarding the MIEX® Process pilot work that they had undertaken, the MIEX® Process appeared to able to provide the benefits claimed. Therefore, Aloha, after consultation with its consulting engineer, decided to undertake pilot testing of the MIEX® Process first and either cancel or delay pilot testing of enhanced packed tower aeration method depending on the level of success obtained with the MIEX® Process. Immediately after the decision to do so was made, Aloha's attorney notified the FPSC on December 21, 2000 of its intent to pilot test the MIEX® Process before the enhanced packed tower aeration process. Attached to this letter was information describing the MIEX® Process. General MIEX® Process literature is provided here in Appendix A.

The MIEX® testing showed that the process was very effective in removing sulfide, THM/HAA precursors, color, and to a lesser extent sulfate. The aesthetic quality of the water was also greatly enhanced. A report was prepared which presented the results of the MIEX® bench-top and pilot testing. Peer review was completed and the report finalized in September 2002. A copy of this report is provided in Appendix A.

After the report was finalized, Aloha's management and consulting engineer (in two separate meetings) met with Mr. Jeffry Greenwell, P.E., Potable Water Program Manager for the

Southwest District Office of the FDEP to discuss the findings presented in the report and to discuss design and permitting of MIEX® facilities. On one occasion, Mr. Greenwell toured all the Seven Springs water facilities to learn first-hand how the system is currently configured. During his inspection, Mr. Greenwell saw first-hand the available size of each of the existing well sites. In a later conversation Mr. Greenwell had with Aloha's engineer, both agreed that there was no available space to construct additional facilities for wells 1, 6, 7, 8 and 9 and that centralization of the treatment and storage facilities for these sites would need to be undertaken. In addition, wells 3 and 4 already provide water to the existing ground storage facility located on Mitchell Ranch Road (targeted to become one of the three centralized water plants; the Mitchell Road WTP) and therefore, on-site treatment for these two wells was also not advisable for technical and economic reasons. The one existing well site that is large enough to allow for the addition of the needed treatment and water storage equipment is Well 2. This well site is the recommended site for location of the new Industrial Park WTP. Aloha already holds title to a lot located adjacent to existing Wells 8 and 9; this site is the chosen location for the third centralized plant; the Wyndtree WTP. Regarding the permitting process, Mr. Greenwell stated that since the pilot program began, he and the Department had received considerable information about the MIEX® Process and that at this point, no additional "demonstration" testing of the process would be required as was originally envisioned. Therefore, he stated that he was prepared to begin the permitting process for the three recommended MIEX® facilities as soon as Aloha's engineers were able to prepare design drawings, specifications and the permit applications. Therefore, the recommendations presented in the MIEX® pilot testing report concerning constructing and operating a "demonstration" plant no longer appear to be necessary at this time.

In 2002, the Commission issued an Order in Docket No. 010503-WU: Petition for Water Rate Increase for the Seven Springs Water System requiring Aloha to prepare a report, within 90 days, that would show how Aloha proposes to remove 98% of the hydrogen sulfide in the raw water provided by its wells. As discussed in Section 1, B above, this Order set a new standard for targeted hydrogen sulfide removal for this system.

Section 2 – Centralized MIEX® Plants Descriptions

A. Overview

This section of the report discusses the provision of MIEX® Process units, finished water storage tanks and high service pumping units and all necessary appurtenant equipment required to produce three (3) centralized water facilities to upgrade the Seven Springs Water System.

B. Proposed Modifications to Existing Mitchell Road WTP

This facility will be supplied raw water from existing Wells 3, 4, 6, and 7. Wells 3 and 4 presently supply water to this facility. Piping modifications will be made to redirect raw water from Wells 6 and 7 to this facility (see Table 6, Item 1). The treatment process will be capable of producing 1,000 GPM of finished water and will have 0.5 mg of existing storage capacity. It is anticipated that the process units will operate 12 hours per day under normal conditions. During times of maximum demand, the units are capable of operating for extended periods to meet that demand.

The modifications will allow the facility to produce a very high quality finished water. In addition to raw water hydrogen sulfide reduction, the MIEX® Process will reduce the raw water Total Organic Carbon (TOC) levels. This reduction in TOC will allow the finished water THM and HAA formation potential to be reduced to the levels at or below that required by the USEPA/FDEP First Stage Disinfection Byproduct Rule. Raw water sulfate concentration will also be diminished, decreasing that possibility that "black water" conditions will form in the customers' home plumbing systems due to sulfate conversion to sulfide. The color, odor and taste of the water will be enhanced. Chloramine disinfection will be provided to make the water produced by this facility compatible with water purchased from Pasco County as a supplemental supply. The existing storage tank will continue to be utilized. The existing high service pumping and control facilities will be replaced to allow this facility to function with the other new centralized facilities and meet fire flow requirements. SCADA (Supervisory Control and Data Acquisition) system components will be added to allow this facility to be efficiently and cost effectively operated as part of the new centralized water system. The existing water storage and pumping facility will be retrofitted to include the equipment shown in Table 2.

Piping modifications will be made to the distribution system to allow the water produced at the Mitchell Road plant to be delivered where it is needed in the distribution system (see Table 6, Items 4 and 5).

The process Flow Diagram for this facility is presented graphically in Figure 1.

C. Proposed New Wyndtree WTP

This facility will be supplied raw water from existing Wells 8 and 9. Piping modifications will be made to redirect raw water from Wells 8 and 9 to this facility (see Table 6, Item 7) on land the Utility already owns. The treatment process will be capable of producing 1,000 GPM of finished water and will have 1.0 MG of new storage capacity. It is anticipated that the process units will operate 12 hours per day under normal conditions. During times of maximum demand, the units are capable of operating for extended periods to meet that demand.

The modifications will allow the facility to produce a very high quality finished water. In addition to raw water hydrogen sulfide reduction, the MIEX® Process will reduce the raw water Total Organic Carbon (TOC) levels. This reduction in TOC will allow the finished water THM and HAA formation potential to be reduced to the levels at or below that required by the USEPA/FDEP First Stage Disinfection Byproduct Rule. Raw water sulfate concentration will also be diminished, decreasing that possibility that "black water" conditions will form in the customers' home plumbing systems due to sulfate conversion to sulfide. The color, odor and taste of the water will be enhanced. Chloramine disinfection will be provided to make the water produced by this facility compatible with water purchased from Pasco County as a supplemental supply. A new 1.0 MG storage tank will be constructed to provide the water storage capacity needed to meet process design demands, FDEP rules and fire flow requirements. New high service pumping and control facilities will be provided to allow this facility to function with the other new centralized facilities and meet fire flow requirements. SCADA (Supervisory Control and Data Acquisition) system components will be added to allow this facility to be efficiently and cost effectively operated as part of the new centralized water system. The equipment that will make up this facility is shown in Table 3.

Piping modifications will be made to the distribution system to allow the water produced at the Wyndtree plant to be delivered where it is needed in the distribution system (see Table 6, Item 6).

The Process Flow Diagram for this facility is presented graphically in Figure 1.

D. Proposed Industrial Park WTP

This facility will be supplied raw water from existing Wells 1 and 2. Piping modifications will be made to redirect raw water from Wells 1 and 2 to this facility (see Table 6, Item 2). The treatment process will be capable of producing 1,000 GPM of finished water and will have 1.6 MG of new storage capacity. It is anticipated that the process units will operate 12 hours per day under normal conditions. During times of maximum demand, the units are capable of operating for extended periods to meet that demand.

The modifications will allow the facility to produce a very high quality finished water. In addition to raw water hydrogen sulfide reduction, the MIEX® Process will reduce the raw water Total Organic Carbon (TOC) levels. This reduction in TOC will allow the finished water THM and HAA formation potential to be reduced to the levels at or below that required by the USEPA/FDEP First Stage Disinfection Byproduct Rule. Raw water sulfate concentration will also be diminished, decreasing that possibility that "black water" conditions will form in the customers' home plumbing systems due to sulfate conversion to sulfide. The color, odor and taste of the water will be enhanced. Chloramine disinfection will be provided to make the water produced by this facility compatible with water purchased from Pasco County as a supplemental supply. A new 1.6 MG storage tank will be constructed to provide the water storage capacity needed to meet process design demands, FDEP rules and fire flow requirements. New high service pumping and control facilities will be provided to allow this facility to function with the other new centralized facilities and meet fire flow requirements. SCADA (Supervisory Control and Data Acquisition) system components will be added to allow this facility to be efficiently and cost effectively operated as part of the new centralized water system. The equipment that will make up this facility is shown in Table 4.

Piping modifications will be made to the distribution system to allow the water produced at the Industrial Park plant to be delivered where it is needed in the distribution system (see Table 6, Item 3).

The Process Flow Diagram for this facility is presented graphically in Figure 1.

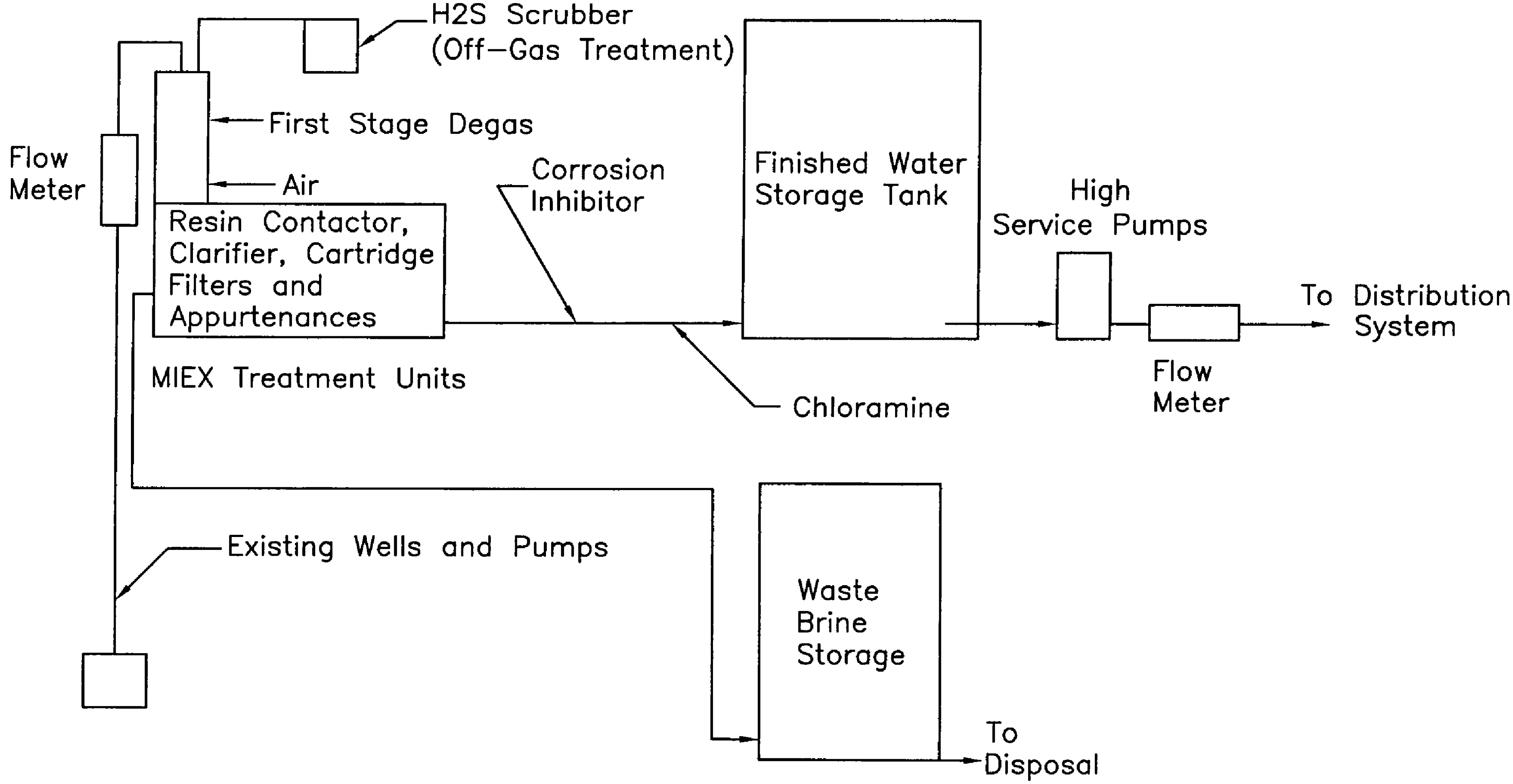


Figure 1	Date / Revisions / Revised By / Checked By	David W. Porter, P.E. Water/Wastewater System Consultant	Process Diagram	PROJECT NO AUI-028-5-S
		3197 Ryans Court, Green Cove Springs, FL 32043	MIEX Process Upgrade	DATE October 2002
		Phone: (904) 291-2744 Fax (904) 291-7769		SCALE None
		Designed By DWP; Drawn By DWP; Checked By DWP; Approved By DWP		SHEET 01 OF 01

Section 3 – Estimated Budget Cost Estimates - MIEX

A. Capital Cost Budget Estimates

Detailed capital cost budget estimate tables can be found at the end of this Section.

The capital cost budget estimates were developed by obtaining equipment budget cost estimates from representative vendors. These budget costs were then adjusted to include costs for sales tax, contractor installation, contractor overhead and profit, and contingencies. No other costs are included, such as the cost of financing, legal, etc.

It is important to note that the process train shown in the figures and the cost estimates are based on budget estimates only. Once final design and permitting are complete, a formal engineer's estimate will be prepared.

Also, these cost estimates do not include any capacity increases beyond the present capacity of the system. No provision has been made for future system capacity increases with the modifications described in this Section. Current population and water demand values indicate that this existing water system requires a major capacity increase at this time.

B. Chemical, Labor and Power Cost Budget Estimates

Chemical, Labor and Power cost budget estimates were obtained by calculating the quantity of chemicals and power required in the operation of the process units associated with each option. Current day representative chemical and power unit costs were applied to the estimated use quantities and a yearly value was obtained. Labor was estimated based on the assignment of two operators to each facility while it is in operation. Two operators are required due to the complexity of the process units and the number of tasks required to be completed. Table 5 presents this data.

C. Engineering Cost Budget Estimates

Engineering cost budget estimates include the expenses associated with design, permitting, observing construction, and start-up of the proposed facilities. See Table 1 for this data and a summary of all costs.

Seven Springs Water System
2002 Water Facilities Upgrade Report
MIEX Capital Cost Budget Estimate Summary–Proposed WTPs

Facility/Item	Estimated Budget Cost
Mitchell Road WTP	$3,185,784
Wyndtree WTP	$4,033,385
Industrial Park WTP	$3,978,674
WTP Sub Total	$11,197,843
Piping Modifications	$3,322,440
Engineering/Surveying Fees	$1,400,000
Grand Total	$15,920,283

Table 1

Seven Springs Water System

2002 Water Facilities Upgrade Report

MIEX Capital Cost Budget Estimate–Proposed Mitchell Road WTP (In 2002 Dollars)

Component	Raw Cost	Installation (30%)	Contractor O&P (15%)	Sales Tax (7.5%)	Sub-Total
Unit Process Equipment					
MIEX Units (2 -500 GPM Units)	$655,100	$196,530	$127,745	$49,133	$1,028,507
Initial MIEX Resin Cost	$60,000	$0	$0	$4,500	$64,500
Off-Gas Treatment System	$121,000	$36,300	$23,595	$9,075	$189,970
Chloramine Feed System and Chemical Storage	$80,000	$24,000	$15,600	$6,000	$125,600
Corrosion Contol Feed System	$3,000	$900	$585	$225	$4,710
500,000 Gallon Water Storage Tank*	$0	$0	$0	$0	$0
5,000 Gallon Waste Brine Holding Tank and Sump	$45,000	$13,500	$8,775	$3,375	$70,650
High Service Pumping System	$220,000	$66,000	$42,900	$16,500	$345,400
Electrical Generators (Plant and Wells)	$175,000	$52,500	$34,125	$13,125	$274,750
Flow Meters & Recorders	$20,000	$6,000	$3,900	$1,500	$31,400
Pressure Relief Valve Assembly	$8,700	$2,610	$1,697	$653	$13,659
SCADA System (Allowance)	$70,000	$21,000	$13,650	$5,250	$109,900
Concrete/Chemical&Mechanical Building	$70,000	$21,000	$13,650	$5,250	$109,900
Operations Building**	$28,000	$8,400	$5,460	$2,100	$43,960
Sitework and Yard Piping (4% Allowance)					$96,516
Electrical (10% Allowance)					$241,291
Contingencies (10%)					$275,071
Land Acquisition Allowance (1 Acre)					$160,000
				Total	$3,185,784

* Present at existing facility. Will not be replaced.

** Existing building will be modified

Table 2

Seven Springs Water System

2002 Water Facilities Upgrade Report

MIEX Capital Cost Budget Estimate–Proposed Wyndtree WTP (In 2002 Dollars)

Component	Raw Cost	Installation (30%)	Contractor O&P (15%)	Sales Tax (7.5%)	Sub-Total
Unit Process Equipment					
MIEX Units (2 -500 GPM Units)	$655,100	$196,530	$127,745	$49,133	$1,028,507
Initial MIEX Resin Cost	$60,000	$0	$0	$4,500	$64,500
Off-Gas Treatment System	$138,600	$41,580	$27,027	$10,395	$217,602
Chloramine Feed System and Chemical Storage	$80,000	$24,000	$15,600	$6,000	$125,600
Corrosion Contol Feed System	$3,000	$900	$585	$225	$4,710
1.0 MG Gallon Water Storage Tank W/Cover	$425,000	$127,500	$82,875	$31,875	$667,250
5,000 Gallon Waste Brine Holding Tank and Sump	$45,000	$13,500	$8,775	$3,375	$70,650
High Service Pumping System	$220,000	$66,000	$42,900	$16,500	$345,400
Electrical Generator (Plant and Wells)	$145,000	$43,500	$28,275	$10,875	$227,650
Flow Meters & Recorders	$20,000	$6,000	$3,900	$1,500	$31,400
Pressure Relief Valve Assembly	$8,700	$2,610	$1,697	$653	$13,659
SCADA System (Allowance)	$50,000	$15,000	$9,750	$3,750	$78,500
Concrete/Chemical&Mechanical Building	$70,000	$21,000	$13,650	$5,250	$109,900
Operations Building	$32,000	$9,600	$6,240	$2,400	$50,240
Sitework and Yard Piping (6% Allowance)					$182,134
Electrical (10% Allowance)					$303,557
Contingencies (10%)					$352,126
Land Acquisition Allowance (1 Acre)					$160,000
				Total	$4,033,385

Table 3

Seven Springs Water System

2002 Water Facilities Upgrade Report

MIEX Capital Cost Budget Estimate–Proposed Industrial Park WTP (In 2002 Dollars)

Component	Raw Cost	Installation (30%)	Contractor O&P (15%)	Sales Tax (7.5%)	Sub-Total
Unit Process Equipment					
MIEX Units (2 -500 GPM Units)	$655,100	$196,530	$127,745	$49,133	$1,028,507
Initial MIEX Resin Cost	$60,000	$0	$0	$4,500	$64,500
Off-Gas Treatment System	$121,000	$36,300	$23,595	$9,075	$189,970
Chloramine Feed System and Chemical Storage	$80,000	$24,000	$15,600	$6,000	$125,600
Corrosion Contol Feed System	$3,000	$900	$585	$225	$4,710
1.6 MG Water Storage Tank W/Cover	$510,000	$153,000	$99,450	$38,250	$800,700
5,000 Gallon Waste Brine Holding Tank and Sump	$45,000	$13,500	$8,775	$3,375	$70,650
High Service Pumping System	$220,000	$66,000	$42,900	$16,500	$345,400
Electrical Generator (Plant and Wells)	$165,000	$49,500	$32,175	$12,375	$259,050
Flow Meters & Recorders	$20,000	$6,000	$3,900	$1,500	$31,400
Pressure Relief Valve Assembly	$8,700	$2,610	$1,697	$653	$13,659
SCADA System (Allowance)	$50,000	$15,000	$9,750	$3,750	$78,500
Concrete/Chemical&Mechanical Building	$70,000	$21,000	$13,650	$5,250	$109,900
Operations Building	$32,000	$9,600	$6,240	$2,400	$50,240
Sitework and Yard Piping (4% Allowance)					$126,911
Electrical (10% Allownace)					$317,279
Contingencies (10%)					$361,698
Land Acquisition Allowance (None)					$0
				Total	$3,978,674

Table 4

Seven Springs Water System

2002 Water Facilities Upgrade Study Report

MIEX Chemical, Power and Labor Cost Estimate–Proposed WTPs @ 1,000 GPM Flow for 12 Hours Per Day For Each Plant

Facility	MIEX Process	Brine Disposal	Off-Gas Control	Chloramine	Corrosion Control	Sub-Total
Mitchell Road WTP	$60,000	$300,000	$35,000	$32,100	$35,000	$462,100
Wyndtree WTP	$60,000	$300,000	$50,000	$32,100	$35,000	$477,100
Industrial Park Plant	$60,000	$300,000	$35,000	$32,100	$35,000	$462,100
Power						$294,000
Personnel						$657,000
Administration						$36,500
					Total	$2,388,800

Note: 1. Operations and maintenance personnel costs estimated at 6 persons, 12 hours per day, 365 days per year at $25/hour.
Administrative personnel costs estimated at 2 hours per day 365 days per year at $50/hour.
2. Power calculated at 50% average power load (0.50 X 300 hp = 150 hp) for 24 hours/day at $0.1/kwh.
3. All estimates based on values of materials and services in 2002

Table 5

Estimated Cost of New Water Mains

Item No.	Description	Estimated Cost
1.	Connect Well 6 & 7 together and Construct Raw Water Main to Existing Raw Water Main at Intersection of Little Road & SR 54.	$990,400
2.	Construct Raw Water Main from Well #1 to Proposed Water Plant at Well #1 Site and 16-inch Water Main from Plant Site to SR 54.	$727,000
3.	Construct 16-inch Potable Water main from Marathon Drive & SR 54 to Existing 12-inch Water Main at SR 54 and Little Road.	$830,000
4.	Construct 12-inch Potable Water Main on Heritage Boulevard from Little Road to Sebring Drive.	$129,000
5.	Construct 12-inch Potable Water Main in Powerline R/W From Mitchell Ranch Road Water Plant to Existing 12-inch Main at River.	$189,000
6.	Construct 10-inch Potable Water Main on Mitchell Boulevard from Perrine Ranch Road to Welbilt Boulevard.	$120,000
7.	Construct 12-inch Raw Water and Potable Water Mains from Mitchell Boulevard to Wyndtree Water plant.	$ 35,000
	Subtotal Estimated Cost	**$3,020,400**
	Construction Contingency	**$ 302,040**
	TOTAL ESTIMATED COST	**$3,322,440**

Table 6

Section 4 – Centralized Enhance Packed Tower Aeration Plants Descriptions

A. Overview

This section of the report discusses the provision of enhanced packed tower aeration process units, finished water storage tanks and high service pumping units and all necessary appurtenant equipment required to produce three (3) centralized water facilities to upgrade the Seven Springs Water System.

B. Proposed Modifications to Existing Mitchell Road WTP

This facility will be supplied raw water from existing Wells 3, 4, 6, and 7. Wells 3 and 4 presently supply water to this facility. Piping modifications will be made to redirect raw water from Wells 6 and 7 to this facility (see Table 12, Item 1). The treatment process will be capable of producing 1,000 GPM of finished water and will have 0.5 mg of existing storage capacity. It is anticipated that the process units will operate 12 hours per day under normal conditions. During times of maximum demand, the units are capable of operating for extended periods to meet that demand.

The modifications will allow the facility to reduce raw water hydrogen sulfide concentration but will provide for no additional treatment enhancements. Raw water TOC, THM/HAA formation potential, color, and sulfate will remain unchanged. Chloramine disinfection will be provided to make the water produced by this facility compatible with water purchased from Pasco County as a supplemental supply. The existing storage tank will continue to be utilized. The existing high service pumping and control facilities will be replaced to allow this facility to function with the other new centralized facilities and meet fire flow requirements. SCADA (Supervisory Control and Data Acquisition) system components will be added to allow this facility to be efficiently and cost effectively operated as part of the new centralized water system. The existing water storage and pumping facility will be retrofitted to include the equipment shown in Table 8.

Piping modifications will be made to the distribution system to allow the water produced at the Mitchell Road plant to be delivered where it is needed in the distribution system (see Table 12, Items 4 and 5).

The Process Flow Diagram for this facility is presented graphically in Figure 2.

C. Proposed New Wyndtree WTP

This facility will be supplied raw water from existing Wells 8 and 9. Piping modifications will be made to redirect raw water from Wells 8 and 9 to this facility (see Table 12, Item 7) on land already owned by the Utility. The treatment process will be capable of producing 1,000 GPM of finished water and will have 1.0 MG of new storage capacity. It is anticipated that the process units will operate 12 hours per day under normal conditions. During times of maximum demand, the units are capable of operating for extended periods to meet that demand.

The modifications will allow the facility to reduce raw water hydrogen sulfide concentration but will provide for no additional treatment enhancements. Raw water TOC, THM/HAA formation potential, color, and sulfate will remain unchanged. Chloramine disinfection will be provided to make the water produced by this facility compatible with water purchased from Pasco County as a supplemental supply. A new 1.0 MG storage tank will be constructed to provide the water storage capacity needed to meet process design demands, FDEP rules and fire flow requirements. New high service pumping and control facilities will be provided to allow this facility to function with the other new centralized facilities and meet fire flow requirements. SCADA (Supervisory Control and Data Acquisition) system components will be added to allow this facility to be efficiently and cost effectively operated as part of the new centralized water system. The existing water storage and pumping facility will be retrofitted to include the equipment shown in Table 9.

Piping modifications will be made to the distribution system to allow the water produced at the Wyndtree plant to be delivered where it is needed in the distribution system (see Table 12, Item 6).

The Process Flow Diagram for this facility is presented graphically in Figure 2.

D. Proposed Industrial Park WTP

This facility will be supplied raw water from existing Wells 1 and 2. Piping modifications will be made to redirect raw water from Wells 1 and 2 to this facility (see Table 12, Item 2). The treatment process will be capable of producing 1,000 GPM of finished water and will have 1.6 MG of new storage capacity. It is anticipated that the process units will operate 12 hours per day under normal conditions. During times of maximum demand, the units are capable of operating for extended periods to meet that demand.

The modifications will allow the facility to reduce raw water hydrogen sulfide concentration but will provide for no additional treatment enhancements. Raw water TOC, THM/HAA formation potential, color, and sulfate will remain unchanged. Chloramine disinfection will be provided to make the water produced by this facility compatible with water purchased from Pasco County as a supplemental supply. A new 1.6 MG storage tank will be constructed to provide the water storage capacity needed to meet process design demands, FDEP rules and fire flow requirements. New high service pumping and control facilities will be provided to allow this facility to function with the other new centralized facilities and meet fire flow requirements. SCADA (Supervisory Control and Data Acquisition) system components will be added to allow this facility to be efficiently and cost effectively operated as part of the new centralized water system. The existing water storage and pumping facility will be retrofitted to include the equipment shown in Table 10.

Piping modifications will be made to the distribution system to allow the water produced at the Industrial Park plant to be delivered where it is needed in the distribution system (see Table 12, Item 3).

The Process Flow Diagram for this facility is presented graphically in Figure 2.

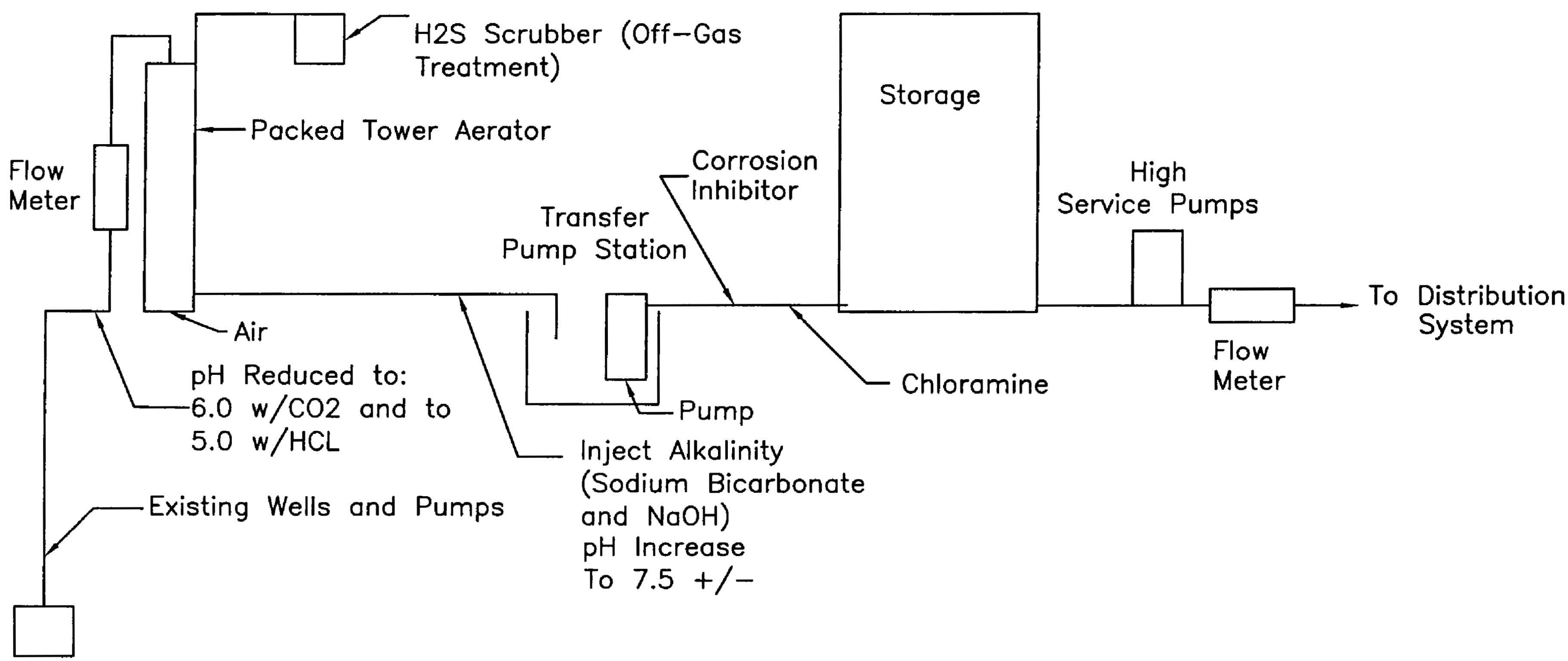


Figure 2

Date	Revisions	Revised By	Checked By

David W. Porter, P.E.
Water/Wastewater System Consultant
3197 Ryans Court Green Cove Springs, FL 32043
Phone (904) 291-2744 Fax (904) 291-7769

Designed By	Drawn By	Checked By	Approved By
DWP	DWP	DWP	DWP

Process Diagram

Enhanced Packed Tower Aeration

PROJECT NO AU-028-5-8
DATE October 2002
SCALE None
SHEET 01 OF 01

Section 5 – Estimated Budget Cost Estimates
Enhanced Packed Tower Aeration

A. Capital Cost Budget Estimates

Detailed capital cost budget estimate tables can be found at the end of this Section.

The capital cost budget estimates were developed by obtaining equipment budget cost estimates from representative vendors. These budget costs were then adjusted to include costs for sales tax, contractor installation, contractor overhead and profit, and contingencies. No other costs are included, such as the cost of financing, legal, etc.

It is important to note that the process train shown in the figures and the cost estimates are based on budget estimates only. Should this option be selected, once final design and permitting are complete, a formal engineer's estimate will be prepared. The costs presented here update those provided in the 1997 Water System Upgrade Study submitted to the Commission on June 17, 1997. Primarily, the updates were needed to address regulatory changes that have taken place since 1997, the increased costs of equipment and services over time, a reconfiguration of the facilities to reflect current water supply availability and locations, present water use locations, etc.

Also, these cost estimates do not include any capacity increases beyond the present capacity of the system. No provision has been made for future system capacity increases with the modifications described in this Section. Current population and water demand values indicate that this existing water system presently requires a major capacity increase.

B. Chemical, Power and Labor Cost Budget Estimates

Chemical, Power and Labor cost budget estimates were obtained by calculating the quantity of chemicals and power required in the operation of the process units associated with each option. Current day representative chemical and power unit costs were applied to the estimated use quantities and a yearly value was obtained. Labor was estimated based on the assignment of two operators to each facility while it is in operation. Two operators are required due to the complexity of the process units and the number of tasks required to be completed. See Table 11 for this data.

C. Engineering Cost Budget Estimates

Engineering budget cost estimates include the expenses associated with design, permitting, observing construction, and start-up of the proposed facilities. See Table 7 for this data and a summary of all costs.

Seven Springs Water System
2002 Water Facilities Upgrade Study Report
Enhanced Packed Tower Aeration Capital Cost Budget Estimate Summary–Proposed WTPs

Facility/Item	Estimated Budget Cost
Mitchell Road WTP	$2,793,637
Wyndtree WTP	$3,599,099
Industrial Park WTP	$3,585,542
WTP Sub Total	$9,978,278
Piping Modifications	$3,322,440
Engineering/Surveying Fees	$1,650,000
Grand Total	$14,950,718

Table 7

Seven Springs Water System

2002 Water Facilities Upgrade Study Report

Enhanced Packed Tower Aeration Capital Cost Budget Estimate–Proposed Mitchell Road WTP (In 2002 Dollars)

Component	Raw Cost	Installation (30%)	Contractor O&P (15%)	Sales Tax (7.5%)	Sub-Total
Chemical Storage and Feed Equipment					
Carbon Dioxide	$116,000	$34,800	$22,620	$8,700	$182,120
Hydrochloric Acid	$29,000	$8,700	$5,655	$2,175	$45,530
Sodium Bicarbonate	$16,500	$4,950	$3,218	$1,238	$25,905
Sodium Hydroxide	$35,000	$10,500	$6,825	$2,625	$54,950
Chloramine Feed System and Chemical Storage	$80,000	$24,000	$15,600	$6,000	$125,600
Corrosion Control Feed System	$3,000	$900	$585	$225	$4,710
Unit Process Equipment					
Packed Tower H2S Stripper/Scrubber	$187,000	$56,100	$36,465	$14,025	$293,590
Off-Gas Pre-Stripper	$46,500	$13,950	$9,068	$3,488	$73,005
Off-Gas Carbon Contactor	$151,000	$45,300	$29,445	$11,325	$237,070
Treated Water Transfer Pump Station	$82,000	$24,600	$15,990	$6,150	$128,740
500,000 Gallon Water Storage Tank*	$0	$0	$0	$0	$0
High Service Pumping System	$220,000	$66,000	$42,900	$16,500	$345,400
Electrical Generators (Plant and Wells)	$175,000	$52,500	$34,125	$13,125	$274,750
Flow Meters & Recorders	$20,000	$6,000	$3,900	$1,500	$31,400
Pressure Relief Valve Assembly	$8,700	$2,610	$1,697	$653	$13,659
SCADA System	$70,000	$21,000	$13,650	$5,250	$109,900
Concrete Slabs/Building Modifications	$70,000	$21,000	$13,650	$5,250	$109,900
Operations Building**	$28,000	$8,400	$5,460	$2,100	$43,960
Sitework and Yard Piping (4%)					$84,008
Electrical (10%)					$210,019
Construction Contingencies (10%)					$239,422
Land Acquisition Allowance (1 Acre)					$160,000
				Total	$2,793,637

* Present at existing facility. Will not be replaced.
** Existing building will be modified.

Table 8

Seven Springs Water System

2002 Water Facilities Upgrade Study Report

Enhanced Packed Tower Aeration Capital Cost Budget Estimate–Proposed Wyndtree WTP (In 2002 Dollars)

Component	Raw Cost	Installation (30%)	Contractor O&P (15%)	Sales Tax (7.5%)	Sub-Total
Chemical Storage and Feed Equipment					
Carbon Dioxide	$116,000	$34,800	$22,620	$8,700	$182,120
Hydrochloric Acid	$29,000	$8,700	$5,655	$2,175	$45,530
Sodium Bicarbonate	$16,500	$4,950	$3,218	$1,238	$25,905
Sodium Hydroxide	$35,000	$10,500	$6,825	$2,625	$54,950
Chloramine Feed System and Chemical Storage	$80,000	$24,000	$15,600	$6,000	$125,600
Corrosion Control Feed System	$3,000	$900	$585	$225	$4,710
Unit Process Equipment					
Packed Tower H2S Stripper/Scrubber	$187,000	$56,100	$36,465	$14,025	$293,590
Off-Gas Pre-Stripper	$46,500	$13,950	$9,068	$3,488	$73,005
Off-Gas Carbon Contactor	$151,000	$45,300	$29,445	$11,325	$237,070
Treated Water Transfer Pump Station	$82,000	$24,600	$15,990	$6,150	$128,740
1,000,000 Gallon Water Storage Tank	$425,000	$127,500	$82,875	$31,875	$667,250
High Service Pumping System	$220,000	$66,000	$42,900	$16,500	$345,400
Electrical Generators (Plant and Wells)	$145,000	$43,500	$28,275	$10,875	$227,650
Flow Meters & Recorders	$20,000	$6,000	$3,900	$1,500	$31,400
Pressure Relief Valve Assembly	$8,700	$2,610	$1,697	$653	$13,659
SCADA System	$50,000	$15,000	$9,750	$3,750	$78,500
Concrete/Chemical&Mechanical Building	$70,000	$21,000	$13,650	$5,250	$109,900
Operations Building	$32,000	$9,600	$6,240	$2,400	$50,240
Sitework and Yard Piping (6%)					$161,713
Electrical (10%)					$269,522
Construction Contingencies (10%)					$312,645
Land Acquisition Allowance (1 Acre)					$160,000
				Total	$3,599,099

Table 9

Seven Springs Water System

2002 Water Facilities Upgrade Study Report

Enhanced Packed Tower Aeration Capital Cost Budget Estimate–Proposed Industrial Park WTP (In 2002 Dollars)

Component	Raw Cost	Installation (30%)	Contractor O&P (15%)	Sales Tax (7.5%)	Sub-Total
Chemical Storage and Feed Equipment					
Carbon Dioxide	$116,000	$34,800	$22,620	$8,700	$182,120
Hydrochloric Acid	$29,000	$8,700	$5,655	$2,175	$45,530
Sodium Bicarbonate	$16,000	$4,800	$3,120	$1,200	$25,120
Sodium Hydroxide	$35,000	$10,500	$6,825	$2,625	$54,950
Chloramine Feed System and Chemical Storage	$80,000	$24,000	$15,600	$6,000	$125,600
Corrosion Control Feed System	$3,000	$900	$585	$225	$4,710
Unit Process Equipment					
Packed Tower H2S Stripper/Scrubber	$187,000	$56,100	$36,465	$14,025	$293,590
Off-Gas Pre-Stripper	$46,500	$13,950	$9,068	$3,488	$73,005
Off-Gas Carbon Contactor	$151,000	$45,300	$29,445	$11,325	$237,070
Treated Water Transfer Pump Station	$82,000	$24,600	$15,990	$6,150	$128,740
1.6 MG Water Storage Tank	$510,000	$153,000	$99,450	$38,250	$800,700
High Service Pumping System	$220,000	$66,000	$42,900	$16,500	$345,400
Electrical Generators (Plant and Wells)	$165,000	$49,500	$32,175	$12,375	$259,050
Flow Meters & Recorders	$20,000	$6,000	$3,900	$1,500	$31,400
Pressure Relief Valve Assembly	$8,700	$2,610	$1,697	$653	$13,659
SCADA System	$50,000	$15,000	$9,750	$3,750	$78,500
Concrete/Chemical&Mechanical Building	$70,000	$21,000	$13,650	$5,250	$109,900
Operations Building	$32,000	$9,600	$6,240	$2,400	$50,240
Sitework and Yard Piping (4%)					$114,371
Electrical (10%)					$285,928
Construction Contingencies (10%)					$325,958
Land Acquisition Allowance (None)					$0
				Total	$3,585,542

Table 10

Seven Springs Water System

2002 Water Facilities Upgrade Report

Enhanced Packed Tower Aeration O&M Cost Budget Estimate–Proposed WTPs @1000 GPM Flow for 12 Hours Per Day For Each Plant

Facility	Carbon Dioxide	Hydrochloric Acid	Air Stripper	Off-Gas Pre-Scrub	Off-Gas Carbon	Sodium Bi-Carb	Sodium Hydroxide	Chloramine	Corrosion Control	Sub-Total
Mitchell Road WTP	$31,500	$93,100	$5,200	$122,400	$35,000	$197,000	$360,000	$32,100	$35,000	$911,300
Wyndtree WTP	$31,500	$93,100	$5,200	$311,800	$50,000	$197,000	$360,000	$32,100	$35,000	$1,115,700
Industrial Park Plant	$31,500	$93,100	$5,200	$122,400	$35,000	$197,000	$360,000	$32,100	$35,000	$911,300
Power										$471,000
Personnel										$657,000
Administration										$36,500
										$4,102,800

Note: 1. Operations and maintenance personnel costs estimated at 6 persons, 12 hours per day, 365 days per year at $25/hour.
Administrative personnel costs estimated at 2 hours per day 365 days per year at $50/hour.
2.The power costs calculated at 50% average power load (240 hp) for 24 hours/day at $0.1/kwh.

Table 11

Estimated Cost of New Water Mains

Item No.	Description	Estimated Cost
1.	Connect Well 6 & 7 together and Construct Raw Water Main to Existing Raw Water Main at Intersection of Little Road & SR 54.	$990,400
2.	Construct Raw Water Main from Well #1 to Proposed Water Plant at Well #1 Site and 16-inch Water Main from Plant Site to SR 54.	$727,000
3.	Construct 16-inch Potable Water main from Marathon Drive & SR 54 to Existing 12-inch Water Main at SR 54 and Little Road.	$830,000
4.	Construct 12-inch Potable Water Main on Heritage Boulevard from Little Road to Sebring Drive.	$129,000
5.	Construct 12-inch Potable Water Main in Powerline R/W From Mitchell Ranch Road Water Plant to Existing 12-inch Main at River.	$189,000
6.	Construct 10-inch Potable Water Main on Mitchell Boulevard from Perrine Ranch Road to Welbilt Boulevard.	$120,000
7.	Construct 12-inch Raw Water and Potable Water Mains from Mitchell Boulevard to Wyndtree Water plant.	$ 35,000
	Subtotal Estimated Cost	**$3,020,400**
	Construction Contingency	**$ 302,040**
	TOTAL ESTIMATED COST	**$3,322,440**

Table 12

Section 6 – Comparison of the MIEX® Process with Enhanced Packed Tower Aeration

A. Technology and Capabilities

The MIEX® Process is capable of reducing raw water hydrogen sulfide concentrations, but, in addition is capable of also reducing raw water TOC, THM/HAA formation potential, color and sulfate concentrations. The enhanced packed tower aeration process is capable of reducing raw water hydrogen sulfide concentrations but does not provide any of the other benefits associated with use of the MIEX® Process.

The enhanced packed tower aeration process requires the addition of a number of chemicals to the raw water at several points along the treatment train. These chemicals include hydrochloric acid, carbon dioxide, sodium bicarbonate, sodium hydroxide among others. There are a number of reasons why one would prefer not to add these chemicals to the water supply if another means of removing hydrogen sulfide could be found. Both hydrochloric acid and sodium hydroxide are very difficult to safely handle. Their handling and use pose a risk for the treatment plant staff. In general, the addition of these chemicals to the water during treatment will increase the dissolved solids found in the finished water. The cost of these chemicals, at the dosages required to affect meaningful raw water hydrogen sulfide reductions, is very high.

In 1997, when Aloha's first report to the PSC concerning hydrogen sulfide removal was prepared, only enhanced packed tower aeration was available to technically and cost effectively achieve high level raw water hydrogen sulfide reduction. Therefore, enhanced packed tower aeration was recommended by Aloha's engineer at that time.

Since that first report was prepared over five years ago, a new technology, the MIEX® Process, has been developed as an alternative to the use of enhanced packed tower aeration to reduce raw water hydrogen sulfide concentration. This resin resides within the reaction tank and does not leave with the finished water. Therefore, the MIEX® Process does not materially increase the quantity of chemicals added to the water, in fact, it greatly reduces them. Most customers today would prefer that their water suppler utilize treatment methods that minimizes the injection of chemicals into the water they receive. Since the resin remains in the reaction tank, it is cost-effectively used over and over again, this results in greatly reduced treatment chemical costs as compared to the enhanced packed tower aeration process. The MIEX® Process also has the ability to not only remove sulfide, but it can also reduce naturally occurring color, sulfates and trihalomethane and haloacetic acid precursors.

Removal of sulfates is important here because it is sulfates that are converted to sulfides in customers' home water piping systems and hot water tanks that are the major cause of the "black water" some customers have reported they experience from time to time in their homes. Presently, Aloha oxidizes raw water hydrogen sulfide at its well sites with chlorine. This process converts the naturally occurring sulfide found in the raw water to sulfates. In addition to the sulfates produced in the sulfide oxidation process, the raw water contains naturally occurring sulfates as well. The combination of these two sources of sulfate generally results in a finished water with a sulfate concentration of 10 to 25 mg/L as it is supplied to the customer. The majority of the sulfate concentration is made up of the naturally occurring sulfate present in the raw water and not the sulfate formed by sulfide oxidation. USEPA rules allows up to 250 mg/L of sulfate to be present in the finished water supplied to customers. Therefore, Aloha's present finished water sulfate concentration is only one tenth of the USEPA standard or less. However, as stated above, it is these sulfates that, under unique and individual conditions, are converted to sulfide in a small number of customers' homes by sulfur reducing bacteria. These sulfides corrode the customers' copper plumbing generating a very dark colored compound known as copper sulfide. It is the very dark copper sulfide that some customers report as "black water." In order to lessen the chance that this "black water" condition will occur, the overall concentration of finished water sulfates needs to be reduced. The enhanced packed tower aeration process accomplishes this goal to a limited extent because it takes the place of the raw water sulfide oxidation process that is currently practiced. However, since it does not have the ability to remove the naturally occurring sulfates found in the raw water, its effectiveness is limited. The MIEX® Process not only takes the place of the currently practiced raw water sulfide oxidation process, but, is also capable of reducing the concentration of naturally occurring sulfates found in the raw water. Therefore, the MIEX® Process will produce finished water with a lower sulfate concentration then is possible with the enhanced packed tower aeration process. Thus, the overall potential for the formation of "black water" in the customer's homes is reduced to a greater extent then that which would be possible with the enhanced packed tower aeration process.

The removal of trihalomethane and haloacetic acid precursors is very important. Trihalomethane (THM) and haloacetic acid (HAA) have both been identified as potential carcinogens. USEPA and FDEP regulations require Aloha and other water systems to reduce the level of THM and HAA in their finished water to 80 parts per billion and 60 parts per billion respectively by January 1, 2004. The MIEX® Process pilot testing work completed shows that the level of cancer causing THM and HAA precursors can be reduced to the levels required for Aloha to meet the USEPA and FDEP Stage One Disinfection Byproduct rules. This is a major advantage of the MIEX® Process over the enhanced packed tower process.

The aesthetic qualities of the finished water will be greatly enhanced by the color removal, taste control and odor reducing capabilities of the MIEX® Process. The enhanced packed tower aeration process will have little, if any, positive effect on the aesthetic quality of the water.

B. Estimated Budget Cost Estimate Comparisons

Tables 13 and 14 present a comparison of the estimated budget capital and chemical, power and labor costs associated with both options.

The total estimated budget cost for the three centralized MIEX® plants, the piping modifications and engineering and permitting costs is $15,920,283. The estimated budget cost for the annual purchase and supply of chemicals, power and labor is $2,388,800.

In contrast, estimated budget cost the enhanced packed tower aeration option identified in the June 1997 report, with technology and prices brought current, is $14,950,718. The estimated budget cost for annual supply of chemicals, power and labor is $4,102,800.

The estimated budget cost of the MIEX® option is $969,565 greater in capital cost then the enhanced packed tower aeration option. However, the estimated annual budget cost for supply of chemicals, power and labor is $1,714,000 less than that for the enhanced packed tower aeration plants. Therefore, the increased one-time capital cost of the MIEX® option is more than offset in annual chemical, power and labor costs and it will produce a far superior finished water.

The MIEX® option also provides a number of benefits that the enhanced packed tower aeration option does not. As stated above, the MIEX® option provides greater hydrogen sulfide removal capabilities, THM/HAA precursor reduction, sulfate removal capability and will enhance the finished water aesthetics. It is also important to note that if the enhanced packed tower aeration option was chosen for implementation, additional treatment modifications may be required in the future when the USEPA/FDEP Second Stage Disinfection Byproduct Rule is promulgated. The MIEX® treatment process proposed will produce finished water that meets the currently proposed Second Stage Disinfection Byproduct Rules. Therefore, overall long term capital costs are reduced by selecting the MIEX® option at this time. The enhanced packed tower option offers none of these benefits.

Aloha believes that the MIEX® option is technically and economically far superior to the enhanced packed tower option, and it will position the Utility to proactively meet current and proposed USEPA and FDEP regulations and is much more cost effective.

Seven Springs Water System

2002 Water Facilities Upgrade Report

Capital Cost Comparison – Enhanced Packed Tower Aeration and MIEX Process (In 2002 Dollars)

Facility/Item	Enhanced Packed Tower Aeration	MIEX Process
Mitchell Road WTP	$2,793,637	$3,185,784
Wyndtree WTP	$3,599,099	$4,033,385
Industrial Park WTP	$3,585,542	$3,978,674
WTP Sub Total	$9,978,278	$11,197,843
Piping Modifications	$3,322,440	$3,322,440
Engineering Fees	$1,650,000	$1,400,000
Grand Total	**$14,950,718**	**$15,920,283**

Table 13

Seven Springs Water System

Water Facilities Upgrade Study Report

Chemical, Power and Labor Cost Estimate Comparison–Packed Tower Aeration and MIEX Proces

Facility/Item	Enhanced Packed Tower Aeration	MIEX Process
Mitchell Road WTP Chemicals	$911,300	$462,100
Wyndtree WTP Chemicals	$1,115,700	$477,100
Industrial Park WTP Chemicals	$911,300	$462,100
Power	$471,000	$294,000
Personnel	$657,000	$657,000
Administration	$36,500	$36,500
Grand Total	**$4,102,800**	**$2,388,800**

Table14

Section 7 – Recommendations

Recommendations

The following recommendations are offered:

1. That the MIEX® option be selected for implementation because it is the one process that has the capability to reduce not only raw water sulfides, but also, raw water sulfates, therefore lowering the chance that customers will experience "black water" conditions in their home plumbing systems.
2. That the PSC formally approve this report and the data contained herein and Issue and Order stating that it agrees that implementation of the MIEX® option is the best choice to meet the PSC goals and objectives in requiring the addition of hydrogen sulfide removal equipment at Aloha's Seven Springs Water System.
3. That the PSC, by Order, direct Aloha to begin implementation of the MIEX® option and deem this implementation as a prudent, cost effective investment being undertaken for the benefit of the customers.
4. That the PSC provide Aloha with a means of funding the design, permitting, construction and operation of the MIEX® option as described herein through approved increases to rates and charges in advance of the Utility undertaking any portion of this work.

Appendix A
MIEX® Pilot Testing Report

Interim Report
MIEX® Pilot Testing

for

Seven Springs Water System
Pasco County, Florida

Prepared for:

Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655
(727) 372-0115

Prepared by:

David W. Porter, P.E., C.O.
3197 Ryans Court
Green Cove Springs, FL 32043
(904) 291-2744

September 2002

10/17/02

Table of Contents

List of Figures

Acknowledgements

A. Participants

As with any major undertaking of this type. a number of companies and their personnel contributed to this effort. I wish to acknowledge the following companies and/or individuals for their valuable participation:

Aloha Utilities, Inc.

Mr. Stephen G. Watford	Project management and oversight, technical advice and draft report review.
Ms. Connie Kurish	Project Coordination and office administration.
Ms. Pam Yacobelli	Project Coordination and office administration.
Mr. Jack Burke	Supervision of the installation of the various pilot plants and appurtenant equipment, technical advice and personnel supervision.
Mr. Charles Painter	Assistance with installation of the various pilot plants and appurtenant equipment, technical advice, personnel supervision, certified water plant operator and on-site lab technician.
Mr. Keith Schneider	Assistance with installation of the various pilot plants and appurtenant equipment, technical advice, certified water plant operator and on-site lab technician.
Mr. Tony Cardinal	Pilot plant set-up and night-time and weekend operation inspection.
Mr. Scott Lent	Pilot plant set-up and night-time and weekend operation inspection.
Mr. Mike McDonald	Pilot plant set-up and night-time and weekend operation inspection.
Mr. Neil Weyant	Pilot plant set-up and night-time and weekend operation inspection.
Ms. Ronnie Santiago	Pilot plant set-up and maintenance.
Ms. Melissa Yacobelli	Pilot plant set-up and maintenance.

Orica Watercare, Inc.

Mr. Michael Bourke	Provided assistance with pilot program development, technical issues, laboratory testing needs development, pilot unit specification, brine disposal alternative development, capital and O&M cost projection development, testing data analysis, project scheduling, pilot plant operation, report preparation and figures, draft report peer review and numerous other matters.

Mr. Stuart Harrison	Provided assistance with pilot program development, technical issues, laboratory testing needs development, pilot unit specification, brine disposal alternative development, capital and O&M cost projection development, testing data analysis, project scheduling, pilot plant operation, report preparation and figures, and numerous other matters.

Short Environmental Laboratories, Inc.

Mr. Bruce Cummings	Provided assistance with pilot program development, technical issues, development of on-site sampling and testing procedures, on-site lab equipment supply, set-up, calibration and quality control and responsible for remote lab testing and reporting.
Mr. David Murto	Provided assistance with pilot program development, technical issues, development of on-site sampling and testing procedures, on-site lab equipment supply, set-up, calibration and quality control and responsible for remote lab testing and reporting. Peer reviewed draft report.

WesTech Engineering, Inc.

Mr. Jacob Blattman	Provided assistance with pilot program development, technical issues, pilot plant design, construction and provision, laboratory testing needs development, project scheduling, pilot plant operation, capital cost projection development, testing data analysis, draft report review and numerous other matters.

Moss-Kelly, Inc.

Mr. Brian Schuette, P.E.	Provided assistance with pilot program development, technical issues, project scheduling, pilot plant operation, capital cost projection development, testing data analysis, and numerous other matters.

University of South Florida

Mr. Robert Carnahan, Ph.D., P.E.	Technical advice and peer review of the draft report.

Executive Summary and Conclusions

A. Interim Report Purpose

This interim report presents MIEX® Process testing results for pilot study work completed at Well Number 9 of the Seven Springs Water System owned and operated by Aloha Utilities, Inc.

B. Goals and Objectives of the MIEX® Pilot Study Work

The goals and objectives of the pilot study work were as follows:

1. To determine if the MIEX® Process was capable of reducing the concentration of hydrogen sulfide found in the raw water supplied by Well 9 to low values.

2. To evaluate the effectiveness of the MIEX® Process in reducing THM (trihalomethane) and HAA (haloacetic acid) formation potentials of the raw water supplied by Well 9.

3. To demonstrate the continuous operation of the MIEX® Process and determine the main operating parameters so as to allow the estimation of capital and operating costs for a large scale demonstration unit.

C. Conclusions

The following conclusions have been developed based on the work completed and the analysis of the data:

1. Raw water hydrogen sulfide concentrations can be effectively reduced to very low values (<0.1 mg/L) utilizing a combination of air-stripping and MIEX® treatment. The air-stripping step removes un-ionized hydrogen sulfide while the MIEX® Process removes ionized sulfides. The combination treatment method removes hydrogen sulfide to the extent that forced draft aeration alone can not accomplish without complicated pH adjustment. With forced draft aeration alone, feed water pH must be reduced significantly prior to aeration to accomplish the same level of hydrogen sulfide removal. In addition, further pH adjustment must be undertaken after aeration to return the treated water pH to that necessary for delivery to the customers.

2. Significant reductions in raw water TOC (Total Organic Carbon) was achieved by the MIEX® Process which lowered THM and HAA formation potentials to values well below the USEPA (United States Environmental Protection Agency) and FDEP (Florida Department of Environmental Protection) Second Stage Disinfection Byproduct Rule requirements. Forced draft aeration alone would

have little or no affect on TOC reduction and therefore, would provide little or no ability to reduce THM and/or HAA formation potentials.

3. Raw water sulfate concentration was reduced by 25 to 60%. Reducing the concentration of sulfates in the finished water will reduce the downstream formation of sulfides in customer's homes.

4. Raw water color was reduced by over 80%. The removal of color can increase the customer's aesthetic satisfaction with the finished water. Forced draft aeration alone would have little or no affect on color.

5. The operating cost of the combined air stripping and MIEX® treatment depends largely on the resin make-up rate required for the MIEX® treatment stage and the disposal costs for the resin regeneration waste (brine). Preliminary estimates of operating cost range from $0.08 to $0.23 per thousand gallons treated depending on brine disposal method implemented and other factors not yet finalized.

6. The construction cost for a full scale MIEX® facility can not be determined until a large scale demonstration facility has been operated for a period of time necessary to finalize the design of a full scale facility.

   WesTech Engineering, Inc. has provided a proposal to provide a complete 500 GPM MIEX® demonstration unit. The cost of this unit is $327,550 as of March 2002. The unit may be rented by Aloha for the demonstration period for $18,780 per month for a minimum of 12 months. Assuming the demonstration period shows the unit to be capable of treating the water to the levels demonstrated in the pilot testing work, the unit can be incorporated into the full-scale facility for Wells 8 and 9 at a later date. WesTech will credit $203,800 of the rental cost toward the purchase of the unit at that time.

   Assuming FDEP approval can be obtained, this facility can be operated at Well 9 for a period of time (6 to 12 months) to confirm the ability of the MIEX® Process to achieve desired results at a large scale facility. Again, assuming FDEP approval can be obtained, the demonstration facility can provide finished water to the customers during the demonstration phase of the project.

   The demonstration unit proposed is self-contained, however, additional expense will be incurred by Aloha in completing the necessary site work (such as installing concrete pads, security fence, necessary interconnecting piping, electrical service, etc.) associated with installing and utilizing the demonstration plant.

7. The major unresolved issue associated with implementation of the MIEX® Process is how and where to dispose of the resin regenerate (brine) and what the disposal costs will be. For the demonstration facility, it is estimated that the volume of brine will be approximately 262 gallons per day. At this volume, the

brine (with FDEP approval) may be disposed-off at the Seven Springs WWTP if fed into the plant at a slow, controlled flow rate. This may not be the case for a full-scale facility. This issue needs to be addressed during the time the demonstration facility is in operation.

Section 1 - Introduction

A. Pilot Project Overview

In Docket Number 960545-WS the Florida Public Service Commission ordered Aloha Utilities, Inc. to develop a pilot project to study and investigate methods/processes which, when fully implemented, would result in a reduction of hydrogen sulfide in the raw water pumped from the wells which provide raw water for the Seven Springs Water System.

Initially, Aloha had intended to pilot test packed tower aeration with pH adjustment as a means of reducing hydrogen sulfide at its wells as its base-line technology. Aloha planned to pilot test additional technologies once the initial packed tower aeration work was completed.

However, just as the project got underway, Aloha's consulting engineer received a telephone call from a FDEP staff member informing him that Pasco County was pilot testing a new and revolutionary ion exchange process (the MIEX® Process) that not only appeared to remove hydrogen sulfide, but in addition, was capable of removing THM and HAA precursors as well as sulfate. Aloha's engineer was urged to look into this process because it held the promise of not only removing hydrogen sulfide, but, also positioning Aloha to comply with USEPA's Second Stage Disinfection Byproducts Rule. It was also claimed that the MIEX® Process would effectively remove sulfate from raw water as well.

The claimed benefits of the MIEX® Process, if realized, would position the MIEX® Process as technical superior to packed tower aeration with pH control for a number of reasons that included:

1. The MIEX® Process does not require complex pH control adjustment to be applied prior to treatment nor after treatment as the packed tower aeration plus pH adjustment option does to achieve the same level of hydrogen sulfide removal.
2. THM and HAA formation potentials would be reduced by removing TOC from the raw water.
3. The Sulfate concentration of the finished water could be reduced.
4. Color and odor could both be reduced rendering the water more aesthetically pleasing.

Based on conversations with Pasco County Utility management and their consulting engineer regarding the pilot work that they had undertaken, the MIEX® Process appeared to able to provide the benefits claimed. Therefore, Aloha, after consultation with its consulting engineer, decided to undertake pilot testing of the MIEX® Process first and delay pilot testing of packed tower aeration with pH control and other processes until after the MIEX® testing was completed (if at all).

On December 21, 2000 Aloha's attorney notified the FPSC of its intent to pilot test the MIEX® Process before the packed tower aeration with pH control process. Attached to this letter was information describing the MIEX® Process. General MIEX® Process literature is provided here in Appendix A.

B. Pilot Testing Project Overview

The pilot testing of the MIEX® Process has been designed to be multi-stage. The major stages are:

1. Bench-Top (jar) testing of the MIEX® Process to determine if the process was compatible with the raw water supplied by the Seven Springs Water System wells. This work was completed in early 2001. Orica Watercare, the company which owns the MIEX® Process, prepared a report detailing this work which was provided to Aloha in March of 2001. A copy of this report is included here in Appendix B. The results of the bench-top testing were very encouraging. Based on these results Aloha decided to move on to the second stage of the MIEX® Process testing.

2. Stage 2 of the MIEX® Process pilot testing program consisted of on-site pilot scale testing (1.6 to 2 GPM) of the process with flow-through units. This testing was conducted from April through July of 2001.

   This testing consisted of a series of trials designed to determine the effectiveness of the MIEX® Process in reducing the hydrogen sulfide, sulfate, TOC, THM and HAA formation potential concentrations and color of the raw water supplied by Well 9. Well 9 was chosen as the pilot test site as this well has historically supplied raw water that exhibited the highest raw water hydrogen sulfide concentration of all Seven Springs wells. Therefore, if it could be shown that the MIEX® Process could effectively remove the subject constituents from the raw water from this well, then this data could be used to estimate the expected degree of success that could be achieved at the remainder of the wells.

   This interim report has been prepared to discuss the work completed during this stage of the project.

3. The third stage of the project will consist of designing, permitting, constructing and operating a demonstration scale MIEX® Process facility at Well 9. The purpose of this facility is to allow for more detailed, long-term data gathering related to the ability of the MIEX® Process to reduce the subject contaminants. This facility will also provide the FDEP the data required to allow them to permit a full scale facility based on this new technology. The data obtained from the operation of this facility will also provide the detailed design parameter for the full-scale facility(s). If constructed, this facility will be operated for 6 to 12 months.

from the County) in a manner different from that now undertaken, or that contemplated.

In addition, during the time the Stage 2 pilot program work was underway, Aloha learned that SWFWMD (South West Florida Water Management District) was going to require that it reduce the quantity of water currently being pumped from its own wells. SWFWMD further required Aloha to utilize much larger quantities of bulk purchased water from Pasco County to make up for reduced pumping of its own wells. In addition, SWFWMD required Aloha to undertake a Feasibility Study to determine if Aloha could develop an alternative source of water. This new source would be brackish water treated by the Reverse Osmosis process. This feasibility study will take approximately one year to complete and has just begun.

These factors both affect the outcome of the three-stage pilot project work. Should Pasco County eventually deliver bulk water to Aloha that is not compatible with the water it currently produces, or, may produce with the MIEX® Process, then this will have a major effect on the recommendations developed from the pilot project work. The same can be said for the R/O feasibility study work. Should the R/O feasibility study determine that development of the alternative brackish water source is feasible, then this information will also have a major effect on the recommendations developed from the pilot project work.

Hopefully, by the time the demonstration facility work is completed, both of these issues have been resolved and appropriate water system configuration recommendations can be made based on the pilot project work.

E. Regulatory Issues

Presently, there are no USEPA or FDEP regulations related to the concentration of sulfide that may be found in finished water provided by a water company. This project was required by the Florida Public Service Commission (FPSC) in their Final Order related to Docket 960545-WS. In 2001, the FDEP modified their regulations to require hydrogen sulfide monitoring and control for new wells added to a system, however, these modifications do not apply to existing wells. Therefore, any recommendations made regarding demonstration facility testing, and, eventually, full-scale facility construction to reduce hydrogen sulfide found in the raw well water will not be related to USEPA and/or FDEP regulations but to the FPSC Order alone.

First Stage USEPA and FDEP Disinfection Byproduct Rule requires that systems of Aloha's size reduce the THM and HAA concentrations of their finished water to 80 and 60 µg/L respectively by January 1, 2004. Aloha currently meets the running annual average THM concentration requirements of the Stage 1 Disinfection Byproduct Rule. HAA values have not been determined to date, therefore, it is unknown if the Stage 1 Disinfection Byproduct Rule requirement for this containment is presently being met.

The Second Stage USEPA and FDEP Disinfection Byproduct Rule has not yet been promulgated, however, it is scheduled to be issued in late 2002 or early 2003. It is anticipated that the Second Stage Rule will continue to require the same THM and HAA concentration limitations as the First Stage Rule, however, sampling site location specific compliance monitoring may be instituted which will differ from the method presently utilized. In that eventuality, Aloha may be required to add treatment equipment to reduce the TOC concentration of the raw water supplied by its wells or to provide some other form of THM/HAA control technology to meet the new requirements. Therefore, any treatment technology recommendation resulting from this pilot program work should include this additional treatment capability if economically feasible to do so. The cost to later implement THM and/or HAA control technology may be considerably greater later if not undertaken concurrent with any hydrogen sulfide control related plant upgrades.

Section 2 - Methodology

A. Multiple Trial MIEX® Pilot Testing

The MIEX® Process on-site pilot testing program consisted of three "control" runs and seven (7) distinct "trials." The control runs provided base-line data, which could be used to evaluate the related trials. Each control was run in the same configuration as the trials undertaken immediately following the control run. Each of the seven trials was undertaken to investigate a specific issue or to confirm the outcome of a previous trial. Below, each control run and its associated trials are briefly described:

Control Trial – Stirred Tank Reactor: Trial was conducted to determine the chemical changes that would take place simply due to aeration at the air/water interface by mixing the tank contents.

Trial 1– Six day Stirred Tank Reactor MIEX® Trial: Trial was conducted to determine the effectiveness of the MIEX resin in reducing the hydrogen sulfide, sulfate, TOC, Color, THM formation potential and HAA formation potential of the raw water delivered by Well 9. This trial was also undertaken to obtain a measure of the capacity of the resin to remove these constituents over time.

Trial 2– Six day Stirred Tank Reactor MIEX® Trial: Trial was conducted to verify the findings of Trial 1 and further investigate the ability of the MIEX resin to remove the constituents over time.

Control Trial–Upflow Fluidized Bed Reactor: Trial was conducted to determine the chemical changes that would take place simply due to aeration at the air/water interface by mixing the tank contents.

Trial 3–One Day Upflow Fluidized Bed Reactor MIEX® Trial: Trial was conducted to determine effectiveness of MIEX resin in reducing the hydrogen sulfide, sulfate, TOC, Color, THM formation potential and HAA formation potential of the raw water delivered by Well 9 at one set of resin dosage and resin bed height conditions.

Trial 4–One Day Upflow Fluidized Bed Reactor MIEX® Trial: Trial was conducted to determine effectiveness of MIEX resin in reducing the hydrogen sulfide, sulfate, TOC, Color, THM formation potential and HAA formation potential of the raw water delivered by Well 9 at a second set of resin dosage and resin bed height conditions.

Trial 5–One Day Upflow Fluidized Bed Reactor MIEX® Trial: Trial was conducted to determine effectiveness of MIEX resin in reducing the hydrogen sulfide, sulfate, TOC, Color, THM formation potential and HAA formation potential of the raw water delivered by Well 9 at a third set of resin dosage and resin bed height conditions.

Control Trial–Upflow Fluidized Bed Reactor-High Dosage: Trial was conducted to determine the chemical changes that would take place simply due to aeration at the air/water interface by mixing the tank contents.

Trial 6–One Day Upflow Fluidized Bed Reactor High Dosage MIEX® Trial: Trial was conducted to determine effectiveness of MIEX resin in reducing the hydrogen sulfide, sulfate, TOC, Color, THM formation potential and HAA formation potential of the raw water delivered by Well 9 at a high resin dosage and a feed water flow of 2 GPM.

Trial 7–One Day Upflow Fluidized Bed Reactor High Dosage MIEX® Trial: Trial was conducted to determine effectiveness of MIEX resin in reducing the hydrogen sulfide, sulfate, TOC, Color, THM formation potential and HAA formation potential of the raw water delivered by Well 9 at a high resin dosage and a feed water flow of 1 GPM.

B. On-Site and Remote Laboratory Testing

All laboratory testing, on-site and remote, was conducted in accordance with industry standard procedures. The sampling and testing methodology for each parameter was developed by SEL (Short Environmental Laboratories, Inc.). Both on-site and remote (SEL laboratory) testing was undertaken.

The on-site laboratory equipment was provided by, installed and maintained by SEL. SEL also conducted the initial calibration of all equipment, developed all specific parameter calculation "factors", provided all standards and reagents, trained the on-site testing staff and provided assistance and periodic quality control checks during the completion of the program. Hydrogen sulfide, pH, color and UV_{254} absorbance were analyzed on-site.

Remote laboratory testing was conducted under the direction of SEL. SEL is a State of Florida Certified laboratory. Samples were collected and preserved per USEPA approved procedures and/or procedures identified in "Standard Methods for the Examination of Water and Wastewater", 20th Edition by the on-site staff. SEL staff collected samples for analysis and transported them to the laboratory with the acceptable holding times as per USEPA approved procedures and/or procedures identified in "Standard Methods for the Examination of Water and Wastewater", 20th Edition. Standard chain of custody documentation accompanied these samples to the laboratory. Parameters determined in the remote laboratory were alkalinity, chloride, sulfate, TOC, iron, manganese, conductivity, gross alpha, THM and HAA formation potentials. Other State Certified laboratories conducted some of the analyses under sub-contract with SEL.

Section 3 - Control Trial, Trials 1 and 2

A. Overview

This control trial and the two pilot trials were undertaken to determine the effectiveness of the MIEX resin in reducing the hydrogen sulfide, sulfate, TOC, Color, THM and HAA formation potentials of the raw water delivered by Well 9 utilizing stirred-tank reactors (mixing tanks). This trial was also undertaken to obtain a measure of the capacity of the resin to remove these constituents over time.

B. Equipment Configuration

The equipment utilized for the control run and the two trials was configured as shown in Figure 1.

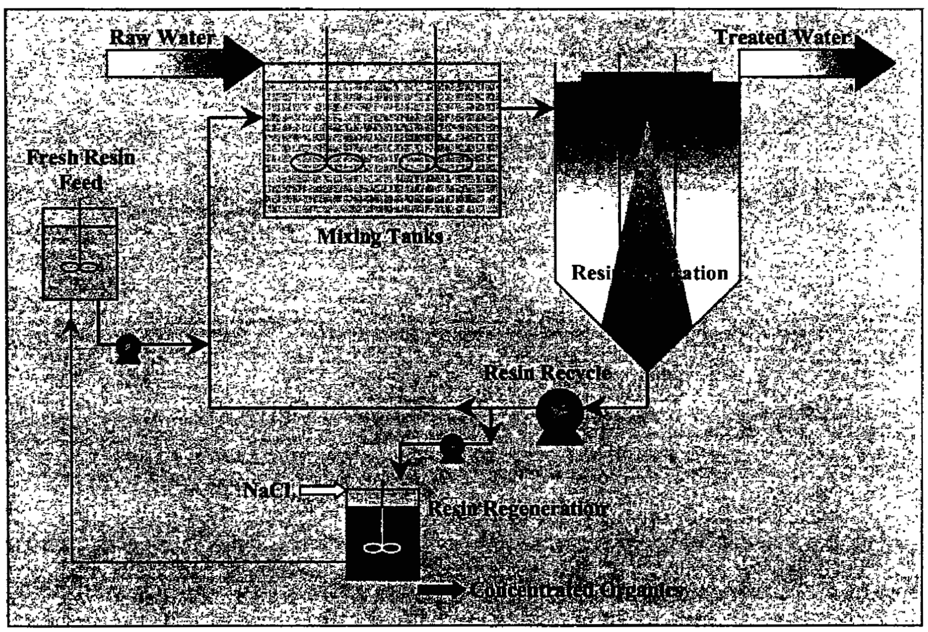


Figure 1 – Stirred Tank Reactor Configuration

First, raw water from Well 9 was pumped at the rate of 1.6 GPM to the mixing tanks. Here, raw water and MIEX® resin were intimately mixed by mechanical mixers. Two mixing tanks, in series, were utilized. The total retention time of the mixing tanks (stirred-tank reactors) was approximately 35 minutes. For the control run, no MIEX® resin was added to the mixing tanks. For both trials, a 6 ml/L MIEX® resin concentration was maintained in the mix tanks.
When describing MIEX® resin concentrations, traditional mass/volume (such as mg/L)

concentration descriptors are not used. Rather, settled volume of settled resin found in a one liter sample of mixing tank contents, held in a one liter graduate cylinder after five minute quiescent settling period is used. Since the MIEX® resin settles very fast and compactly, this means of quickly measuring resin concentration provides a quick and easy means of monitoring resin concentration in the mixing tanks.

After the water was treated in the mixing tanks, it traveled to the resin separation tank (a down-flow gravity clarifier). Here the MIEX® resin was removed from the treated water. Settled resin was removed from the separation tank by a resin recycle peristaltic pump to the head of the mixing tanks. A Resin regeneration peristaltic pump diverted a portion of the resin recycle flow and sent it to regeneration. Concurrently, fresh resin (regenerated resin) was pumped to the head end of the mixing tanks. Regeneration of resin was conducted once per day.

The pilot unit, being a very small-scale representation of a conventional MIEX® complete mix facility, could experience problems with resin plugging the very small peristaltic pump tubing. Therefore, the fresh resin tank and mixing tank concentrations as well as the pump flow rates were selected to minimize this problem. The fresh resin tank concentration was maintained at 150 ml/L. The mixing tank concentrations were set at 6 ml/L. The recycle pump flow rate was set at 240 ml/min to maintain a cleansing velocity in the pump tubing, however, it was operated on a 90% on-10% off cycle so as to provide the proper total flow rate. The resin recycle and resin regeneration pumps also operated at 240 ml/min, however they operated at 10% on-90% off cycle. These pump rates and tank concentrations allowed the test unit to operated continuously with minimum plugging problems. A picture of the pilot unit is provided as Figure 2.

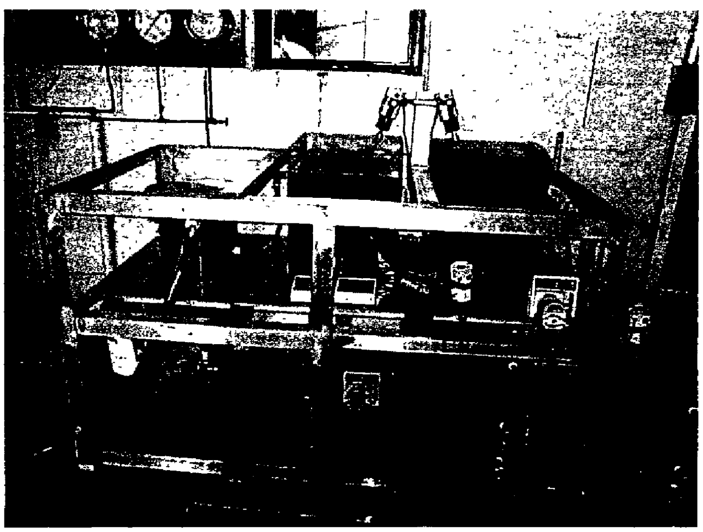


Figure 2 – Stirred Tank Reactor Configuration Pilot Unit

C. Control Trial – Stirred Tank Reactor

The control trial was operated under the following conditions:

Stirred Tank Reactor
MIEX® Resin Dosage: 0 ml/L
Raw Water Flow Rate: 1.6 GPM
Duration of Run: 1 Day

This control trial confirmed the findings obtained in the bench-top trials completed earlier (see Appendix B) as they related to hydrogen sulfide release through mixing and aeration in the mixing tanks. The data shows that approximately 40 to 45% of the hydrogen sulfide present in the raw water is lost in the mixing tanks due to mixing and aeration alone. The results obtained were as anticipated. The solubility of hydrogen sulfide is dependent on pH. With a water pH of 7, the relative percentage of dissolved hydrogen sulfide would be 50%. It is this component that is primarily removed by simple aeration alone. At pH 7, the remaining 50% of the sulfides would be in the ionized form. It is this ionized form that the MIEX® Process is capable of removing.

Complete results for all water testing conducted during this trial can be found in Appendix C.

D. Trial 1

Trial 1 was operated under the following conditions:

Stirred Tank Reactor
MIEX® Resin Dosage: 6 ml/L
Raw Water Flow Rate: 1.6 GPM
Duration of Run: 6 Continuous Days

Trial 1 was operated for a continuous six day period. During the trial, raw water flow rate, resin tank concentrations, and all appurtenant pumps were operated at constant conditions to the extent possible. The configuration of the test unit for this trial was a conventional MIEX® complete mix system. The same resin was utilized throughout the trial as well, however, a portion of the resin was regenerated each day. The same brine was utilized to regenerate the resin for the entire 6 day period; only additional salt was added to the brine each day.

The results show that the MIEX® Process was very effective in removing the ionized portion of the hydrogen sulfide present in the raw water. Over 98% of the total hydrogen sulfide found in the raw water was removed by the combination of mixing/aeration and MIEX® resin ion exchange.

Color was reduced to a very high degree. The color of the finished water was frequently between 0 and 1 platinum cobalt color units. Visually the finished water was very pleasing with the appearance of bottled water.

TOC was reduced by as much as 75%.

Alkalinity was essentially unchanged by the process.

The pH of the treated water increased to a minor degree due mainly to the reduction of hydrogen sulfide.

The iron concentration of the treated water increased due to minor carryover of MIEX® resin into the finished water. The scale of the test unit was such that the ability of the clarifier to remove the very light and fine MIEX® resin was limited. It is anticipated that this resin carryover will not occur in a larger scale unit. However, it is very important that this carryover be controlled for two major reasons. The resin is very costly and the loss resin will increase operating costs. Resin loss results in increased iron concentration of the finished water. Since the MCL (maximum contaminant level) allowed by FDEP rule for iron is 0.3 mg/L, resin loss could cause the finished water to exceed this value.

Sulfate was removed by up to 31%.

Chlorides were increased through the process. The magnitude of the increase was in the neighborhood of 20 to 30 mg/L on average. The maximum concentration of chlorides leaving the pilot unit was 41.7 mg/L which is substantially less then the 250 mg/L MCL.

UV_{254} absorbance was reduced by up to 96%.

THM formation potential was reduced by up to 60%. The lowest concentration obtained was 57 μg/L. This value was well below the Stage 1 Disinfection Byproduct Rule requirements of 80 μg/L.

HAA formation potential was reduced by up to 79%. The lowest concentration obtained was 24.6 μg/L. This value was well below the Stage 1 Disinfection Byproduct Rule requirements of 60 μg/L.

Complete results for all water testing conducted during this trial can be found in Appendix C. Please see that section for a complete report of the entire range of values obtained for each parameter.

E. Trial 2

Trial 2 was operated under the same conditions as trial 1:

Stirred Tank Reactor
MIEX® Resin Dosage: 6 ml/L
Raw Water Flow Rate: 1.6 GPM
Duration of Run: 6 Continuous Days

Trial 2 was operated for a continuous six-day period. During the trial, raw water flow rate, resin tank concentrations, and all appurtenant pumps were operated at constant conditions to the extent possible. The configuration of the test unit for this trial was a conventional MIEX® complete mix system. The same resin was utilized throughout the trial as well, however, a portion of the resin was regenerated each day. The brine from Trial 1 was set aside and new brine was produced for use in Trial 2. The same new brine was utilized to regenerate the resin for the entire 6 day period;

only additional salt was added to the brine each day.

The results show that the MIEX® Process was very effective in removing the ionized portion of the hydrogen sulfide present in the raw water. Over 98% of the total hydrogen sulfide found in the raw water was removed by the combination of mixing/aeration and MIEX® resin ion exchange.

Color was reduced to a very high degree. The color of the finished water was frequently between 0 and 1 platinum cobalt color units. Visually the finished water was very pleasing with the appearance of bottled water.

TOC was reduced by as much as 69%.

Alkalinity was essentially unchanged by the process.

The pH of the treated water increased to a minor degree due mainly to the reduction of hydrogen sulfide.

The iron concentration of the treated water increased due to minor carryover of MIEX® resin into the finished water. The scale of the test unit was such that the ability of the clarifier to remove the very light and fine MIEX® resin was limited. It is very important that this resin carryover be controlled for two major reasons. The resin is very costly and the lost resin will increase operating costs. Resin loss results in increased iron concentration of the finished water. Since the MCL (maximum contaminant level) allowed by FDEP rule for iron is 0.3 mg/L, resin loss could cause the finished water to exceed this value. One testing result for finished water iron was 0.47 mg/L which was in excess of the MCL. It is anticipated that this resin carryover will not occur in a larger scale unit as a cartridge filter will be included in the design.

Sulfate was removed by up to 66%.

Chlorides were increased through the process. The magnitude of the increase was in the neighborhood of 20 to 30 mg/L on average. The maximum concentration of chlorides leaving the pilot unit was 47.6 mg/L which is substantially less then the 250 mg/L MCL.

UV_{254} absorbance was reduced by up to 95%.

THM formation potential was reduced by up to 60%. The lowest concentration obtained was 67 μg/L. This value was well below the Stage 1 Disinfection Byproduct Rule requirements of 80 μg/L.

HAA formation potential was reduced by up to 70%. The lowest concentration obtained was 23.0 μg/L. This value was well below the Stage 1 Disinfection Byproduct Rule requirements of 60 μg/L.

Complete results for all water testing conducted during this trial can be found in Appendix C. Please see that section for a complete report of the entire range of values obtained for each parameter.

F. Graphical Presentation of Testing Results for Trials 1 and 2

Finished water data for selected parameters are presented below for the data obtained in Trials 1 and 2 combined:

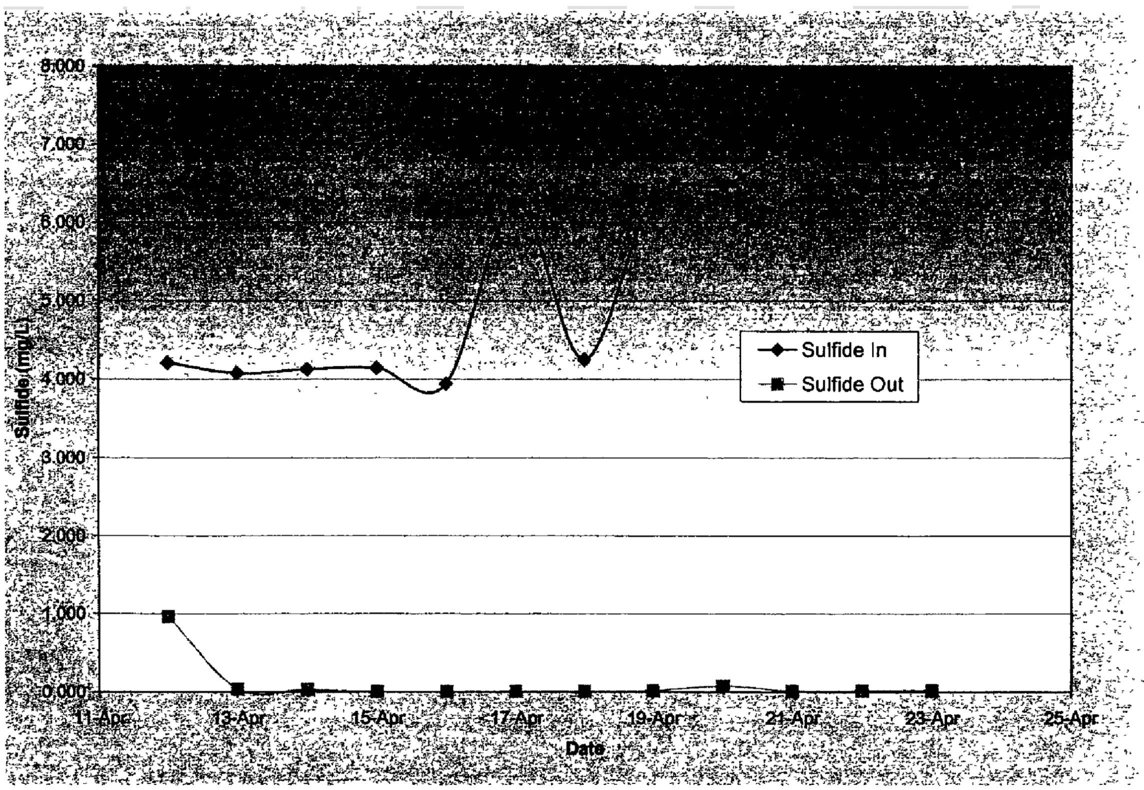


Figure 3 - Sulfide Results

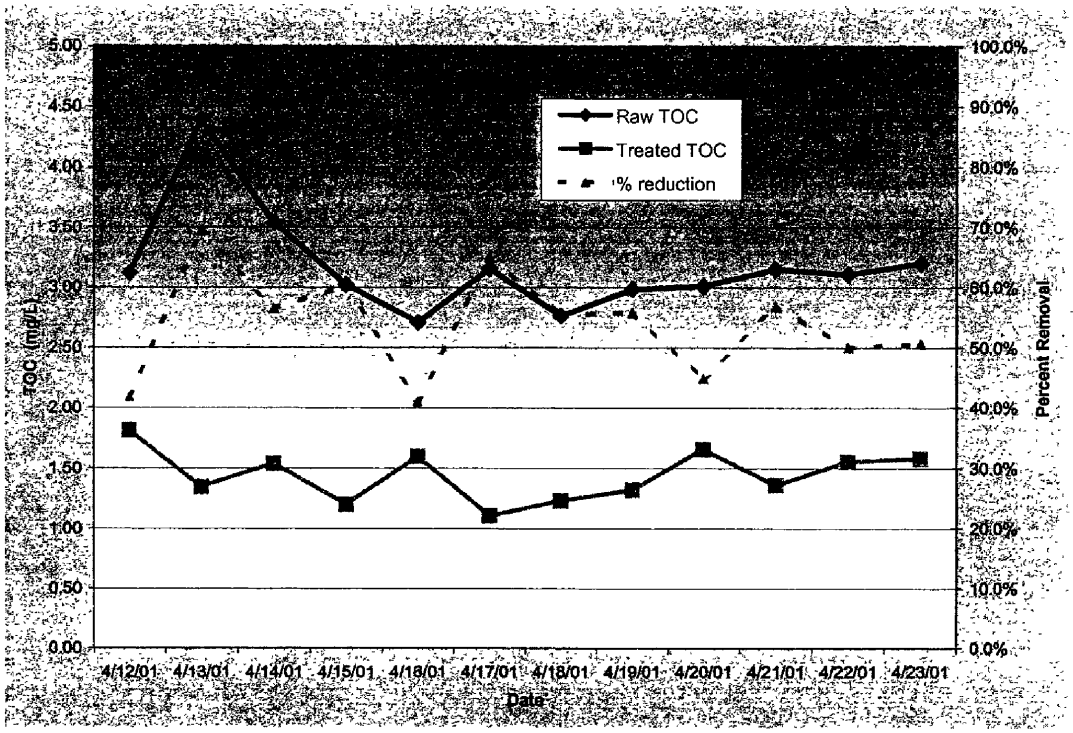


Figure 4 - TOC Results

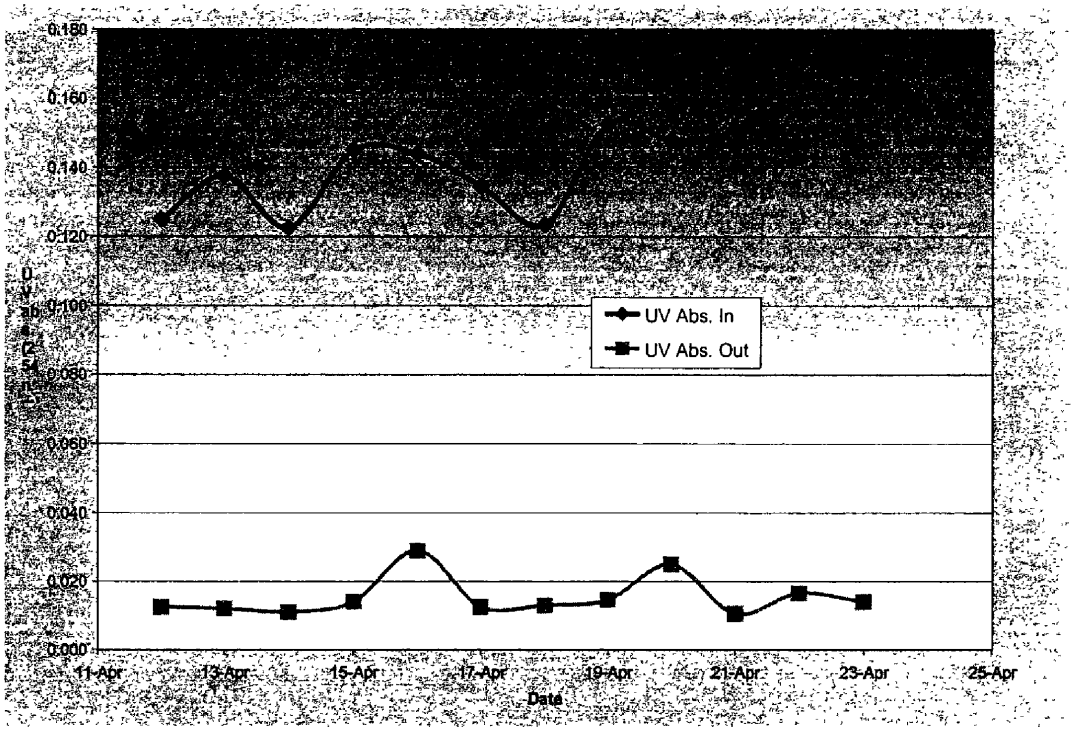


Figure 5 - UV_{254} Absorbance

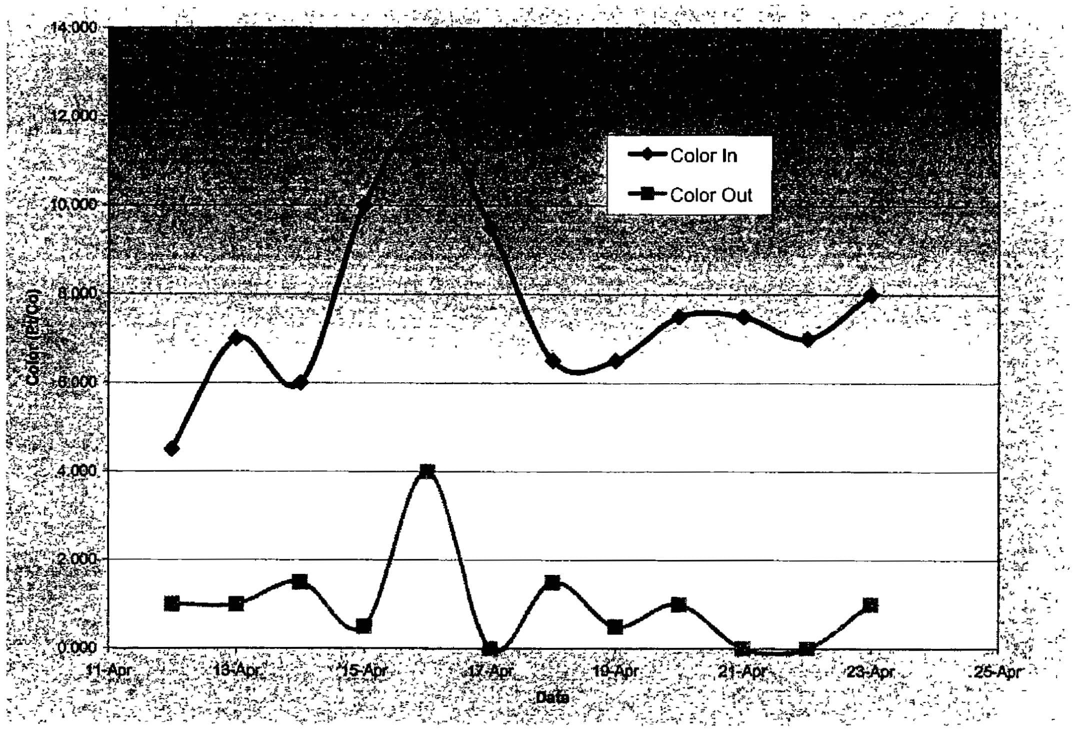


Figure 6 - Color Results

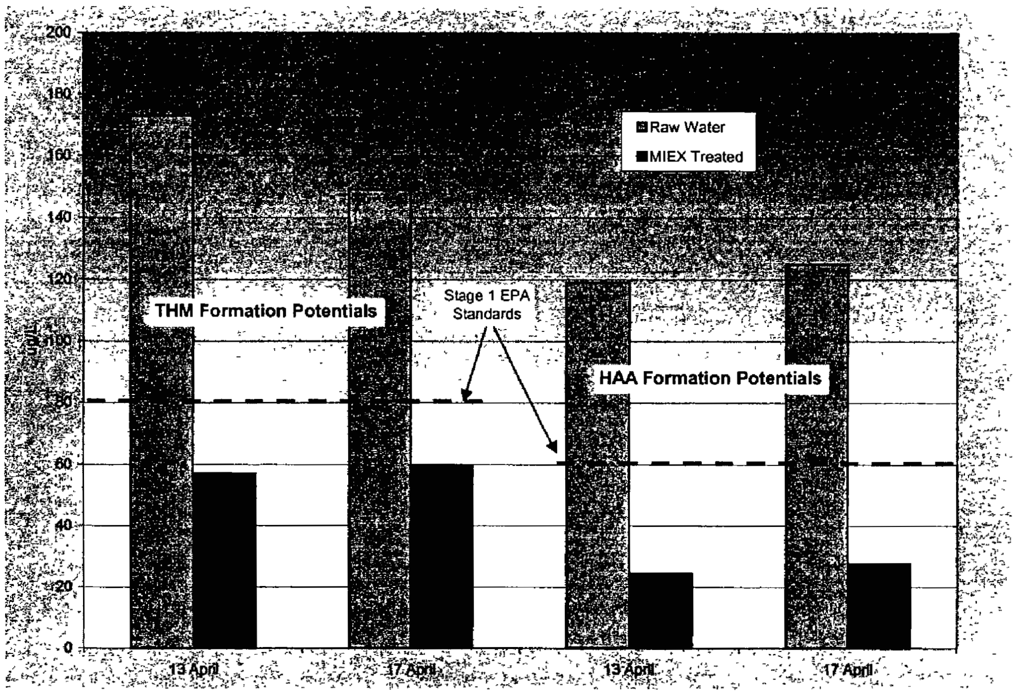


Figure 7 - THM and HAA Formation Potential Results

Section 4 – Control Trial, Trials 3, 4, and 5

A. Overview

This control trial and the three pilot trials were undertaken to determine the effectiveness of the MIEX® resin in reducing the hydrogen sulfide, sulfate, TOC, UV_{254} absorbance, and Color of the raw water delivered by Well 9 utilizing an upflow fluidized bed reactor.

The objective of this configuration is to combine the reactor and resin separation stages. This is achieved by passing the water through a high concentration of fluidized resin at the bottom of the vessel at a rate that keeps the resin within the vessel. Resin is then withdrawn from the bed for regeneration and then added back to the reactor. The advantages of piloting this configuration are as follows:

- The footprint of the plant is significantly reduced resulting in lower capital costs.
- There is less pumping and mixing of the resin, which therefore minimizes resin attrition and lowers operating costs.
- In the absence of mechanical mixing there will not be H_2S stripped from the water. Therefore, the effectiveness of the MIEX® resin in removing total sulfides can be determined.

A disadvantage of this configuration is a higher initial resin inventory, but at the scale being considered for Aloha Utilities, operating cost savings and the benefits of a smaller footprint will outweigh the initial resin inventory cost.

B. Equipment Configuration

The equipment utilized for the control run and the two trials was configured as shown in Figures 8 and 9.

First, raw water from Well 9 was pumped at the rate of 2.0 GPM to the upflow fluidized bed reactor. Here, raw water and MIEX® resin were intimately mixed by the action of the water flowing through the unit. The total retention time of the upflow fluidized bed reactor was dependant on the resin bed height. The resin bed height was function of the quantity of resin placed in the reactor and the flow rate of the raw water and/or recycle flows through the reactor.

For the control run, no MIEX® resin was added to the mixing tanks. This allowed the measurement of sulfide loss through the unit due to physical processes alone.

For trial number 3, approximately 3,000 ml of resin was added to the reactor. The raw water flow rate was set to 2.0 GPM. Fresh resin was added to the reactor at 160 ml/min. with the pump operating at 10% on time. Resin was removed from the reactor at the rate of 160 ml/min. with the pump operating at 10% on time. The bed expansion (height) during this trial was approximately 26 inches. The approximate total contact time was 95 seconds. The approximate resin concentration in the bed was 230 ml/L at a point 18" from the bottom of the reactor floor in the resin bed.

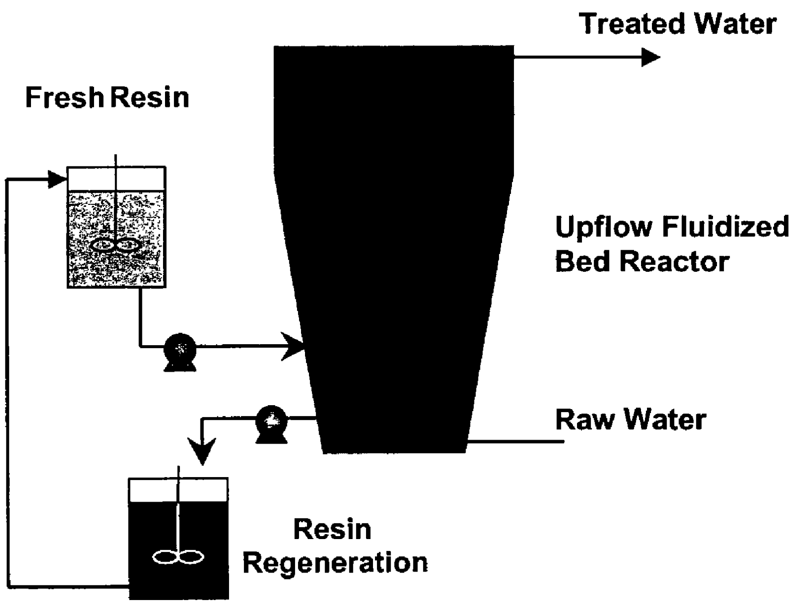


Figure 8 – Upflow Fluidized Bed Configuration

For trial number 4, approximately 4,000 ml of resin was added to the reactor. The raw water flow rate was set to 2.0 GPM. Fresh resin was added to the reactor at 300 ml/min. with the pump operating at 10% on time. Resin was removed from the reactor at the rate of 300 ml/min. with the pump operating at 10% on time. The bed expansion (height) during this trial was approximately 39 inches. The approximate total contact time was 143 seconds. The approximate resin concentration in the bed was 230 ml/L at a point 18" from the bottom of the reactor floor in the resin bed.

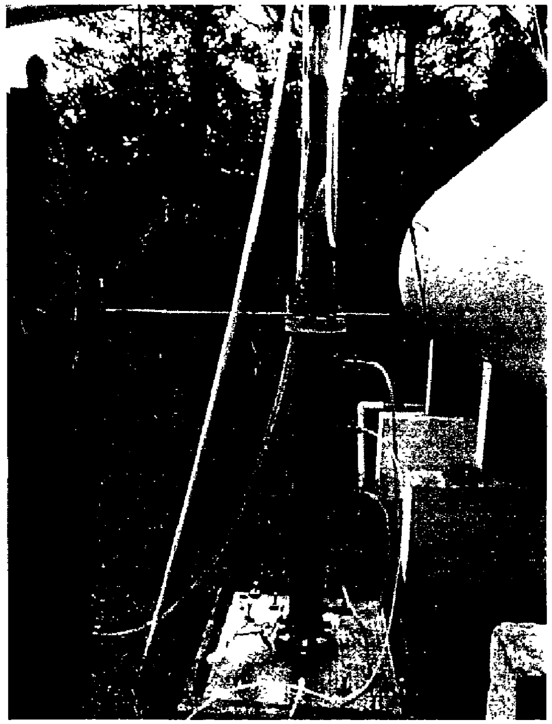


Figure 9 – Upflow Fluidized Bed Configuration Pilot Unit

For trial number 5, approximately 8,000 ml of resin was added to the reactor. The raw water flow rate was set to 2.0 GPM. No fresh resin was added to the reactor during this trial. No resin was removed from the reactor during this trial. The bed expansion (height) during this trial was approximately 74 inches. The approximate total contact time was 270 seconds. The approximate resin concentration in the bed was 230 ml/L at a point 18" from the bottom of the reactor floor in the resin bed.

C. Control Trial – Upflow Fluidized Bed Reactor

The control run was operated under the following conditions:

Upflow Fluidized Bed Reactor
MIEX® Resin Dosage: 0 ml/L
Raw Water Flow Rate: 2.0 GPM
Duration of Run: 45 Minutes

This control trial confirmed that in the absence of sufficient air/water interface and mechanical mixing, no appreciable reduction in hydrogen sulfide concentration is experienced through the reactor.
Complete results for all water testing conducted during this trial can be found in Appendix C.

Please see that section for a complete report of the entire range of values obtained for each parameter.

D. Trial 3

Trial 3 was operated under the following conditions:

Upflow Fluidized Bed Reactor
MIEX® Resin Dosage: 3,000 ml of Resin Added
Bed Expansion (Height): 26"
Raw Water Flow Rate: 2.0 GPM
Resin Contract Time: Approximately 95 Seconds
Duration of Run: 60 Minutes

The results show that the MIEX® Process, when operated in this configuration, was effective in removing the ionized portion of the hydrogen sulfide present in the raw water. Over 30% of the total sulfides found in the raw water was removed by the MIEX® resin alone.

Color was reduced to 1 platinum cobalt color unit. Visually the finished water was very pleasing with the appearance of bottled water.

TOC was reduced by as much as 26%. This was less than anticipated. We believe that this was due to mixing (chemical transport) limitations inherent in the design of the upflow fluidized bed reactor pilot unit. The demonstration unit proposed will allow confirmation that a properly sized and designed unit will not exhibit this limitation.

Alkalinity was essentially unchanged by the process.

The pH of the treated water was not changed to any degree.

Sulfate was removed by approximately 58%.

UV_{254} absorbance was reduced by approximately 58%.

Complete results for all water testing conducted during this trial can be found in Appendix C. Please see that section for a complete report of the entire range of values obtained for each parameter.

E. Trial 4

Trial 4 was operated under the following conditions:

Upflow Fluidized Bed Reactor
MIEX® Resin Dosage: 4,000 ml of Resin Added
Bed Expansion (Height): 39"
Raw Water Flow Rate: 2.0 GPM

Resin Contract Time: Approximately 143 Seconds
Duration of Run: 110 Minutes

The results show that the MIEX® Process, when operated in this configuration, was effective in removing the ionized portion of the hydrogen sulfide present in the raw water. Over 36% of the total sulfides found in the raw water was removed by the MIEX® resin alone.

Color was reduced to 1 platinum cobalt color unit. Visually the finished water was very pleasing with the appearance of bottled water.

TOC was reduced by as much as 38%. This was less than anticipated. We believe that this was due to mixing (chemical transport) limitations inherent in the design of the upflow fluidized bed reactor pilot unit. The demonstration unit proposed will allow confirmation that a properly sized and designed unit will not exhibit this limitation.

Alkalinity was essentially unchanged by the process.

The pH of the treated water was not changed to any degree.

Sulfate was removed by approximately 61%.

UV_{254} absorbance was reduced by approximately 59%.

Complete results for all water testing conducted during this trial can be found in Appendix C. Please see that section for a complete report of the entire range of values obtained for each parameter.

F. Trial 5

Trial 5 was operated under the following conditions:

Upflow Fluidized Bed Reactor
MIEX® Resin Dosage: 8,000 ml of Resin Added
Bed Expansion (Height): 74"
Raw Water Flow Rate: 2.0 GPM
Resin Contract Time: Approximately 270 Seconds
Duration of Run: 90 Minutes

The results show that the MIEX® Process, when operated in this configuration, was effective in removing the ionized portion of the hydrogen sulfide present in the raw water. Approximately 60% of the total sulfides found in the raw water was removed by the MIEX® resin alone.

Color was reduced to 1 platinum cobalt color unit. Visually the finished water was very pleasing with the appearance of bottled water.

TOC was reduced by as much as 39%. This was less than anticipated. We believe that this was due to mixing (chemical transport) limitations inherent in the design of the upflow fluidized bed reactor pilot unit. The demonstration unit proposed will allow confirmation that a properly sized and designed unit will not exhibit this limitation.

Alkalinity was reduced by 19%. This appears to be a anomaly.

The pH of the treated water was not changed to any degree.

Sulfate was removed by approximately 85%.

UV_{254} absorbance was reduced by approximately 80%.

Complete results for all water testing conducted during this trial can be found in Appendix C. Please see that section for a complete report of the entire range of values obtained for each parameter.

G. Discussion

The upflow fluidized bed reactor pilot unit was of first generation design. During the pilot work, it was apparent that this unit was mixing limited in the reaction zone. This caused the removal rates for the various parameters to be lower then expected when typical resin concentrations were utilized.

Due to the design of the unit, no modification could be made on-site to increase the mixing provided in the reaction zone. The net result of reduced mixing is the reduction in the number of resin-contaminant contacts, lowering efficiency. Therefore, it was decided that additional trials (Trials 4 and 5) would be run with increasing reaction times to simulate more effective mixing in the reaction zone of the standard upflow reactor (Trail 3). This required that additional resin be added over that provided in Trial 3 for these additional runs. The addition of resin caused the bed height to increase, which increased the reaction time. It is important to note that the resin concentration in the bed was maintained at approximately similar levels due to the increase in bed height.

Section 5 – Control Trial, Trials 6 and 7

A. Overview

This control trial and the two pilot trials were undertaken to further determine the effectiveness of the MIEX® resin in reducing the hydrogen sulfide, TOC, UV_{254} Absorbance, and Color of the raw water delivered by Well 9 utilizing an upflow fluidized bed reactor.

As discussed in Section 4, the upflow fluidized bed reactor pilot unit was of first generation design. During the pilot work, it was apparent that this unit was mixing limited in the reaction zone. This caused the removal rates for the various parameters to be lower then expected when typical resin concentrations were utilized.

Trials 6 and 7 were operated at very high MIEX® resin dosages (8,400 ml of resin added to reactor). Trial 6 was operated at 2 GPM raw water flow rate. Trial 7 was operated at 1 GPM flow rate. Therefore, Trial 6 was essentially a repeat of Trial 5 with a slight increase in resin concentration and bed expansion. Trial 7, due to the decrease in the raw water flow rate to 1 GPM essentially doubled the resin dosage per unit of raw water applied.

B. Equipment Configuration

The equipment utilized for the control run and the two trials was configured the same as that utilized in Section Three above (See Figures 8 and 9).

First, raw water from Well 9 was pumped at the rate of 2.0 GPM to the upflow fluidized bed reactor. Here, raw water and MIEX® resin were intimately mixed by the action of the water flowing through the unit. The total retention time of the upflow fluidized bed reactor was dependant on the resin bed height. The resin bed height was function of the quantity of resin placed in the reactor and the flow rate of the raw water and/or recycle flows through the reactor.

For the control run, no MIEX® resin was added to the mixing tanks. This allowed the measurement of sulfide loss through the unit due to physical processes alone.

For trial number 6, approximately 8,400 ml of resin was added to the reactor. The raw water flow rate was set for 2.0 GPM. No fresh resin was added to the reactor during this trial. No resin was removed from the reactor during this trial. The bed expansion (height) during this trial was at 196 inches (top of the reactor). The approximate total contact time was approximately 715 seconds. The approximate resin concentration in the bed was 230 ml/L at a point 18" from the bottom of the reactor floor in the resin bed.

For trial number 7, approximately 8,400 ml of resin was added to the reactor. The raw water flow rate was set for 1.0 GPM. No fresh resin was added to the reactor during this trial. No resin was removed from the reactor during this trial. The bed expansion (height) during this trial was at 50 inches (top of the reactor). The approximate total contact time was approximately 356 seconds. The approximate resin concentration in the bed was 400 ml/L at a point 30" from the bottom of the reactor floor in the resin bed.

C. Control Trial – Upflow Fluidized Bed Reactor

The control run was operated under the following conditions:

Upflow Fluidized Bed Reactor
MIEX® Resin Dosage: 0 ml/L
Raw Water Flow Rate: 2.0 GPM
Duration of Run: 120 Minutes

This control trial confirmed that in the absence of sufficient air/water interface and mechanical mixing, no appreciable reduction in hydrogen sulfide concentration is experienced through the reactor.

Complete results for all water testing conducted during this trial can be found in Appendix C. Please see that section for a complete report of the entire range of values obtained for each parameter.

D. Trial 6

Trial 6 was operated under the following conditions:

Upflow Fluidized Bed Reactor
MIEX® Resin Dosage: 8,400 ml of Resin Added
Bed Expansion (Height): 196"
Raw Water Flow Rate: 2.0 GPM
Resin Contract Time: Approximately 715 Seconds
Duration of Run: 120 Minutes

The results show that the MIEX® Process, when operated in this configuration, was effective in removing the ionized portion of the hydrogen sulfide present in the raw water. Over 52% of the total sulfides found in the raw water was removed by the MIEX® resin alone.

Color was reduced to 6 platinum cobalt color unit. This trial shows a reduction in color removal over that shown for Trial 5. We believe that this was due to carryover of resin from the reactor into the finished water reservoir. The resin dosage was great enough to cause the resin bed to expand to the top of the reactor causing the loss of resin.

TOC was reduced by as much as 49%.

The pH of the treated water was not changed to any meaningful degree.

UV_{254} absorbance was reduced by approximately 70%.

Complete results for all water testing conducted during this trial can be found in Appendix C. Please see that section for a complete report of the entire range of values obtained for each parameter.

E. Trial 7

Trial 7 was operated under the following conditions:

Upflow Fluidized Bed Reactor
MIEX® Resin Dosage: 8,400 ml of Resin Added
Bed Expansion (Height): 50"
Raw Water Flow Rate: 1.0 GPM
Resin Contract Time: Approximately 356 Seconds
Duration of Run: 120 Minutes

The results show that the MIEX® Process, when operated in this configuration, was effective in removing the ionized portion of the hydrogen sulfide present in the raw water. Over 45% of the total sulfides found in the raw water was removed by the MIEX® resin alone.

Color was reduced to 4 platinum cobalt color unit. This trial shows a reduction in color removal over that shown for Trial 5. Again we believe that this was caused by pilot unit design and configuration limitations.

TOC was reduced by as much as 49%.

The pH of the treated water was not changed to any meaningful degree.

UV_{254} absorbance was reduced by approximately 72%.

Complete results for all water testing conducted during this trial can be found in Appendix C. Please see that section for a complete report of the entire range of values obtained for each parameter.

F. Discussion

The testing results for the three previous trials (3,4 and 5) and high dosage trails (6 and 7), indicate that as the likelihood of resin and contaminants contact increases (from Trial 3 to 4 to 5 to 6 and finally 7) the removal rates of the various contaminants also increased. We believe that this indicates that with a properly designed upflow fluidized bed reactor, one can anticipate that the contaminant removal rates will be at least equal to those obtained with a properly sized conventional MIEX® Process (stirred tank) unit. The proposed large-scale demonstration unit will be operated to confirm or disprove this hypothesis.

Section 6 - Resin Activity

A. Overview

Testing of the resin's kinetic performance was undertaken to determine if there was any decline in resin performance due to irreversible fouling or reuse of regenerant. A decline in resin activity may be caused by inorganic precipitation or by partial organic fouling of the resin due to inefficient regeneration.

The activity tests were performed as standard MIEX® jar tests on the raw water with a dose of 6 ml/l resin. Water samples were extracted after 15 and 30 minutes of mixing, and filtered through a 0.45 μm GF (glass fiber) filter prior to UV_{254} Absorbance analyses.

The UV_{254} Absorbance results were used to compare the kinetics of UV_{254} Absorbance reduction (i.e. organic uptake) of the resin samples. The results shown in Figure 10 indicate minimal differences in the resin performance, hence no irreversible fouling.

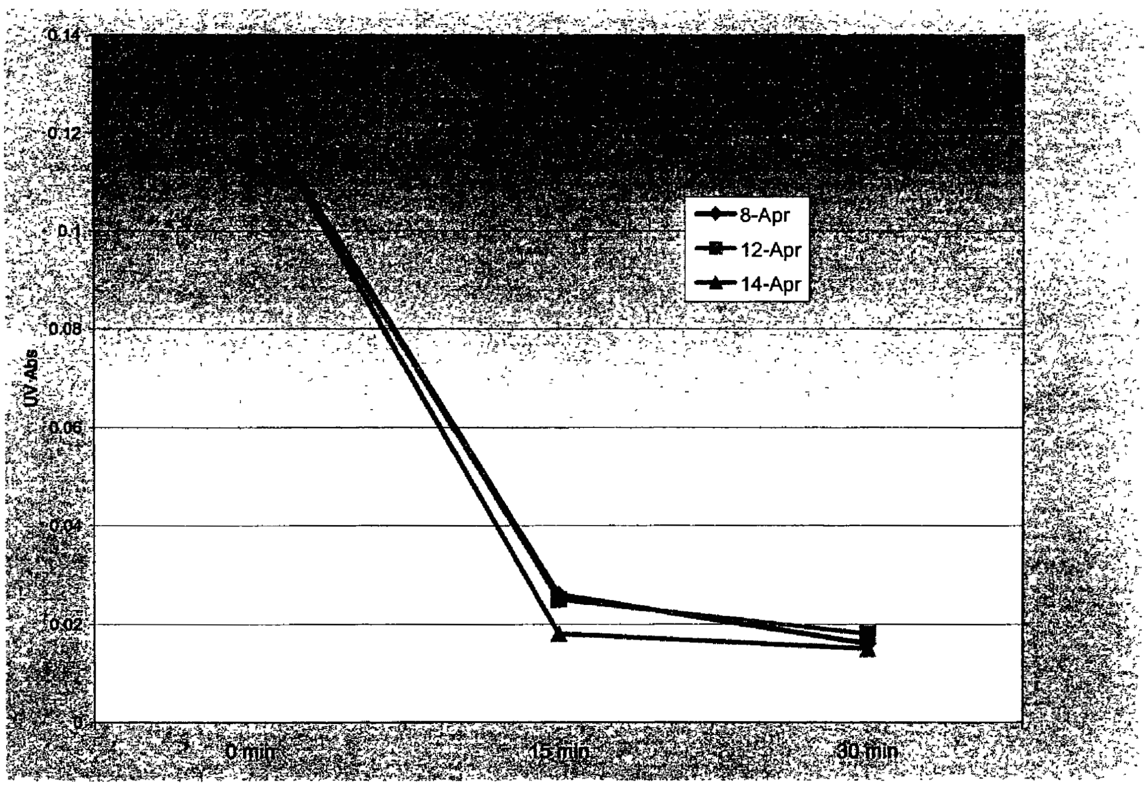


Figure 10 – Resin Activity Tests

Section 7 - Brine Characteristics and Disposal

A. Overview

Various contaminants (such as sulfide, sulfate and organics) are removed from the raw water by their adsorption onto the MIEX® resin. Eventually, the number of sites where this adsorption can occur on the surface of the MIEX® resin particles is reduced to the point where the process will no longer function. To prevent this process breakdown, some of the resin is removed from the reactor each day and is regenerated. This regeneration process causes the adsorbed contaminants to be removed from the resin, restoring the capacity of the used resin to approximately that of virgin resin. The regenerated resin is then returned back to the reactor to enable it to continue operation.

Regeneration is accomplished by placing the used resin into a strong solution of salt (sodium chloride). The adsorption sites on the resin have a stronger affinity for the chloride then they do for the attached contaminants under these conditions. The attached contaminants are freed from the adsorption sites and chloride takes their place on the surface of the resin particles.

The solution used to regenerate the resin is called a "brine" as it is very salty. In addition, this brine is used a number of times to regenerate resin before it is disposed of. Consequently, this brine accumulates large quantities of salt, organics, sulfide, sulfate and other contaminants. The disposal of this brine, which is very difficult and complex, is the largest impediment to the use of ion exchange processes in water treatment.

B. Brine Capacity For Reuse

The pilot plant was initially (Trials 1 and 2) started up and operated continuously for a 12 day period. Over this period the resin was regenerated each day and the brine regenerant was collected and reused after correcting the chloride concentration. The brine regenerate was reused 5 times before being replaced by a fresh batch of brine (i.e. 6 uses overall). The spent brine was collected in a 5-gallon bucket and shipped back to Orica for analysis and disposal. After each regeneration, the brine was analyzed for TOC and sulfate to determine if these anions were being less effectively removed during regeneration with increasing uses of the brine. Figure 11 shows that for the first batch of brine (that used in Trial 1), the removal of anions was fairly consistent up to the sixth use while for the second batch (that used in Trial 2) removal was consistent for all but the last use. The sulfide and TOC removal results in Figures 3 and 4 show no decline in performance with an increasing number of brine uses, indicating that at least 6 uses of brine is possible. Appendix C provides detailed testing data for the two brine batches produced during Trials 1 and 2 (Sample ID PP071 and PP072 respectively).

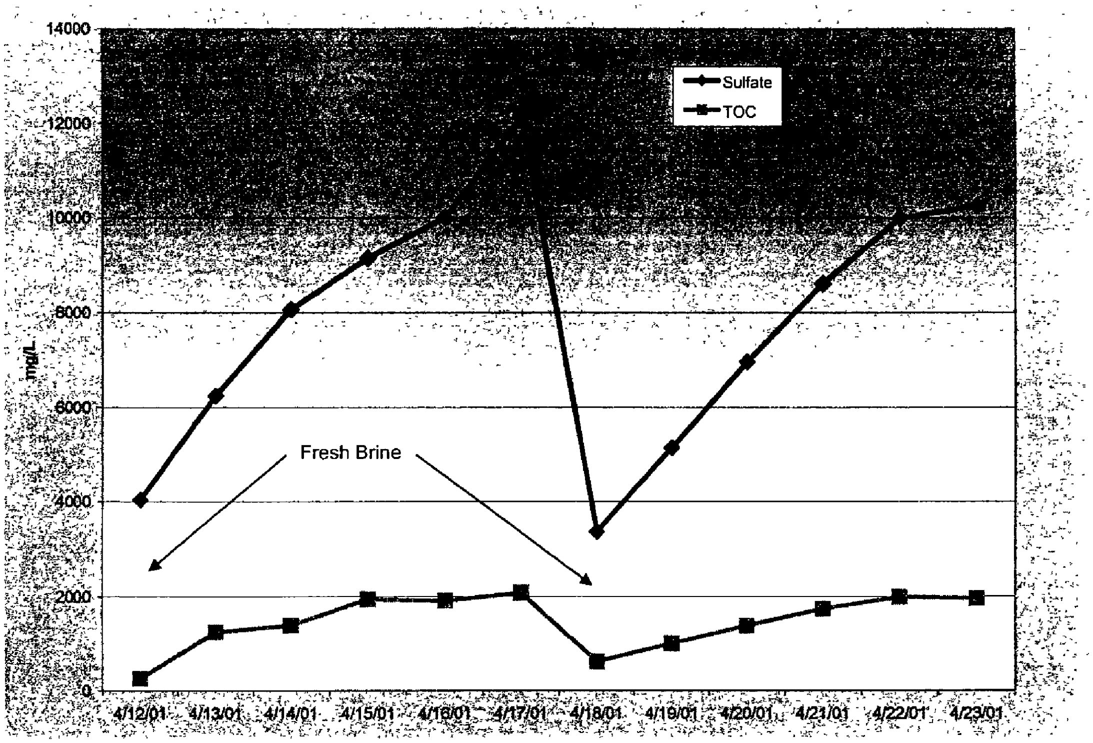


Figure 11 – Brine Characteristics

C. Brine Disposal Options

Appendix D provides an analysis of brine disposal options for the Demonstration Facility developed by ORICA Watercare, the company that produces the MIEX® resin.

This analysis indicates that the quantity and characteristics of the brine anticipated to be produced at the 500 GPM Demonstration Facility will be such that they may be disposed of at the existing Seven Springs WWTP if the necessary permits can be obtained from the FDEP.

Section 8 - Estimated MIEX® Demonstration Facility Capital Costs

A. Capital Cost and/or Lease Rental Estimate for Demonstration Unit

Appendix E provides a detailed cost proposal for the 500 GPM Demonstration Facility that has been developed for Well 9.

In addition to the costs provided in this proposal, additional costs will be incurred for site engineering, permitting, site preparation, on-site piping and electrical modifications and other necessary items that must be completed to facilitate the set-up and operation of the Demonstration Facility. These costs are undefined at this time. Once design of on-site systems and permitting are underway, a cost estimate will be prepared for these items.

B. Operation and Maintenance Cost Estimates

Rough operating costs, based on the trial results, for a conventional MIEX process configuration were provided by Orica Watercare. Their estimates are as follows:

Parameter	**Cost (Cents/1000 gal)**
Resin make-up (3 gal/MG)	11.4
Regenerant (0.3 ton NaCl/MG)*	1.5
Power – 6c/kWh (180 kWh/MG)	1.1
Waste regenerant disposal** (220 gal/MG)*	0.0-8.8
TOTAL	**14-22.8 Cents/1000 gal**

***Previous trial results were used – 10 uses of regenerant are assumed**
****Bottom range if waste can be discharged to sewer and upper range if treated as an industrial waste (40¢/gal disposal charge assumed).**

Assuming the waste regenerate disposal cost estimates shown are correct, the major operating cost is resin replacement. The above resin replacement rate is mostly due to resin attrition in the process and is based on results from full scale installations in Australia. The Fluidized Bed Reactor is expected to have less resin attrition because there is significantly less pumping and no mixing of the resin. The operation of the Demonstration Unit will allow these estimates to be verified and/or updated before a full-scale unit is constructed.

Section 9 - Recommendations

A. Overview

Bench top and pilot scale testing of the MIEX® Process have been completed. The results of these two projects have shown that the pilot-scale MIEX® Process provides a high degree of reduction of ionized sulfide, TOC and THM and HAA formation potential of Well Number 9 raw water. The MIEX® Process offers unique advantages over other sulfide reduction technologies. Packed tower aeration, for instance, is only effective in removing the un-ionized hydrogen sulfide unless complex pH control treatment is also undertaken. Also, the packed tower process does not reduce sulfates to any extent, therefore, the potential for the reformation of sulfides in customer's homes will still exist with aeration methods alone. The MIEX® Process reduces THM and HAA formation potentials which aeration alone does not to any extent. Finally, the MIEX® Process reduces water color and odor greatly enhancing the aesthetic quality of the finished water. It is our opinion that the MIEX® Process will be capable of even greater removal efficiencies when it is constructed to treat higher raw water flow rates.

The MIEX® Process is new to the United States. The process has been implemented in full-scale in Australia, however, no large MIEX® Process plants have been permitted, constructed or operated in the Untied Stated to date. Therefore, obtaining permits to construct a MIEX® Process plant will require additional effort over that normally expended to obtain a FDEP construction permit for a tried and tested water treatment process.

The disposal of the regenerate (brine) that is produced when this process is utilized poses a challenge. Additional brine characterization work needs to be undertaken. Alternative methods of reusing, recovering and/or disposing of the brine must be developed before system-wide implementation of the MIEX® Process can be undertaken.

B. Recommendations

1. Upon acceptance of this report, submit it to the FPSC in partial compliance of its Final Order related to Docket Number 960545-WS.
2. Authorize David W. Porter, P.E. to begin the permitting process for the construction of a demonstration scale (500 GPM) facility to serve Well 9. The purpose of this demonstration scale facility is to "prove" the technology and to allow for development of large-scale, system wide facility design criteria and cost estimates.
3. Authorize David W. Porter, P.E. to begin preparation of construction drawings for the demonstration scale (500 GPM) facility (MIEX® Process and appurtenances) to serve Well 9.
4. Begin final negotiation with Orica Watercare, Inc. and WesTech Engineering, Inc. for the provision of the MIEX® Process equipment and resin for the demonstration facility as soon as FDEP permitting and facility design allow.
5. Authorize David W. Porter, P.E. to continue working with Orica Watercare, Inc. to evaluate brine disposal alternatives and to seek brine disposal options.
6. When design, permitting, equipment and resin purchase negotiations and suitable brine

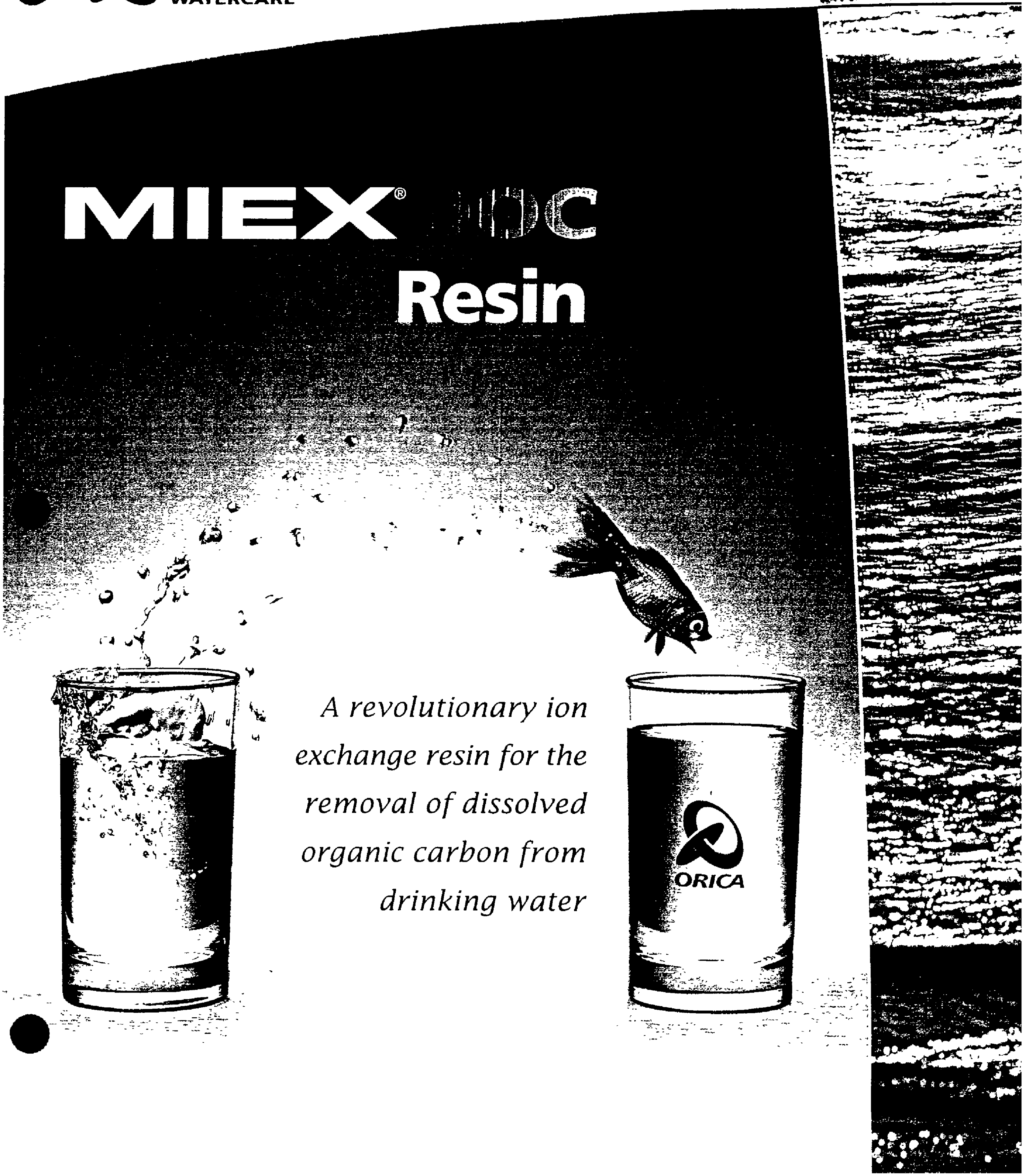
disposal option has been selected, arrange for construction, start-up and operation of the demonstration MIEX® facility for a period of at least 6 months to prove the technology appropriate for larger scale implementation.

7. Should the operation of the demonstration MIEX® facility show that the process is technically and financially cost effective for large-scale implementation, begin work to construct regional MIEX® Process facilities system-wide.

Appendix A
MIEX® Literature

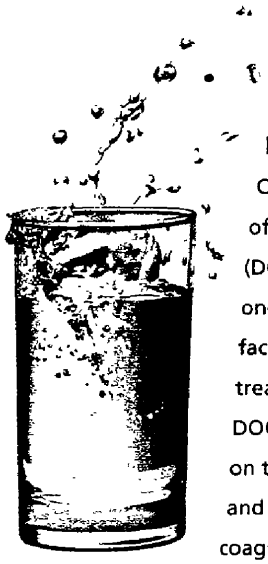
ORICA
WATERCARE

MIEX® DOC Resin



A revolutionary ion exchange resin for the removal of dissolved organic carbon from drinking water

Introduction



Cost effective management of dissolved organic carbon (DOC) in potable water is one of the key challenges facing today's water treatment industry. DOC has a major impact on treated water taste and odor, appearance, coagulation and disinfection by-product formation.

Traditional solutions for the removal of DOC involved the application of complex water treatment processes, requiring large capital outlays and significant increases in operating costs.

Orica Watercare, in conjunction with two leading research organisations: CSIRO Division of Molecular Science and South Australian Water Corporation, have developed a simple and revolutionary process that incorporates the MIEX® DOC resin for the removal of dissolved organic carbon from potable water.

The MIEX® DOC resin is a patented high capacity ion exchange resin which includes a magnetized component.

The combination of this magnetic resin with a unique continuous ion exchange process offers water treatment operators a cost effective and environmentally friendly DOC removal process, capable of achieving new standards in water quality.

The MIEX® DOC resin delivers:

- **Cost effective removal of dissolved organic carbon**
- **Significant reductions in disinfection by-product formation**
- **Color reduction**
- **A continuous and flexible process that can adjust to wide variations in raw water quality**
- **Significantly reduced coagulant doses and chemical sludge volumes**
- **Reduction in chlorine demand for disinfection**

Application

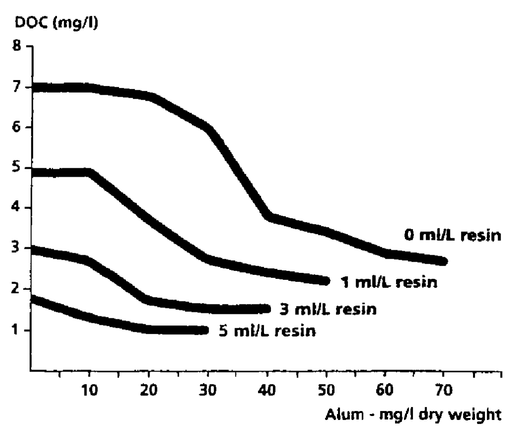
DOC Removal

DOC has many detrimental effects on the treatment of drinking water. These include:

- **Reacting with disinfectants, which increases chemical demand and disinfection by-products**
- **Reacting with coagulants causing slower, less effective flocculation and increasing coagulant demand**
- **Acting as a food source for micro-organisms, resulting in bacterial regrowth in distribution systems**
- **Interfering with the performance of activated carbon by competing with targeted compounds for active sites**
- **Reducing the capacity of membrane filtration by fouling**

The MIEX® DOC resin is highly effective in the removal of DOC.

Extensive trialing has shown that pretreating raw water with the MIEX® DOC resin can significantly reduce treated water DOC levels.



Ground Water, Perth, Western Australia.

In the above graph, the lowest DOC level that could be achieved using alum coagulation was 3mg/L. After pre-treatment with MIEX® DOC resin the DOC was reduced to below 1mg/L at significantly lower alum doses.

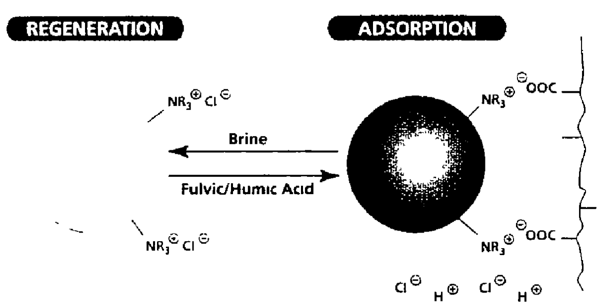
The MIEX® DOC Resin

The name MIEX® comes from Magnetic Ion EXchange, because the ion exchange resin beads contain a magnetized component within their structure which allows the beads to act as weak individual magnets. The very small resin bead size of around 180 µm provides a high surface area allowing rapid adsorption kinetics. In a settler these magnetic particles agglomerate into rapidly settling resin flocs.

The MIEX® DOC resin has been designed specifically for the removal of DOC from drinking water. When in contact with water, negatively charged DOC is removed by exchanging with a chloride ion on active sites on the resin surface. This results in a reduction in the DOC level and a small increase in the treated water chloride level (2 to 4 mg/L).

In the regeneration process, resin loaded with DOC undergoes a reversed ion exchange reaction, where the resin substitutes chloride ions for DOC which is released from the resin into a concentrated brine (NaCl) solution.

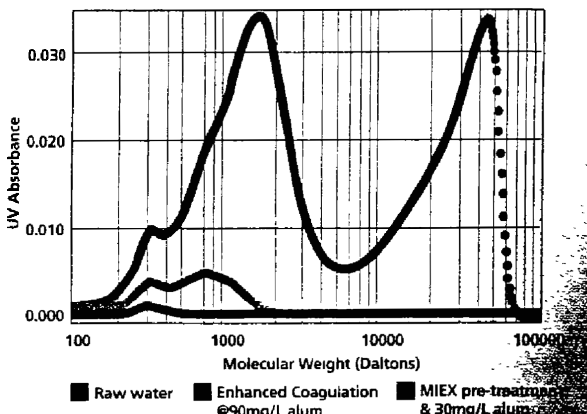
The MIEX® DOC resin was developed specifically to be used in a continuous water treatment process and has the optimum size, DOC exchange properties, attrition resistance and magnetic properties for this application.



MIEX® DOC Resin chemistry.

MIEX® DOC resin is effective at removing low molecular weight DOC.

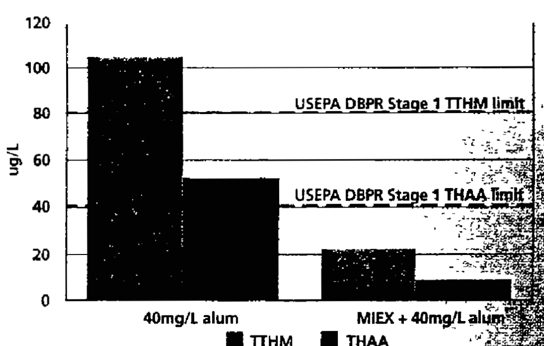
What's more, the MIEX® DOC resin is particularly effective at removing the low molecular weight fraction of DOC that cannot be removed by enhanced coagulation. This results in treated water with a lower DOC level and disinfection by-product (DBP) formation potential.



Ground Water, Perth, Western Australia.

DBP Reduction

The discovery of DBPs in drinking water supplies in the 1970's has lead to the introduction of new water treatment standards for those DBPs that are potentially harmful to human health. Compounds such as trihalomethanes (THMs) and haloacetic acids (HAAs) are formed by the reaction of disinfectants with dissolved organic carbon in water. The most effective solution is to remove the precursors of the DBPs prior to disinfection. Often traditional water treatment technologies cannot achieve the low DOC levels required to meet tightening DBP standards. Lower DOC levels can be cost effectively achieved through the application of the MIEX® DOC resin.



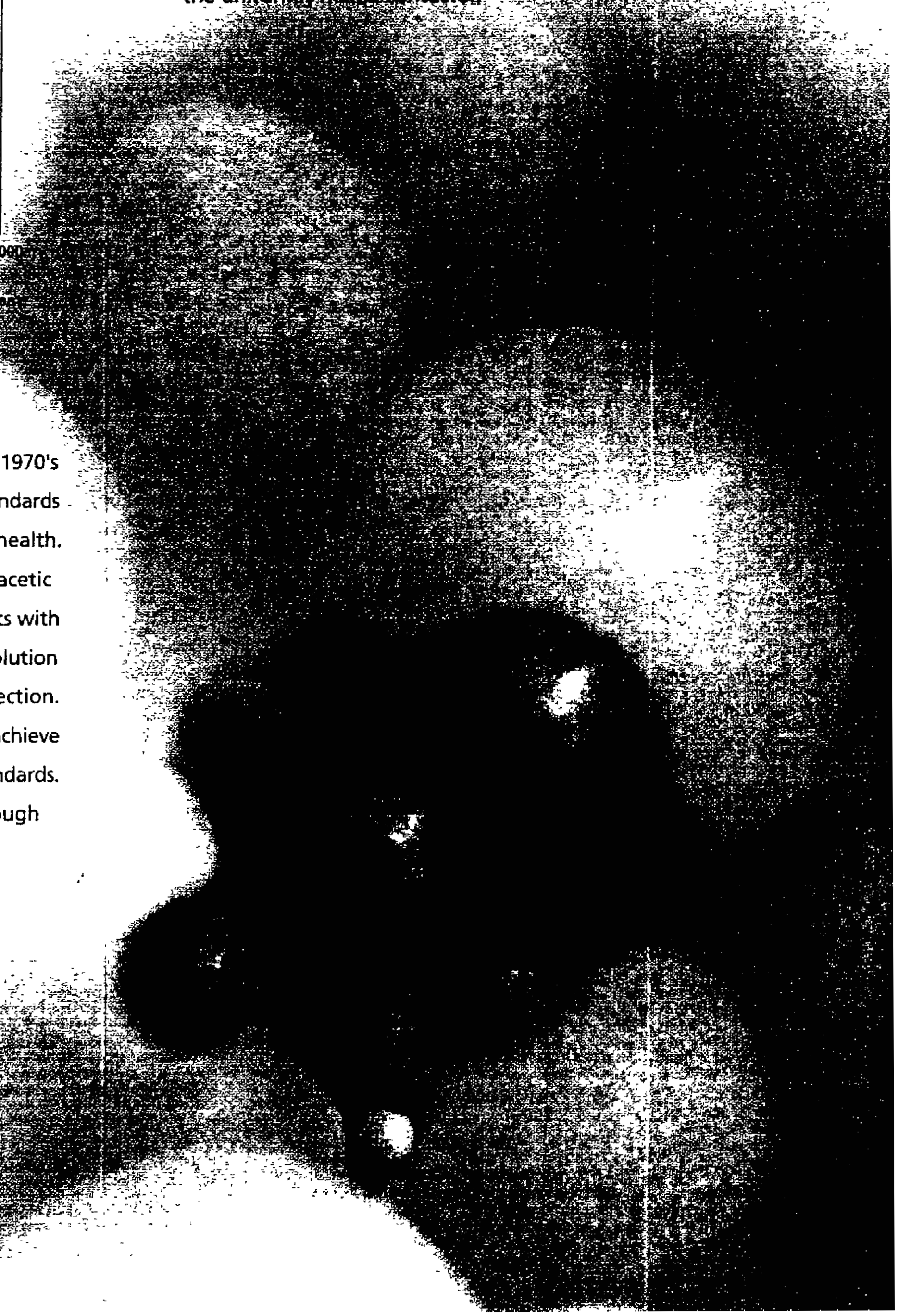
Tests on raw water at Wade G. Brown WTP, Durham NC

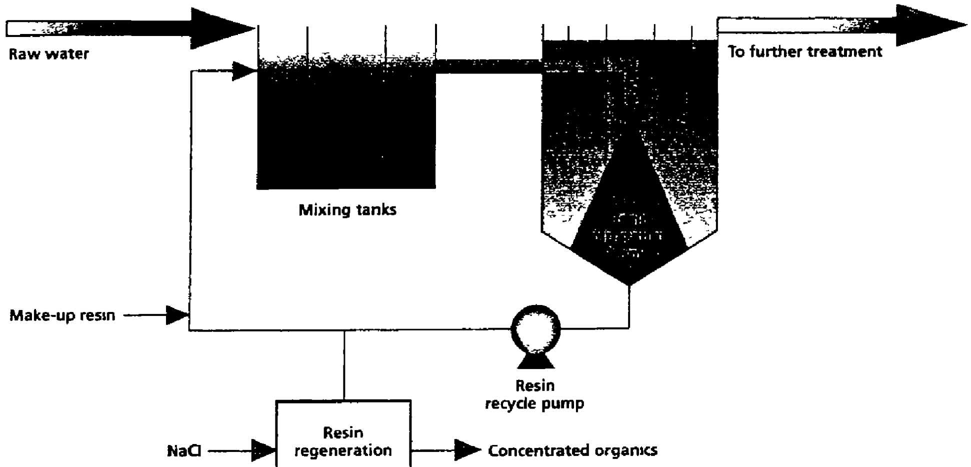
Application of MIEX® DOC Resin

The MIEX® DOC resin is utilized in a continuous ion exchange process, designed for the removal of dissolved organic carbon (DOC) from drinking water supplies.

The MIEX® DOC resin has been developed to enable removal of DOC to occur in a stirred contactor, much like a flash mixer in a conventional water treatment plant. The MIEX® DOC resin beads are much smaller than conventional resin beads, at around 180 μm (80 mesh), to allow rapid DOC exchange in the contactor vessel.

Only very low resin concentrations are therefore required to achieve DOC removal because of efficient mass transfer in the uniformly mixed contactor.





Continuous Ion Exchange Process schematic.

The resin suspension then passes to a separating stage where the resin is recovered and recycled. A magnetic component is dispersed within the resin bead structure so that when passed to a settler the fine resin beads rapidly agglomerate into larger, fast settling particles. Resin recovery rates of greater than 99.9% [illegible]

[illegible]

In contrast, the MIEX® DOC resin is used in a process where the overall ion exchange capacity is continuously maintained. As a consequence, the product water is of a consistent quality with DOC controlled at a predetermined level.

Unlike conventional ion exchange processes, this continuous process does not require pre-treatment for solids removal and can therefore be used to treat raw water at the start of the treatment chain, or as a polishing step at the end. When MIEX® DOC resin is used to remove DOC from raw water, further treatment downstream is required for turbidity removal.

A subsequent filtration stage is also required due to a slight increase in turbidity caused by a small amount of resin carry-over from the settler.

Orica Watercare Services

Orica Watercare can provide full details on the use of the MIEX® DOC Resin and process. Where required, laboratory simulations and plant trials are conducted to determine the optimum performance of MIEX® DOC Resin on specific water streams. Generally, only plant trials can reliably provide full scale engineering design parameters.

Orica Watercare can provide a comprehensive technical service for your water treatment needs, whether you are looking at a new plant or upgrading your existing treatment process. We can provide laboratory simulations, in-plant trials and assistance during start-up. Just contact your local Orica Watercare sales office.

The Orica Watercare Sales and Technical Service staff are a highly trained and experienced group, dedicated to providing our customers with quality service and support.

Below left and centre: Orica Watercare technical support team.
Below right: MIEX® DOC Resin Liquisack.

About Orica Watercare

Orica Watercare supplies a range of water treatment products and services in Australia, New Zealand and North America. Orica Watercare is the largest supplier of water treatment chemicals in Australasia, supplying chlorine disinfectants, iron salts, polyaluminium chloride, acids and alkalis and MIEX® DOC resin. Orica is an Australian company that manufactures and supplies industrial and specialty chemicals, agricultural chemicals and fertilizers, commercial explosives and mining chemicals, plastics and paints and other handyman products. Orica is the largest chemical company in Australasia with over AUS$4B in sales and is the world's leading supplier of commercial explosives (see www.orica.com.au).

Further Information

This brochure is not intended to be all inclusive.
Further details on the application of the MIEX® DOC resin are available from all Orica Watercare sales offices.

Visit: www.miexresin.com

The MIEX® DOC resin and application process have been developed in conjunction with:

CSIRO

SA WATER

Orica Watercare offices

AUSTRALIA

[illegible]
Tel: 61 3 9283 [illegible]
Fax: 61 3 9283 6266

USA
Denver
[illegible] Blvd
Englewood Colorado
80112
Tel: 303 268 5122
[illegible]

ORICA
WATERCARE

Appendix B
Bench Top MIEX® Testing Data and Report

REPORT ON MIEX® JAR TESTS PERFORMED ON ALOHA UTILITIES RAW WATER

March 8, 2001

REPORT ON MIEX® JAR TESTS PERFORMED ON ALOHA UTILITIES RAW WATER

TABLE OF CONTENTS

1.0 Introduction

Water supplied by Aloha Utilities, FL., contains levels of hydrogen sulfide which causes complaints from its customers. Therefore the utility is investigating methods for sulfide reduction/removal before pumping the water into the reticulation system.

The objective of this series of jar tests was to determine the effectiveness of MIEX® resin in reducing sulfide levels and total organic carbon (TOC) from the raw water supply. The testing regime involved measuring sulfide levels in the raw water at the well, sulfide levels in the water once transported to the temporary laboratory and following the MIEX® resin tests. This ensured that the amount of sulfide lost during transport and mixing could be quantified hence giving a true indication of the performance of the MIEX® resin.

2.0 Raw Water Characteristics

5 gallon water samples were taken from 8 wells operated by the Utility and another sample from the water supplied to the utility by Pasco County. Testing was performed over two days, 02/19/01 and 02/20/01. Samples were taken from the wells and shipped back to the temporary laboratory facility within 30 minutes, where they were tested immediately.

The raw water characteristics ranged markedly with regard to sulfide levels as follows:

	Well 9	Well 7
Apparent Colour – Pt/Co	10	8
TOC – mg/L		
UV Abs (254 nm) – cm^{-1}	0.125	0.054
pH	7.62	7.93
Alkalinity	210	145
Sulfide – mg/L (measured at the well)	4.43	< 0.01

Raw water information for all waters are given in Appendix 1.

3.0 Hydrogen Sulfide Chemistry

The solubility of hydrogen sulfide in water depends on the oxidation potential of the water and pH. The total concentration of hydrogen sulfide in water includes nonionized H_2S, hydrogen sulfide (HS^-) and sulfide ion (S^{-2}).

$$\text{Total sulfide} = H_2S + HS^- + S^{-2}$$

The threshold odor concentration of nonionized hydrogen sulfide, H_2S, in clean water is between 0.025 and 0.25 µg/L depending on the temperature (Standard Methods, 1998). Odours are not associated with the ionized forms ($HS^- + S^{-2}$)

The distribution of hydrogen sulfide in water as a function of pH is shown in Figure 1. At pH 7, about half of the sulfide present is in the nonionized form, whereas, at pH 5, almost all of the sulfide is H_2S.

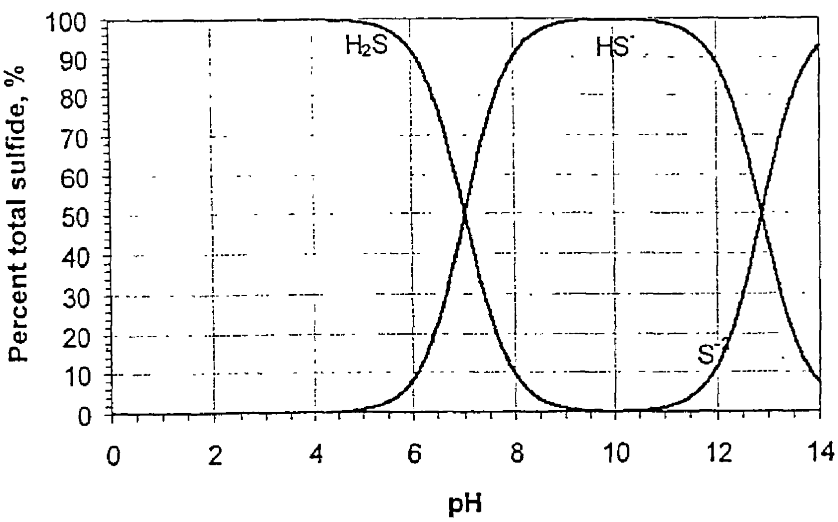


Figure 1. Distribution of Hydrogen sulfide in water as a function of pH

The significance of the above information is that MIEX® resin will only remove ionized species of sulfide and any hydrogen sulfide present will not be affected by the resin. Therefore, pH of the water will affect the results achieved.

4.0 Jar Testing Procedures

4.1 MIEX® Resin Concentration Tests

These tests were performed by adding several resin concentrations to 1-liter raw water samples and agitating the samples at 140 rpm on a jar testing apparatus to keep the resin in suspension. After 30 minutes of agitation the resin was allowed to settle and samples were analysed for Sulfide, Apparent Color, pH, Alkalinity and UV_{254} Absorbance (unfiltered) on site. A blank sample was run to quantify the loss of sulfide experienced due to mixing in the jars. Some samples were taken and preserved to allow analysis of other water characteristics at a later date.

4.2 MIEX® Resin Kinetic Tests

Kinetic tests were performed on some raw waters with the MIEX® resin to look at the rate at which sulfides are removed by the resin. The optimum MIEX® resin concentration was chosen based on sulfide results from test 3.1. 1-liter samples were then dosed with one concentration of MIEX® resin and mixed at 140 rpm for 5, 10, 15, 20 and 30 minutes. At the specified times, the agitation was stopped, the resin allowed to settle and the water analysed for sulfide and UV absorbance.

5.0 Results

The results of the laboratory analyses carried out by Short Environmental Laboratories & Orica Watercare are included in Appendix 1.

5.1 MIEX® Resin Tests

The results of the tests outlined in section 3.1 are shown in Figures 2, 3, 4 & 5 for waters with high initial sulfide levels. Results for other wells are presented in Appendix 1.

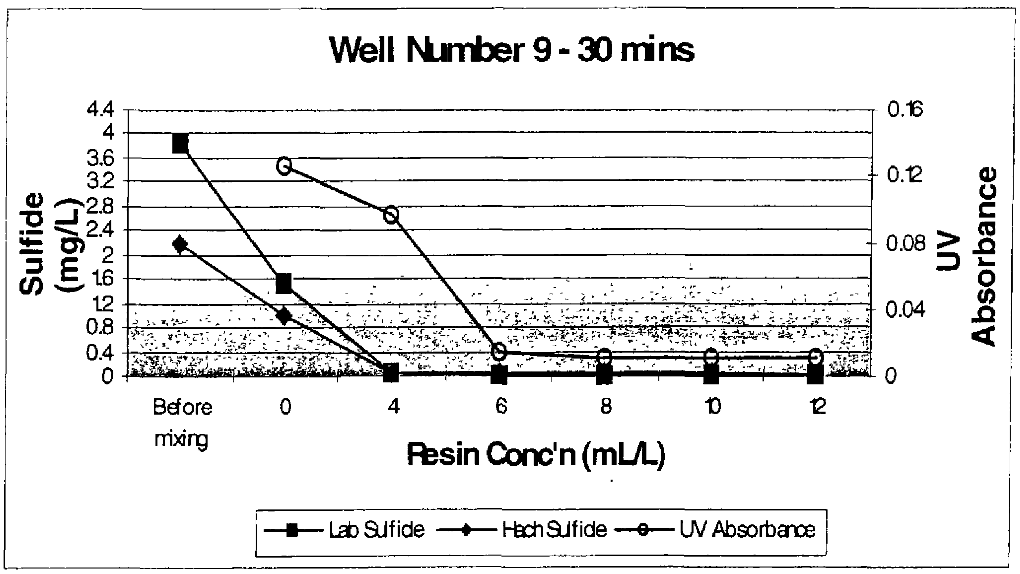
The MIEX® tests show that a small reduction in sulfide was experienced during transport of the raw water sample from the well to the laboratory. A greater loss of sulfide was experienced due to the mixing performed when using the MIEX® resin. For example, the sulfide level at the start of the mixing period for well number 9 was 3.85 mg/L and this dropped to 1.51 mg/L at the end of the 30 minutes mixing with no MIEX® resin addition.

This is a 61% reduction of sulfide levels due to mixing. The sulfide loss due to mixing for all waters is shown in Table 1.

Table 1 – Sulfide loss due to mixing in MIEX® resin jar tests

Well Number	H2S Before Mixing (mg/L)	H2S After Mixing (mg/L)	Reduction
9	3.85	1.51	61%
8	1.6	0.17	89%
6	0.94	0.11	88%
1	0.02	<0.01	<50%
3	1.81	1.02	44%
4	0.46	0.09	80%
7	<0.01	<0.01	--
2	0.68	0.15	78%
Pasco County	<0.01	<0.01	--

Figure 2: Sulfide and UV_{254} Absorbance reduction – Well 9.



In Figure 2 above, 4mL/L resin concentration was found to reduce the sulfide level to 0.033 mg/L after 30 minutes when initially it had been 3.85 mg/L but it should be noted that the blank sample (no resin added) reduced from 3.85 mg/L to 1.51 mg/L in that 30 minutes. Higher concentrations of MIEX resin reduced the sulfide levels down to < 0.01

mg/L, the detection limit for sulfide for the laboratory. This very high sulfide removal by the resin was seen for all other tests. Three further results are shown in figures 2, 3 & 4. Note that two sulfide results are shown in the graphs – one result is that obtained by the laboratory while the other is that obtained using a Hach DR850 colorimeter. The Hach colorimeter was used to measure sulfides to investigate the accuracy of this instrument when compared with a laboratory's results.

Figure 3: Sulfide and UV_{254} Absorbance reduction – Well 8

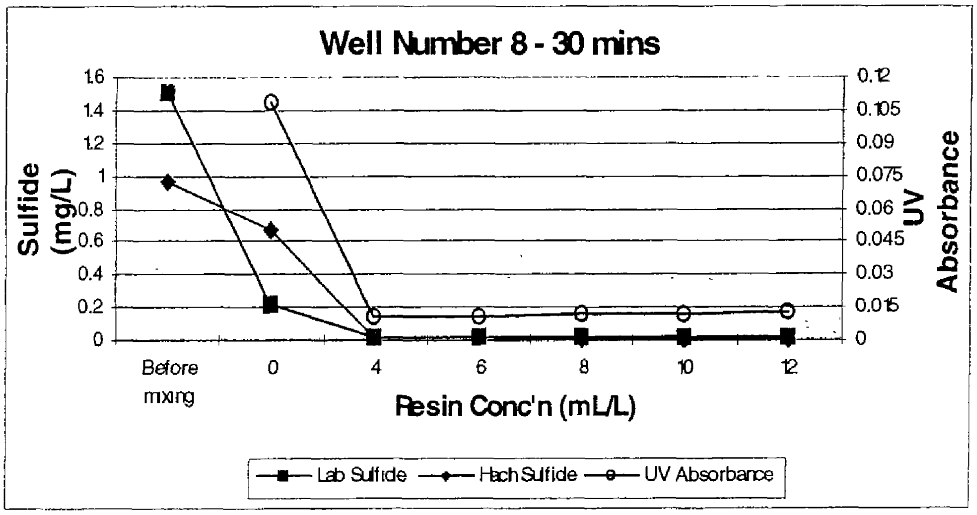


Figure 4: Sulfide and UV_{254} Absorbance reduction – Well 6

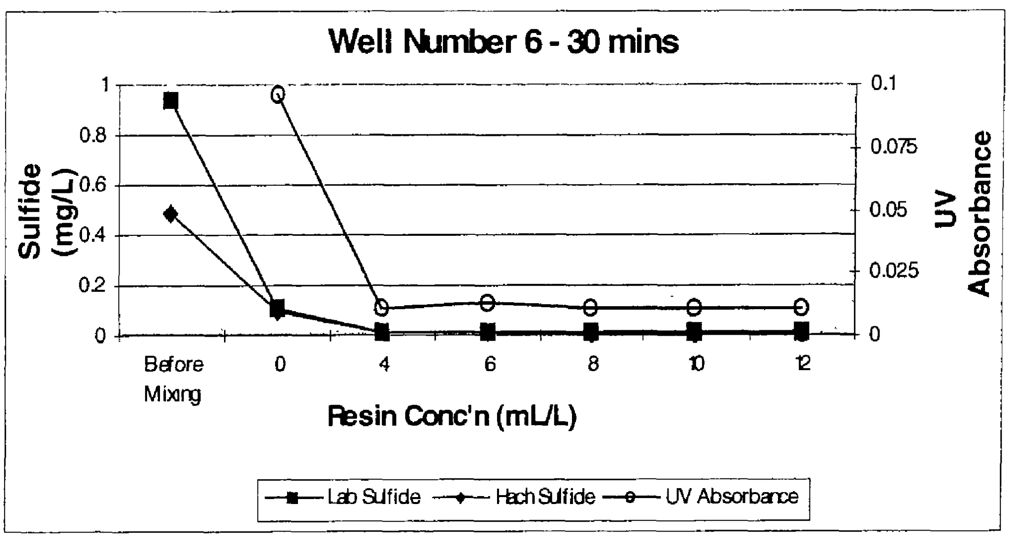
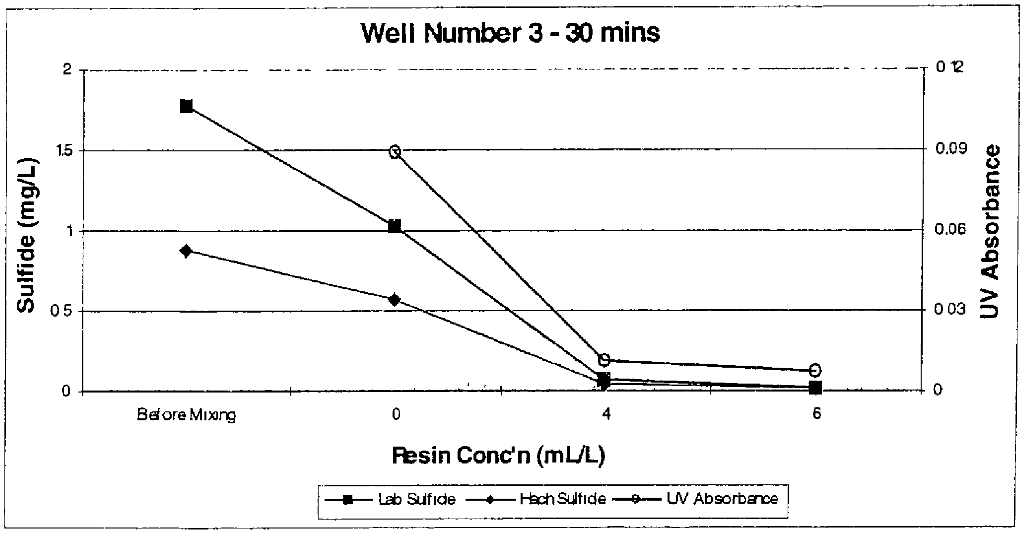


Figure 5: Sulfide and UV_{254} Absorbance reduction – Well 3



The UV absorbance reduction achieved by the MIEX resin during the 30 minute testing showed that a resin concentration of 6 mL/L was capable of reducing UV absorbances by > 75% for all waters and the average reduction was around 87%. A summary is presented in Table 2 below. This indicates that good TOC removal will be achieved by the resin.

Table 2: UV absorbance performance – 6mL/L resin concentration, 30 minutes mixing

Well Number	UV before Treatment	UV after Treatment	Reduction
9	0.125	0.013	90%
8	0.108	0.011	90%
6	0.096	0.013	86%
1	0.142	0.02	86%
3	0.089	0.007	92%
4	0.107	0.015	86%
7	0.054	0.013	76%
2	0.11	0.011	90%
Pasco County	0.087	0.015	83%
Average			**87%**

5.2 MIEX® Resin Kinetic Tests

Based on the earlier 30 minute tests a resin concentration of either 4 mL/L or 6 mL/L was chosen for the kinetic tests. UV absorbance reduction and sulfide removal over time for various waters are shown in Figures 6 , 7, 8, 9, 10 & 11 below.

Figure 6: UV_{254} Absorbance reduction over time – Well 9

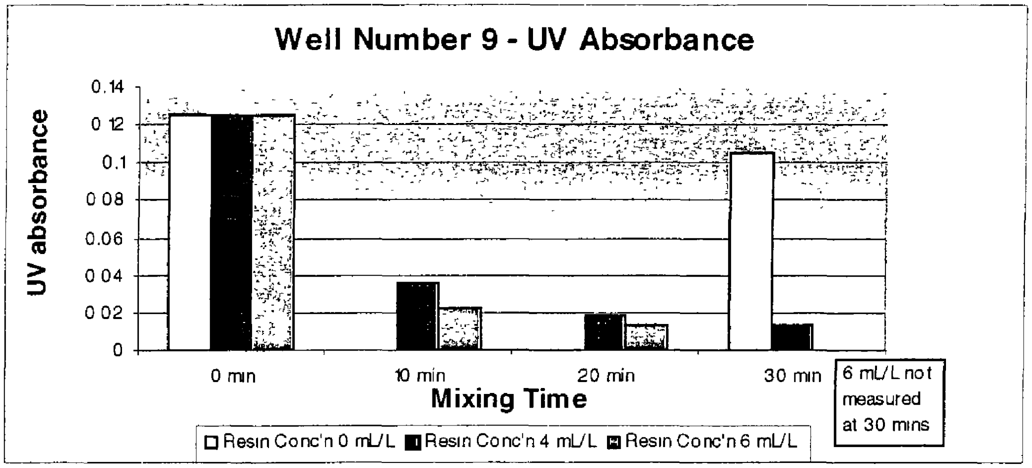


Figure 7: UV_{254} Absorbance reduction over time – Well 8

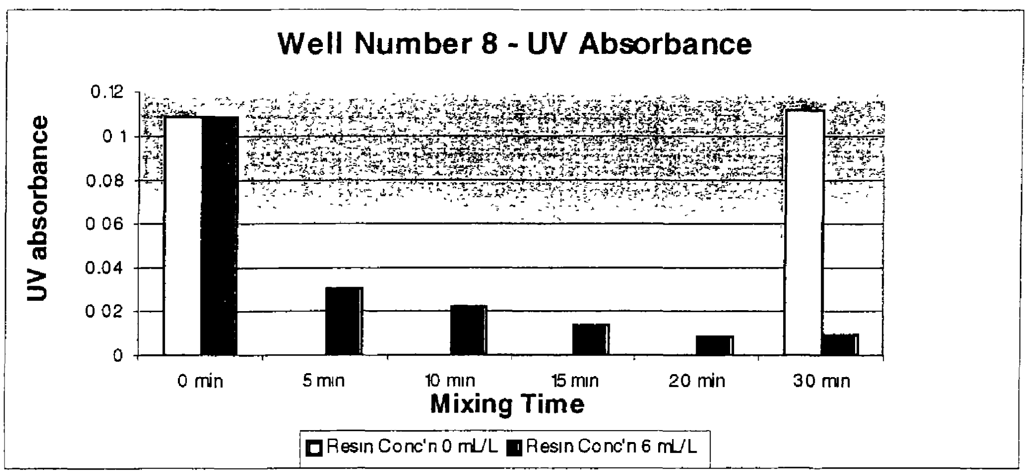
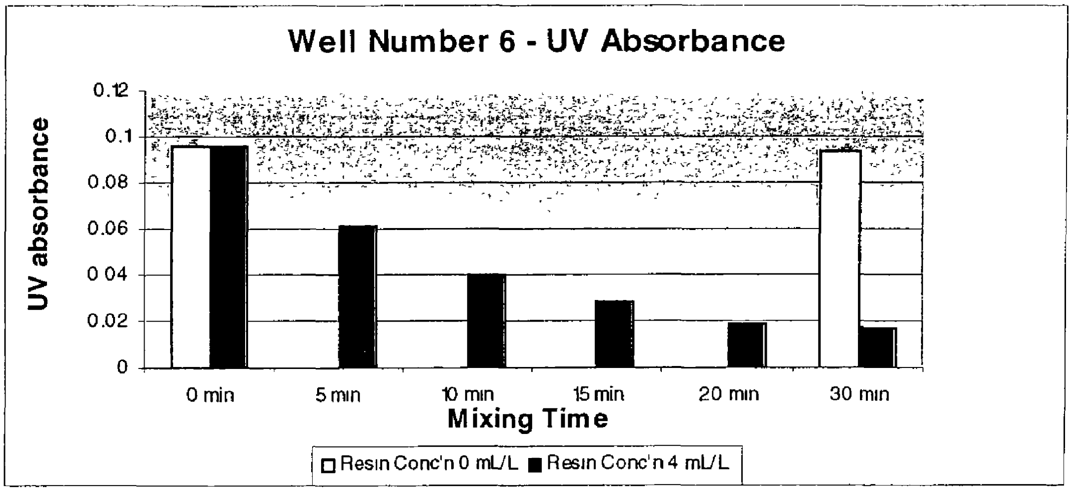


Figure 8: UV_{254} Absorbance reduction over time – Well 6



The UV absorbance results showed very good reductions with low MIEX® resin concentrations and short contact times. In general, resin concentrations of 4 to 6 mL/L and a contact time of 20 minutes was sufficient to obtain low TOC levels in the lab. tests.

Figure 9: Sulfide reduction over time – Well 9

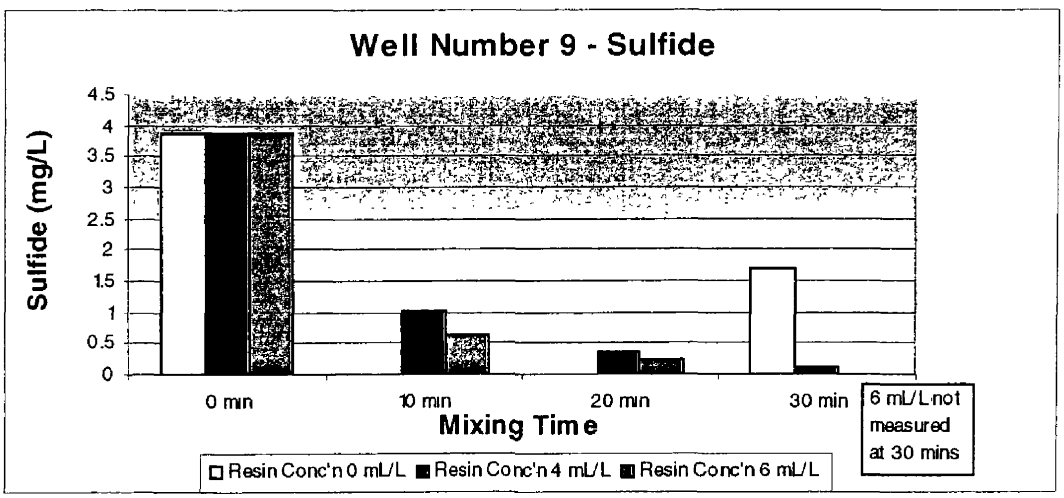


Figure 10: Sulfide reduction over time – Well 8

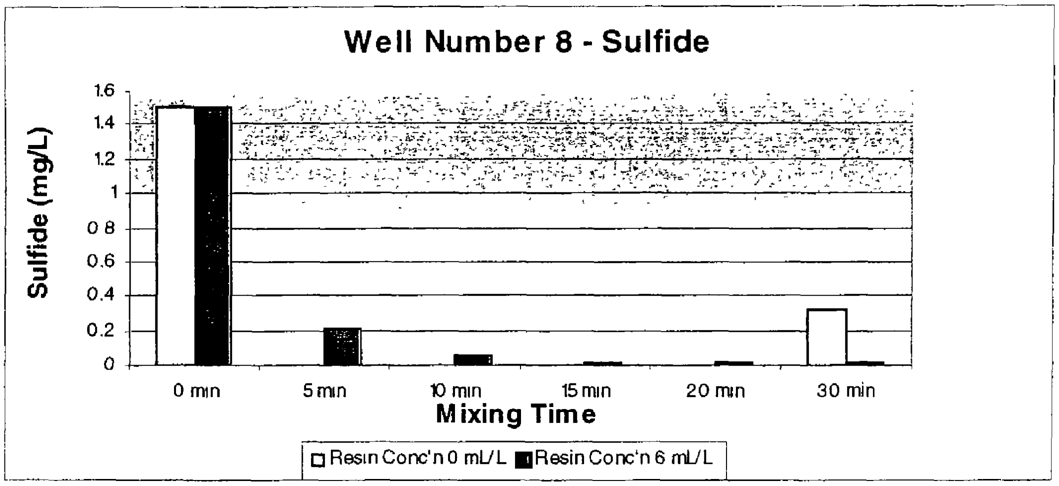
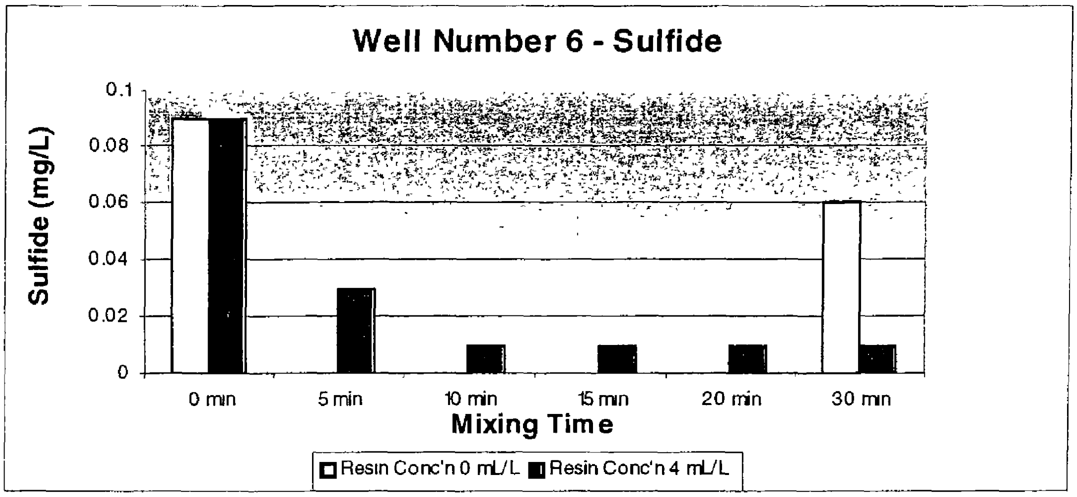


Figure 11: Sulfide reduction over time – Well 6



The laboratory results indicated that low resin concentrations of 4 to 6 mL/L with contact times of 10-15 minutes led to very low levels of sulfides. The shorter contact time required for sulfide reduction can be explained by the size of the sulfide ion compared to the TOC compounds. The smaller sulfide ion can readily attach to the surface of the MIEX resin while the larger TOC compound needs time to "adsorb" into the resin pores.

5.3 MIEX® Resin Color Reduction Results

The MIEX® resin also provides another benefit of reducing color in treated waters. The color reduction achieved by the MIEX resin during the 30 minute testing showed that a resin concentration of 6 mL/L was capable of complete removal of color from virtually all of the waters tested. A summary is presented in Table 3 below.

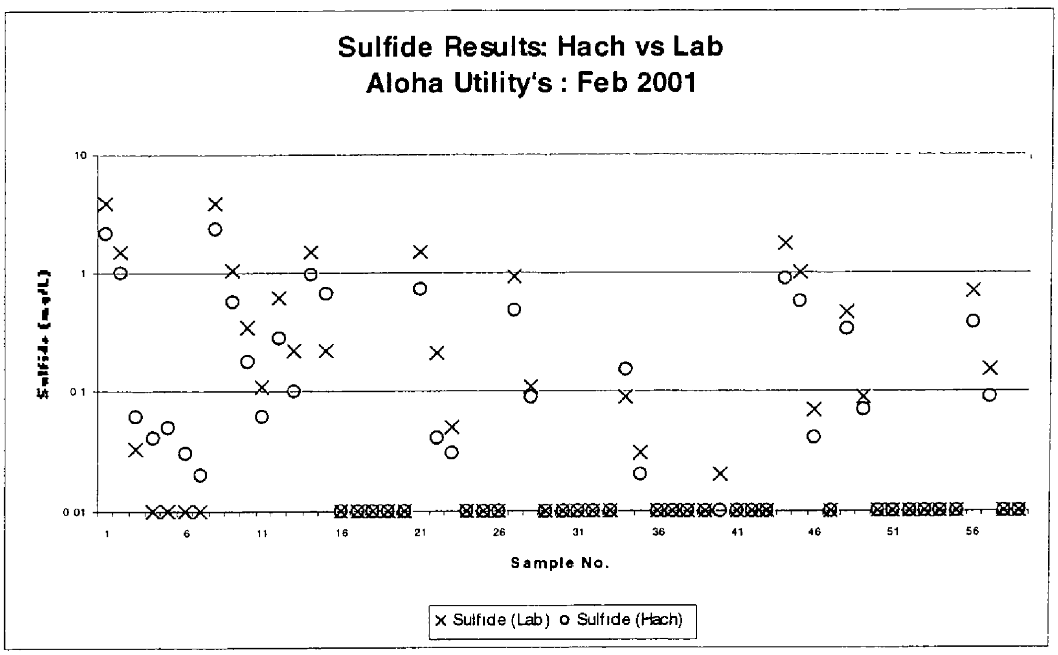
Table 3: Color removal – 6mL/L resin concentration, 30 minutes mixing

Well Number	Color before Treatment	Color after Treatment	Reduction
9	10	0	100%
8	10	0	100%
6	17	1	94%
1	12	2	83%
3	10	0	100%
4	12	1	92%
7	8	0	100%
2	12	1	92%
Pasco County	3	0	100%

5.4 Comparison of Hach Sulfide Results vs Lab Results

A comparison of the results between the Hach colorimeter and the lab results are shown in Figure 12. When sulfide levels were greater than 0.8 mg/L it was necessary to dilute the sample before analysing with the Hach unit. This would lead to errors occurring with the result. As can be seen, the Hach results correlate very closely when zero sulfide levels are present. Below around 0.4 mg/L sulfide the laboratory results are comparable with the Hach. Above 0.4 mg/L the Hach unit is less accurate and essentially gives order of magnitude results. This shows that the Hach can be used to give good results when very low levels of sulfide are present.

Figure 12 – Hach vs Lab Sulfide results



5.5 pH Results

The pH of the raw waters varied from well to well ranging from 7.6 to 8.0. These pH ranges ensured that the majority of sulfide present was dissolved in the liquid in an ionized form. It was found that with most well waters that the pH rose in the blank sample after 30 minutes mixing.

With the MIEX treated samples no definite trend in pH can be found. In general the pH of these samples, after treatment, were within ± 0.1 pH units of the raw water pH.
Figures 13 and 14 below show pH versus resin concentration before mixing and after 30 minutes mixing with different resin concentrations for two of the wells.

Figure 13: pH vs Resin concentration – Well 9

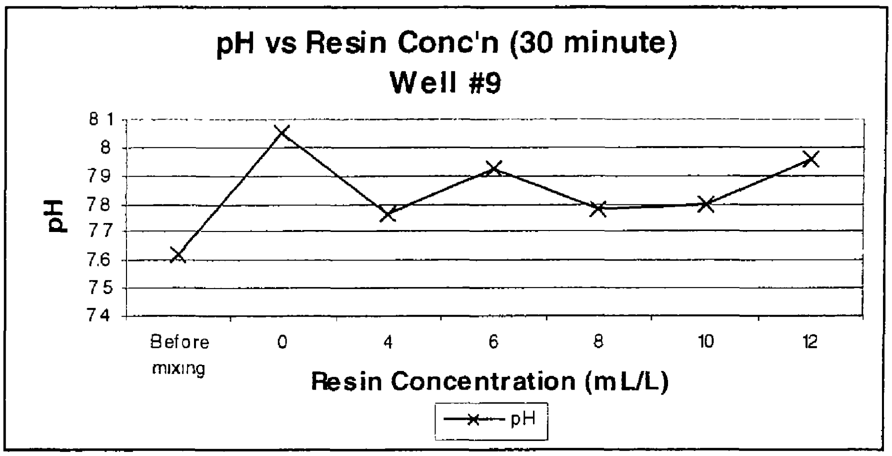
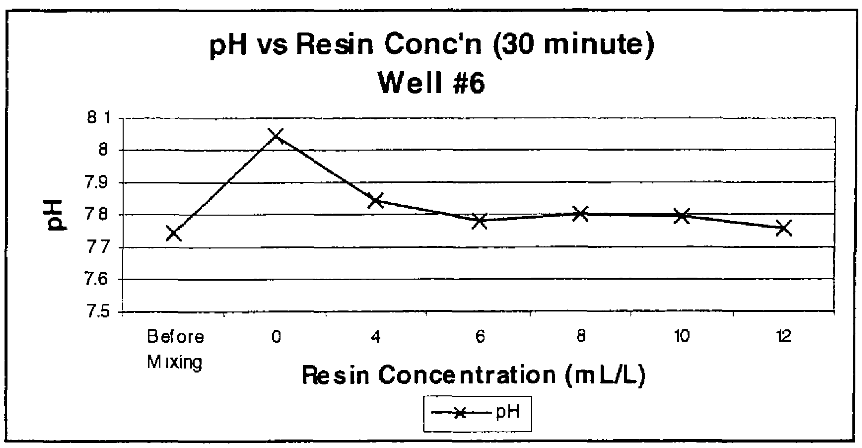


Figure 14: pH vs Resin concentration – Well 6



6.0 Conclusions

This series of jar tests indicates that MIEX® treatment of water from the Aloha Utilities wells could lead to complete removal of sulfides from the water. It was found that the mixing regime involved in contacting the MIEX® resin with the water led to between 60-90% of the sulfides present in the water being lost to the atmosphere. This would need to be considered in the design of a MIEX® treatment step.

The jar tests demonstrated that low concentrations of MIEX resin could remove all sulphides from the water after 30 minutes contact. The kinetic tests suggest that contact time may be reduced below 30 minutes to 15-20 minutes and still achieve complete sulfide removal.

Other benefits of MIEX® treatment include a reduction in the TOC of the treated water. UV absorbance results indicate that significant TOC reduction can be achieved by the use of the MIEX® resin at low concentrations. Color removal in the treated water was also significant with many waters showing 100% reduction.

The Hach unit was found to give results that correlated closely with the laboratory results when sulfide levels were less than 0.4 mg/L. Where sulfide levels were above 0.4 mg/L (as reported by the laboratory) significant differences between results occurred. If sulfide levels were above 0.8 mg/L it was necessary to dilute samples for use in the Hach, hence much larger errors occurred.

7.0 Recommendation

It is recommended that a pilot trial be performed on selected waters from Aloha Utilities to investigate the performance of the resin in a continuous process.

Appendix 1: Test Results

30 Minute Test Results

Well Number 9 - 30 minute test

		After 30 minutes mixing					
Resin Conc'n (mL/L)	Before mixing	**0**	**4**	**6**	**8**	**10**	**12**
Sulfide (lab)	3.85	1.51	0.033	<0.01	<0.01	<0.01	<0.01
Sulfide (Hach)	2.2	1.00	0.06	0.04	0.05	0.03	0.02
UV abs 254	0.125	0.125	0.096	0.013	0.011	0.011	0.011
Colour	10	10	0	0	0	0	0
pH	7.62	8.05	7.76	7.92	7.78	7.8	7.96

Well Number 8 - 30 minute test

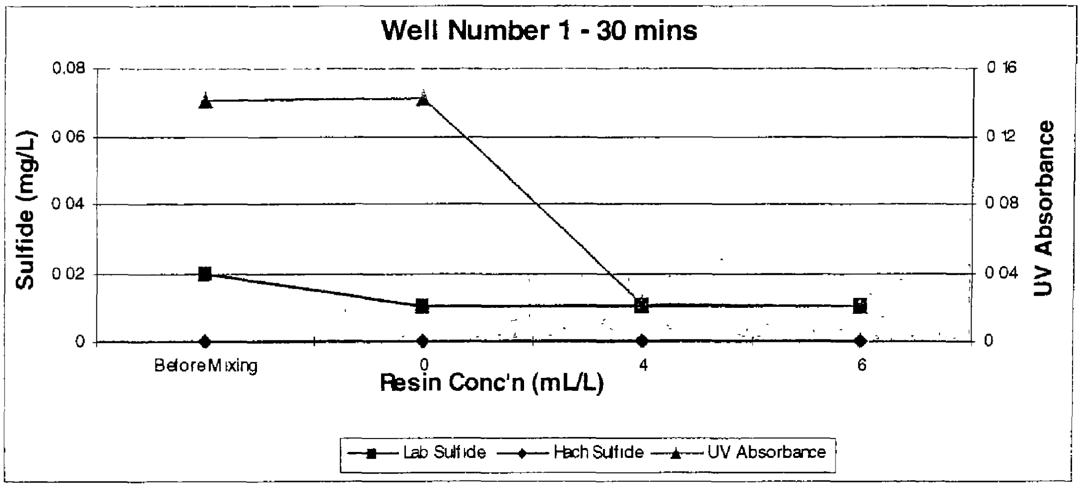
		After 30 minutes mixing					
Resin Conc'n (mL/L)	**Before Mixing**	**0**	**4**	**6**	**8**	**10**	**12**
Lab Sulfide (mg/L)	1.50	0.22	<0.01	<0.01	<0.01	<0.01	<0.01
Hach Sulfide (mg/L)	0.97	0.675	0.01	0.01	0	0	0
UV abs (254 nm)	0.108	0.09	0.01	0.011	0.012	0.012	0.013
Color (Pt/Co)	10	10	0	0	0	0	0
pH	--	8.04	7.91	7.92	7.7	7.82	7.84

Well Number 6 - 30 minute test

		After 30 minutes mixing					
Resin Conc'n (mL/L)	**Before Mixing**	**0**	**4**	**6**	**8**	**10**	**12**
Lab Sulfide (mg/L)	0.94	0.11	<0.01	<0.01	<0.01	<0.01	<0.01
Hach Sulfide (mg/L)	0.48	0.09	0.01	0.01	0	0	0
UV abs (254 nm)	0.097	0.096	0.011	0.013	0.011	0.011	0.011
Color (Pt/Co)	14	17	1	1	1	1	0
pH	7.74	8.04	7.84	7.78	7.8	7.79	7.76

Well Number 1 - 30 minute test

		After 30 minutes mixing		
Resin Conc'n (mL/L)	Before Mixing	0	4	6
Lab Sulfide (mg/L)	0.02	<0.01	<0.01	<0.01
Hach Sulfide (mg/L)	0	0	0	0
UV abs (254 nm)	0.141	0.142	0.021	0.02
Color (Pt/Co)	12	12	4	2
pH	7.8	7.72	7.7	7.7



Well Number 3 - 30 minute test

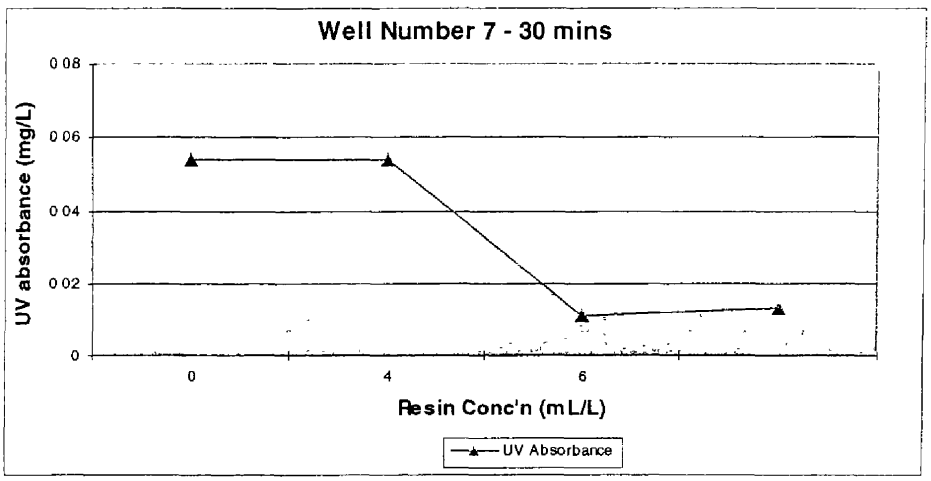
		After 30 minutes mixing		
Resin Conc'n (mL/L)	Before Mixing	0	4	6
Lab Sulfide (mg/L)	1.78	1.02	0.07	0.01
Hach Sulfide (mg/L)	0.875	0.57	0.04	0.01
UV abs (254 nm)	0.090	0.089	0.011	0.007
Color (Pt/Co)	10	10	0	0
pH	7.84	8.12	7.83	7.75

Well Number 4 - 30 minute test

		After 30 minutes mixing		
Resin Conc'n (mL/L)	Before Mixing	0	4	6
Lab Sulfide (mg/L)	0.46	0.09	0.01	0.01
Hach Sulfide (mg/L)	0.33	0.07	0.01	0.01
UV abs (254 nm)	0.106	0.107	0.015	0.015
Color (Pt/Co)	11	12	1	1
pH	7.84	7.88	7.90	7.88

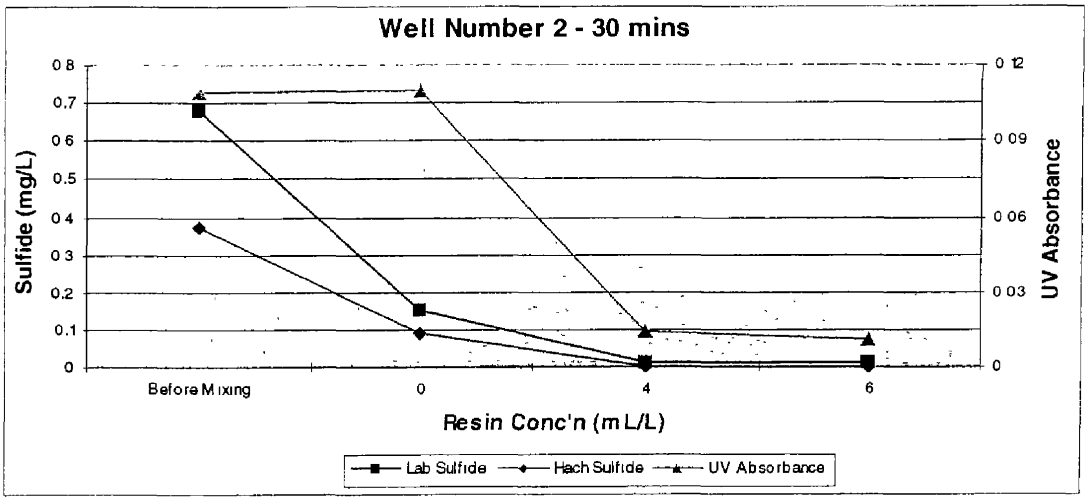
Well Number 7 - 30 minute test

		After 30 minutes mixing		
Resin Conc'n (mL/L)	Before Mixing	0	4	6
Lab Sulfide (mg/L)	< 0.01	< 0.01	< 0.01	< 0.01
Hach Sulfide (mg/L)	0.01	0	0	0
UV abs (254 nm)	0.054	0.054	0.011	0.013
Color (Pt/Co)	8	8	0	0
pH	7.93	7.9	7.78	7.7



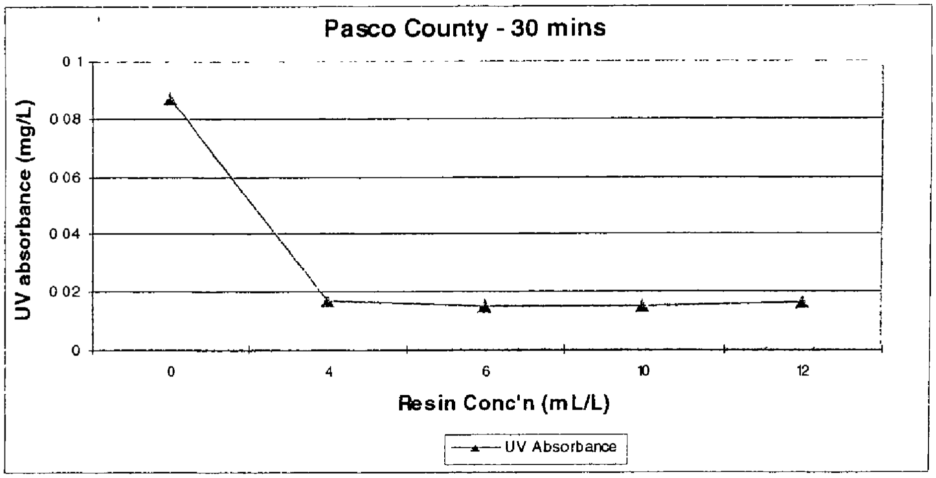
Well Number 2 - 30 minute test

		After 30 minutes mixing		
Resin Conc'n (mL/L)	Before Mixing	0	4	6
Lab Sulfide (mg/L)	0.68	0.15	0.01	0.01
Hach Sulfide (mg/L)	0.37	0.09	0	0
UV abs (254 nm)	0.109	0.110	0.014	0.011
Color (Pt/Co)	12	12	2	1
pH	7.87	8.05	7.72	7.68



Pasco County Treated Water - 30 minute test

	After 30 minutes mixing				
Resin Conc'n (mL/L)	0	4	6	10	12
Lab Sulfide (mg/L)	0	0	0	0	0
Hach Sulfide (mg/L)	0	0	0	0	0
UV abs (254 nm)	0.087	0.017	0.015	0.015	0.016
Color (Pt/Co)	3	1	0	0	0
pH	7.76	7.79	7.73	7.55	7.46



Kinetic Test Results

Kinetic Test - Well No. 9

	Laboratory Results			Hach Results		
Resin Conc'n (mL/L)	**0**	**4**	**6**	**0**	**4**	**6**
Sulfide 0 min (mg/L)	3.85	3.85	3.85	2.4	2.4	2.4
Sulfide 10 min (mg/L)	---	1.03	0.62	---	0.57	0.28
Sulfide 20 min (mg/L)	---	0.35	0.22	---	0.18	0.1
Sulfide 30 min (mg/L)	1.69	0.11	---	1.03	0.06	---
UV abs 0 min	0.125	0.125	0.125			
UV abs 10 min	---	0.036	0.022			
UV abs 20 min	---	0.019	0.014			
UV abs 30 min	0.105	0.014	---			

Kinetic Test - Well No. 8

	Laboratory Results		Hach Results	
Resin Conc'n (mL/L)	**0**	**6**	**0**	**6**
Sulfide 0 min (mg/L)	1.5	1.5	0.73	0.73
Sulfide 5 min (mg/L)	---	0.21	---	0.04
Sulfide 10 min (mg/L)	---	0.05	---	0.03
Sulfide 15 min (mg/L)	---	<0.01	---	0
Sulfide 20 min	---	<0.01	---	0
Sulfide 30 min	0.32	<0.01	0.18	0

UV abs 0 min	0.112	0.112
UV abs 5 min	---	0.031
UV abs 10 min	---	0.022
UV abs 15 min	---	0.014
UV abs 20 min	---	0.008
UV abs 30 min	0.112	0.01

Kinetic Test - Well No. 6

	Laboratory Results		Hach Results	
Resin Conc'n (mL/L)	**0**	**4**	**0**	**4**
Sulfide 0 min (mg/L)	0.09	0.09	0.15	0.15
Sulfide 5 min (mg/L)		0.03		0.02
Sulfide 10 min (mg/L)		<0.01		0
Sulfide 15 min (mg/L)		<0.01		0.01
Sulfide 20 min		<0.01		0
Sulfide 30 min	0.06	<0.01	0.05	0

UV abs 0 min	0.096	0.096
UV abs 5 min		0.061
UV abs 10 min		0.04
UV abs 15 min		0.028
UV abs 20 min		0.019
UV abs 30 min	0.094	0.017

Appendix C
MIEX® Pilot Plant Testing Data

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Control Trial

Start Trial: April 9, 2001 @ 2:00 PM
Stop Trial: April 10, 2001 @ 11:15 AM
Stirred Tank Reactor
No Resin Added
Raw Water Flow: 1.6 gal/min.
Makeup Resin Feed Pump: 240 ml/min. (10% On Time)
Recycle Pump Flow: 240 ml/min. (90% On time)
Reject Pump Flow: 240 ml/min. (10% On Time)

			On-Site Analyses					Laboratory Analyses		
			H_2S	pH	Color	UV	Temp.	Alkalinity	Sulfate	TOC
Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L
9:20 AM	Raw	PP001	5.42	7.70	12	0.122	25.8	205	14.3	3.20
9:20 AM	Final	PP002	3.23	7.86	12	0.101	25.6	206	13.9	3.06
11:15 AM	Raw	PP003	5.17	7.69	10	0.130	26.2	208	14.0	3.36
11:15 AM	Final	PP004	2.89	7.77	10	0.107	26.0	205	15.7	3.19

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

Laboratory Number: 140430

Project: Pilot Plant
Location: Well #9
Sample ID: PP001 Raw
Sampled By: D. Murto on 04/10/2001 @ 0920
Received: 04/11/2001 @ 1535

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	205.	mg/L	EPA 310.1	J. Lair	04/11/2001 @ 1642	0.5
Sulfate	14.3	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	3.20	mg/L	EPA 415.1	E84098	04/18/2001 @ 1231	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/04/2001

Laboratory Number: 140431

Project: Pilot Plant
Location: Well #9
Sample ID: PP002 Final
Sampled By: D. Murto on 04/10/2001 @ 0920
Received: 04/11/2001 @ 1535

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	206.	mg/L	EPA 310.1	J. Lair	04/11/2001 @ 1642	0.5
Sulfate	13.9	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	3.06	mg/L	EPA 415.1	E84098	04/18/2001 @ 1231	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/04/2001

Laboratory Number: 140432

Project: Pilot Plant
Location: Well #9
Sample ID: PP003 Raw
Sampled By: D. Murto on 04/10/2001 @ 1115
Received: 04/11/2001 @ 1535

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	208.	mg/L	EPA 310.1	J. Lair	04/11/2001 @ 1642	0.5
Sulfate	14.0	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	3.36	mg/L	EPA 415.1	E84098	04/18/2001 @ 1231	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/04/2001

Laboratory Number: 140433

Project: Pilot Plant
Location: Well #9
Sample ID: PP004 Final
Sampled By: D. Murto on 04/10/2001 @ 1115
Received: 04/11/2001 @ 1535

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	205.	mg/L	EPA 310.1	J. Lair	04/11/2001 @ 1642	0.5
Sulfate	15.7	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	3.19	mg/L	EPA 415.1	E84098	04/18/2001 @ 1231	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Trial 1
MIEX Resin Trial
Day 1
Start Time: April 11, 2001 @ 10:00 AM
End Time: April 12, 2001 @ 11:15 AM
Sitrred Tank Reactor
MIEX Resin Dosage: 6 ml/L
Raw Water Flow: 1.6 gal/min.
Makeup Resin Feed Pump: 240 ml/min. (10% On Time at 150 ml/L Resin Concentration)
Recycle Pump Flow: 240 ml/min. (90% On Time)
Reject Pump Flow: 240 ml/min. (10% On Time)

				On-Site Analyses					Laboratory Analyses							
				H_2S	pH	Color	UV	Temp.	Alkalinity	Chloride	Sulfate	TOC	Iron	THM FP	HAA FP
Date	Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L
4/12/01	11:15 AM	Raw	PP005	4.05	7.61	5	0.121	26.1	202	12.6	14.1	2.83	N/A	N/A	N/A
4/12/01	11:15 AM	Final	PP006	1.81	7.76	2	0.020	25.5	205	15.8	9.9	2.00	N/A	N/A	N/A
4/12/01	11:35 AM	Brine	PP007	N/A	N/A	N/A	N/A	N/A	2,340	60,320	4,040	258	N/A	N/A	N/A

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Trial 1
MIEX Resin Trial
Day 2
Start Time: April 12, 2001 @ 11:15 AM
End Time: April 13, 2001 @ 12:00 PM
Sitrred Tank Reactor
MIEX Resin Dosage: 6 ml/L
Raw Water Flow: 1.6 gal/min.
Makeup Resin Feed Pump: 240 ml/min. (10% On Time at 150 ml/L Resin Concentration)
Recycle Pump Flow: 240 ml/min. (90% On Time)
Reject Pump Flow: 240 ml/min. (10% On Time)

				On-Site Analyses					Laboratory Analyses						
				H_2S	pH	Color	UV	Temp.	Alkalinity	Chloride	Sulfate	TOC	Iron	THM FP	HAA FP
Date	Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L
4/12/01	4:00 PM	Raw	PP008	4.37	7.62	4	0.129	28.0	207	13.6	13.6	3.41	N/A	N/A	N/A
4/12/01	4:00 PM	Final	PP009	0.11	7.72	0	0.005	27.4	201	30.6	9.6	1.63	N/A	N/A	N/A
4/13/01	9:00 AM	Raw	PP010	4.22	7.46	8	0.127	25.4	204	13.4	14.3	3.62	0.02	173	119
4/13/01	9:00 AM	Final	PP011	0.03	7.61	1	0.009	25.3	197	29.6	9.8	1.62	0.11	57	24.6
4/13/01	12:05 PM	Brine	PP012	N/A	N/A	N/A	N/A	N/A	3,300	52,620	6,240	1,249	N/A	N/A	N/A

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Trial 1
MIEX Resin Trial
Day 3
Start Time: April 13, 2001 @ 12:00 PM
End Time: April 14, 2001 @ 12:00 PM
Sitrred Tank Reactor
MIEX Resin Dosage: 6 ml/L
Raw Water Flow: 1.6 gal/min.
Makeup Resin Feed Pump: 240 ml/min. (10% On Time at 150 ml/L Resin Concentration)
Recycle Pump Flow: 240 ml/min. (90% On Time)
Reject Pump Flow: 240 ml/min. (10% On Time)

				On-Site Analyses					Laboratory Analyses						
				H_2S	pH	Color	UV	Temp.	Alkalinity	Chloride	Sulfate	TOC	Iron	THM FP	HAA FP
Date	Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L
4/13/01	2:45 PM	Raw	PP013	3.93	7.59	6	0.148	27.5	206	12.9	13.8	5.16	N/A	N/A	N/A
4/13/01	2:45 PM	Final	PP014	0.04	7.71	1	0.015	27.5	201	34.8	10.8	1.07	N/A	N/A	N/A
4/14/01	8:30 AM	Raw	PP015	4.10	7.32	6	0.136	25.9	205	12.5	15.3	2.70	N/A	N/A	N/A
4/14/01	9:00 AM	Final	PP016	0.04	7.50	2	0.008	25.9	200	36.8	11.0	1.87	N/A	N/A	N/A
4/14/01	12:00 PM	Brine	PP017	N/A	N/A	N/A	N/A	N/A	3,620	53,030	8,060	1,391	N/A	N/A	N/A

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Trial 1
MIEX Resin Trial
Day 4
Start Time: April 14, 2001 @ 12:00 PM
End Time: April 15, 2001 @ 11:15 AM
Sitrred Tank Reactor
MIEX Resin Dosage: 6 ml/L
Raw Water Flow: 1.6 gal/min.
Makeup Resin Feed Pump: 240 ml/min. (10% On Time at 150 ml/L Resin Concentration)
Recycle Pump Flow: 240 ml/min. (90% On Time)
Reject Pump Flow: 240 ml/min. (10% On Time)

				On-Site Analyses					Laboratory Analyses						
				H_2S	pH	Color	UV	Temp.	Alkalinity	Chloride	Sulfate	TOC	Iron	THM FP	HAA FP
Date	Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L
4/14/01	3:00 PM	Raw	PP018	4.15	7.57	6	0.109	28.0	203	12.9	15.5	4.38	N/A	N/A	N/A
4/14/01	3:00 PM	Final	PP019	0.02	7.63	1	0.014	27.6	204	38.1	11.1	1.21	N/A	N/A	N/A
4/15/01	9:10 AM	Raw	PP020	4.32	7.47	8	0.136	25.2	205	13.1	14.8	3.31	N/A	N/A	N/A
4/15/01	9:10 AM	Final	PP021	0.00	7.61	1	0.015	25.1	199	38.7	11.9	1.16	N/A	N/A	N/A
4/15/01	11:15 AM	Brine	PP022	N/A	N/A	N/A	N/A	N/A	4,260	56,670	9,140	1,941	N/A	N/A	N/A

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Trial 1
MIEX Resin Trial
Day 5
Start Time: April 15, 2001 @ 11:15 AM
End Time: April 16, 2001 @11:05 AM
Sitrred Tank Reactor
MIEX Resin Dosage: 6 ml/L
Raw Water Flow: 1.6 gal/min.
Makeup Resin Feed Pump: 240 ml/min. (10% On Time at 150 ml/L Resin Concentration)
Recycle Pump Flow: 240 ml/min. (90% On Time)
Reject Pump Flow: 240 ml/min. (10% On Time)

				On-Site Analyses					Laboratory Analyses						
				H_2S	pH	Color	UV	Temp.	Alkalinity	Chloride	Sulfate	TOC	Iron	THM FP	HAA FP
Date	Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L
4/15/01	3:30 PM	Raw	PP023	3.96	7.25	12	0.154	27.3	204	10.9	18.8	2.73	N/A	N/A	N/A
4/15/01	3:30 PM	Final	PP024	0.00	7.42	0	0.013	27.6	188	41.7	12.9	1.24	N/A	N/A	N/A
4/16/01	9:15 AM	Raw	PP025	3.50	7.15	10	0.144	25.1	206	12.7	13.8	2.75	N/A	N/A	N/A
4/16/01	9:15 AM	Final	PP026	0.00	7.70	1	0.020	25.0	72	7.9	8.9	2.96	N/A	N/A	N/A
4/16/01	11:05 AM	Brine	PP027	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10,000	1,909	N/A	N/A	N/A

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Trial 1
MIEX Resin Trial
Day 6
Start Time: April 16, 2001 @ 11:05 AM
End Time: April 17, 2001 @10:00 AM
Sitrred Tank Reactor
MIEX Resin Dosage: 6 ml/L
Raw Water Flow: 1.6 gal/min.
Makeup Resin Feed Pump: 240 ml/min. (10% On Time at 150 ml/L Resin Concentration)
Recycle Pump Flow: 240 ml/min. (90% On Time)
Reject Pump Flow: 240 ml/min. (10% On Time)

				On-Site Analyses					Laboratory Analyses						
				H_2S	pH	Color	UV	Temp.	Alkalinity	Chloride	Sulfate	TOC	Iron	THM FP	HAA FP
Date	Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L
4/16/01	4:00 PM	Raw	PP028	3.94	7.66	12	0.144	25.9	200	13.3	13.8	2.71	N/A	N/A	N/A
4/16/01	4:00 PM	Final	PP029	0.00	7.78	4	0.029	26.0	201	13.8	18.6	1.60	N/A	N/A	N/A
4/17/01	10:00 AM	Raw	PP030	5.93	7.57	12	0.136	24.8	204	13.3	13.8	2.67	0.02	149	125
4/17/01	10:00 AM	Final	PP031	0.00	7.75	0	0.013	24.5	197	36.9	12.4	1.07	0.15	60	27.7
4/17/01	10:00 AM	Brine	PP032	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12,120	2,075	N/A	N/A	N/A

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140906

Project: Pilot Plant
Location: Well #9
Sample ID: PP005 Raw
Sampled By: K. Schneider on 04/12/2001 @ 1115
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	202.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	12.6	mg/L	EPA 325.3	J. Lair	04/20/2001 @ 1445	0.5
Sulfate	14.1	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	2.83	mg/L	EPA 415.1	E84098	04/26/2001 @ 1026	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

Laboratory Number: 140907

Project: Pilot Plant
Location: Well #9
Sample ID: PP006 Final
Sampled By: K. Schneider on 04/12/2001 @ 1115
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	205.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	15.8	mg/L	EPA 325.3	J. Lair	04/20/2001 @ 1445	0.5
Sulfate	9.9	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	2.00	mg/L	EPA 415.1	E84098	04/26/2001 @ 1026	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140908

Project: Pilot Plant
Location: Well #9
Sample ID: PP007 Brine
Sampled By: D. Porter on 04/12/2001 @ 1135
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	2340.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	60,320.	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	4040.j	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	258.	mg/L	EPA 415.1	E84098	04/26/2001 @ 1026	0.1

j = Estimated value

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

Laboratory Number: 140909

Project: Pilot Plant
Location: Well #9
Sample ID: PP008 Raw
Sampled By: C. Painter on 04/12/2001 @ 1600
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	207.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	13.6	mg/L	EPA 325.3	J. Lair	04/20/2001 @ 1445	0.5
Sulfate	13.6	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	3.41	mg/L	EPA 415.1	E84098	04/26/2001 @ 1026	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140910

Project: Pilot Plant
Location: Well #9
Sample ID: PP009 Final
Sampled By: C. Painter on 04/12/2001 @ 1600
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	201.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	30.6	mg/L	EPA 325.3	J. Lair	04/20/2001 @ 1445	0.5
Sulfate	9.6	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	1.63	mg/L	EPA 415.1	E84098	04/26/2001 @ 1026	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.

10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140911

Project: Pilot Plant
Location: Well #9
Sample ID: PP010 Raw
Sampled By: C. Painter on 04/13/2001 @ 0900
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	204.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	13.4	mg/L	EPA 325.3	J. Lair	04/20/2001 @ 1445	0.5
Sulfate	14.3	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Phosphorus (P)	0.05	mg/L	EPA 365.2	J. Cosgrave	04/30/2001 @ 1730	0.01
Total Organic Carbon	3.62	mg/L	EPA 415.1	E84098	04/26/2001 @ 1026	0.1
Iron	0.02u	mg/L	EPA 236.1	J. Mansell	04/23/2001 @ 1336	0.02
Manganese	0.01u	mg/L	EPA 243.1	J. Mansell	04/26/2001 @ 1034	0.01
THM Formation Potential	173.	ug/L	EPA 502.2	E84129	05/02/2001 @ 1221	1.5
HAA Formation Potential	119.	ug/L	EPA 552.2	E84129	04/26/2001 @ 1042	6.0

u = Parameter was analyzed for but not detected

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140912

Project: Pilot Plant
Location: Well #9
Sample ID: PP011 Final
Sampled By: C. Painter on 04/13/2001 @ 0900
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	197.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	29.6	mg/L	EPA 325.3	J. Lair	04/20/2001 @ 1445	0.5
Sulfate	9.8	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Phosphorus (P)	0.04	mg/L	EPA 365.2	J. Cosgrave	04/30/2001 @ 1730	0.01
Total Organic Carbon	1.62	mg/L	EPA 415.1	E84098	04/26/2001 @ 1026	0.1
Iron	0.11	mg/L	EPA 236.1	J. Mansell	04/23/2001 @ 1336	0.02
Manganese	0.01u	mg/L	EPA 243.1	J. Mansell	04/26/2001 @ 1034	0.01
THM Formation Potential	57.	ug/L	EPA 502.2	E84129	05/02/2001 @ 1221	1.5
HAA Formation Potential	24.6	ug/L	EPA 552.2	E84129	04/26/2001 @ 1042	6.0

u = Parameter was analyzed for but not detected

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140913

Project: Pilot Plant
Location: Well #9
Sample ID: PP012 Brine
Sampled By: D. Porter on 04/13/2001 @ 1205
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	3300.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	52,620.	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	6240.j	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	1249.	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1

j = Estimated value

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140914

Project: Pilot Plant
Location: Well #9
Sample ID: PP013 Raw
Sampled By: C. Painter on 04/13/2001 @ 1445
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	206.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	12.9	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	13.8	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	5.16	mg/L	EPA 415.1	E84098	04/26/2001 @ 1026	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.

10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140915

Project: Pilot Plant
Location: Well #9
Sample ID: PP014 Final
Sampled By: C. Painter on 04/13/2001 @ 1445
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	201.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	34.8	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	10.8	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	1.07	mg/L	EPA 415.1	E84098	04/26/2001 @ 1026	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.

10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140916

Project: Pilot Plant
Location: Well #9
Sample ID: PP015 Raw
Sampled By: K. Schneider on 04/14/2001 @ 0830
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	205.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	12.5	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	15.3	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	2.70	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140917

Project: Pilot Plant
Location: Well #9
Sample ID: PP016 Final
Sampled By: K. Schneider on 04/14/2001 @ 0900
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	200.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	36.8	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	11.0	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	1.87	mg/L	EPA 415.1	E84098	04/26/2001 @ 1026	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.

10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140918

Project: Pilot Plant
Location: Well #9
Sample ID: PP017 Brine
Sampled By: K. Schneider on 04/14/2001 @ 1200
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	3620.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	53,030.	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	8060.j	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	1391.	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1

j = Estimated value

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140919

Project: Pilot Plant
Location: Well #9
Sample ID: PP018 Raw
Sampled By: K. Schneider on 04/14/2001 @ 1500
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	203.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	12.9	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	15.5	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	4.38	mg/L	EPA 415.1	E84098	04/26/2001 @ 1026	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140920

Project: Pilot Plant
Location: Well #9
Sample ID: PP019 Final
Sampled By: K. Schneider on 04/14/2001 @ 1500
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	204.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	38.1	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	11.1	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	1.21	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140921

Project: Pilot Plant
Location: Well #9
Sample ID: PP020 Raw
Sampled By: C. Painter on 04/15/2001 @ 0910
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	205.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	13.1	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	14.8	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	3.31	mg/L	EPA 415.1	E84098	04/26/2001 @ 1026	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140922

Project: Pilot Plant
Location: Well #9
Sample ID: PP021 Final
Sampled By: C. Painter on 04/15/2001 @ 0910
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	199.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	38.7	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	11.9	mg/L	EPA 375.4	J. Cosgrave	04/24/2001 @ 0830	1.
Total Organic Carbon	1.16	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140923

Project: Pilot Plant
Location: Well #9
Sample ID: PP022 Brine
Sampled By: C. Painter on 04/15/2001 @ 1115
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	4260.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	56,670.	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	9140j	mg/L	EPA 375.4	J. Cosgrave	04/26/2001 @ 0830	1.
Total Organic Carbon	1941.	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1

j = Estimated value

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.

10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140924

Project: Pilot Plant
Location: Well #9
Sample ID: PP023 Raw
Sampled By: C. Painter on 04/15/2001 @ 1530
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	204.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	10.9	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	18.8	mg/L	EPA 375.4	J. Cosgrave	04/26/2001 @ 0830	1.
Total Organic Carbon	2.73	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140925

Project: Pilot Plant
Location: Well #9
Sample ID: PP024 Final
Sampled By: C. Painter on 04/15/2001 @ 1530
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	188.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	41.7	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	12.9	mg/L	EPA 375.4	J. Cosgrave	04/26/2001 @ 0830	1.
Total Organic Carbon	1.24	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140926

Project: Pilot Plant
Location: Well #9
Sample ID: PP025 Raw
Sampled By: C. Painter on 04/16/2001 @ 0915
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	206.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	12.7	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	13.8	mg/L	EPA 375.4	J. Cosgrave	04/26/2001 @ 0830	1.
Total Organic Carbon	2.75	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140927

Project: Pilot Plant
Location: Well #9
Sample ID: PP026 Final
Sampled By: C. Painter on 04/16/2001 @ 0915
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	72.	mg/L	EPA 310.1	J. Lair	04/23/2001 @ 1100	0.5
Chloride	7.9	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	8.9	mg/L	EPA 375.4	J. Cosgrave	04/26/2001 @ 0830	1.
Total Organic Carbon	2.96	mg/L	EPA 415.1	E84098	04/26/2001 @ 1026	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140928

Project: Pilot Plant
Location: Well #9
Sample ID: PP027 Brine
Sampled By: D. Porter on 04/16/2001 @ 1105
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Sulfate	10,000.j	mg/L	EPA 375.4	J. Cosgrave	04/26/2001 @ 0830	1.
Total Organic Carbon	1909.	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1

j = Estimated value

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140929

Project: Pilot Plant
Location: Well #9
Sample ID: PP028 Raw
Sampled By: C. Painter on 04/16/2001 @ 1600
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	200.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	13.3	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	13.8	mg/L	EPA 375.4	J. Cosgrave	04/26/2001 @ 0830	1.
Total Organic Carbon	2.71	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140930

Project: Pilot Plant
Location: Well #9
Sample ID: PP029 Final
Sampled By: C. Painter on 04/16/2001 @ 1600
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	201.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	13.8	mg/L	EPA 325.3	J. Lair	04/25/2001 @ 0930	0.5
Sulfate	18.6	mg/L	EPA 375.4	J. Cosgrave	04/26/2001 @ 0830	1.
Total Organic Carbon	1.60	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.

10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140931

Project: Pilot Plant
Location: Well #9
Sample ID: PP030 Raw
Sampled By: D. Porter on 04/17/2001 @ 1000
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	204.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	13.3	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	13.8	mg/L	EPA 375.4	J. Cosgrave	04/26/2001 @ 0830	1.
Total Phosphorus (P)	0.05	mg/L	EPA 365.2	J. Cosgrave	04/30/2001 @ 1730	0.01
Total Organic Carbon	2.67	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1
Iron	0.02u	mg/L	EPA 236.1	J. Mansell	04/23/2001 @ 1336	0.02
Manganese	0.01u	mg/L	EPA 243.1	J. Mansell	04/26/2001 @ 1034	0.01
Total THMs	0.0015u	mg/L	EPA 502.2	E84129	04/23/2001 @ 0030	0.0015
Bromoacetic acid	1.0u	ug/L	EPA 552.2	E84129	04/27/2001 @ 0114	1.0
Bromochloroacetic acid	1.0u	ug/L	EPA 552.2	E84129	04/27/2001 @ 0114	1.0
Chloracetic acid	1.0u	ug/L	EPA 552.2	E84129	04/27/2001 @ 0114	1.0
Dibromoacetic acid	1.0u	ug/L	EPA 552.2	E84129	04/27/2001 @ 0114	1.0
Dichloroacetic acid	1.0u	ug/L	EPA 552.2	E84129	04/27/2001 @ 0114	1.0
Trichloroacetic acid	1.0u	ug/L	EPA 552.2	E84129	04/27/2001 @ 0114	1.0
THM Formation Potential	149.	ug/L	EPA 502.2	E84129	05/02/2001 @ 1221	1.5
HAA Formation Potential	125.	ug/L	EPA 552.2	E84129	04/26/2001 @ 1042	6.0

u = Parameter was analyzed for but not detected

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.

10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140932

Project: Pilot Plant
Location: Well #9
Sample ID: PP031 Final
Sampled By: D. Porter on 04/17/2001 @ 1000
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	197.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	36.9	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	12.4	mg/L	EPA 375.4	J. Cosgrave	04/26/2001 @ 0830	1.
Total Phosphorus (P)	0.03	mg/L	EPA 365.2	J. Cosgrave	04/30/2001 @ 1730	0.01
Total Organic Carbon	1.07	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1
Iron	0.15	mg/L	EPA 236.1	J. Mansell	04/23/2001 @ 1336	0.02
Manganese	0.01u	mg/L	EPA 243.1	J. Mansell	04/26/2001 @ 1034	0.01
Total THMs	0.0015u	mg/L	EPA 502.2	E84129	04/23/2001 @ 0030	0.0015
Bromoacetic acid	1.0u	ug/L	EPA 552.2	E84129	04/27/2001 @ 0114	1.0
Bromochloroacetic acid	1.0u	ug/L	EPA 552.2	E84129	04/27/2001 @ 0114	1.0
Chloracetic acid	1.0u	ug/L	EPA 552.2	E84129	04/27/2001 @ 0114	1.0
Dibromoacetic acid	1.0u	ug/L	EPA 552.2	E84129	04/27/2001 @ 0114	1.0
Dichloroacetic acid	1.0u	ug/L	EPA 552.2	E84129	04/27/2001 @ 0114	1.0
Trichloroacetic acid	1.0u	ug/L	EPA 552.2	E84129	04/27/2001 @ 0114	1.0
THM Formation Potential	60.	ug/L	EPA 502.2	E84129	05/02/2001 @ 1221	1.5
HAA Formation Potential	27.7	ug/L	EPA 552.2	E84129	04/26/2001 @ 1042	6.0

u = Parameter was analyzed for but not detected

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140933

Project: Pilot Plant
Location: Well #9
Sample ID: PP032 Brine
Sampled By: D. Porter on 04/17/2001 @ 1000
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Sulfate	12,120.j	mg/L	EPA 375.4	J. Cosgrave	04/26/2001 @ 0830	1.
Total Organic Carbon	2075.	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1

j = Estimated value

Respectfully Submitted,

Bruce Cummings
Laboratory Director

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Trial 2
MIEX Resin Trial
Day 1
Start Time: April 17, 2001 @ 10:00 AM
End Time: April 18, 2001 @11:30 AM
Sitrred Tank Reactor
MIEX Resin Dosage: 6 ml/L
Raw Water Flow: 1.6 gal/min.
Makeup Resin Feed Pump: 240 ml/min. (10% On Time at 150 ml/L Resin Concentration)
Recycle Pump Flow: 240 ml/min. (90% On Time)
Reject Pump Flow: 240 ml/min. (10% On Time)

				On-Site Analyses					Laboratory Analyses							
				H_2S	pH	Color	UV	Temp.	Alkalinity	Chloride	Sulfate	TOC	Iron	THM FP	HAA FP
Date	Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L
4/17/01	3:30 PM	Raw	PP033	6.55	7.61	7	0.133	25.7	204	13.6	13.2	3.64	N/A	N/A	N/A
4/17/01	3:30 PM	Final	PP034	0.01	7.71	0	0.012	26.1	197	35.0	11.8	1.14	N/A	N/A	N/A
4/18/01	9:30 AM	Raw	PP035	4.38	7.39	7	0.105	21.3	204	13.1	13.9	2.62	N/A	N/A	N/A
4/18/01	9:30 AM	Final	PP036	0.00	7.52	1	0.006	21.3	202	33.4	12.6	1.17	N/A	N/A	N/A
4/18/01	11:30 AM	Brine	PP037	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3,360	618	N/A	N/A	N/A

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Trial 2
MIEX Resin Trial
Day 2

Start Time: April 18, 2001 @ 11:30 AM
End Time: April 19, 2001 @11:45 AM
Sitrred Tank Reactor
MIEX Resin Dosage: 6 ml/L
Raw Water Flow: 1.6 gal/min.
Makeup Resin Feed Pump: 240 ml/min. (10% On Time at 150 ml/L Resin Concentration)
Recycle Pump Flow: 240 ml/min. (90% On Time)
Reject Pump Flow: 240 ml/min. (10% On Time)

				On-Site Analyses					Laboratory Analyses						
				H_2S	pH	Color	UV	Temp.	Alkalinity	Chloride	Sulfate	TOC	Iron	THM FP	HAA FP
Date	Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L
4/18/01	3:30 PM	Raw	PP038	4.12	7.36	6	0.142	22.7	209	12.4	18.5	2.91	N/A	N/A	N/A
4/18/01	3:30 PM	Final	PP039	0.01	7.51	2	0.007	22.4	203	41.2	11.8	1.29	N/A	N/A	N/A
4/19/01	10:15 AM	Raw	PP040	6.26	7.34	5	0.152	23.9	207	12.2	17.8	2.97	N/A	N/A	N/A
4/19/01	10:15 AM	Final	PP041	0.01	7.44	0	0.015	23.6	205	43.2	11.7	1.31	N/A	N/A	N/A
4/19/01	11:45 AM	Brine	PP042	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5,140	999	N/A	N/A	N/A

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Trial 2
MIEX Resin Trial
Day 3
Start Time: April 19, 2001 @ 11:45 AM
End Time: April 20, 2001 @12:00 PM
Sitrred Tank Reactor
MIEX Resin Dosage: 6 ml/L*
Raw Water Flow: 1.6 gal/min.
Makeup Resin Feed Pump: 240 ml/min. (10% On Time at 150 ml/L Resin Concentration)
Recycle Pump Flow: 240 ml/min. (90% On Time)
Reject Pump Flow: 240 ml/min. (10% On Time)

				On-Site Analyses					Laboratory Analyses						
				H_2S	pH	Color	UV	Temp.	Alkalinity	Chloride	Sulfate	TOC	Iron	THM FP	HAA FP
Date	Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L
4/19/01	4:00 PM	Raw	PP043	6.35	7.61	8	0.153	25.0	211	12.4	17.5	3.00	N/A	N/A	N/A
4/19/01	4:00 PM	Final	PP044	0.02	7.73	1	0.014	24.6	202	33.5	9.9	1.33	N/A	N/A	N/A
4/20/01	9:20 AM	Raw	PP045	6.35	7.59	8	0.143	23.9	210	13.5	17.9	2.96	0.05	150	94
4/20/01	9:20 AM	Final	PP046	0.14	7.73	2	0.038	22.9	206	13.2	17.9	2.00	0.04	106	45
4/20/01	12:00 PM	Brine	PP047	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6,960	1,380	N/A	N/A	N/A

* Due to resin recycle pump blockage, resin concentration was reduced to 3 ml/L for at least several hours prior to sample extration on 4/20/01 @ 9:20 AM. Therefore, process performance values were reduced as exhibited on this chart for that date and time.

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Trial 2
MIEX Resin Trial
Day 4
Start Time: April 20, 2001 @ 12:00 PM
End Time: April 21, 2001 @9:50 AM
Sitrred Tank Reactor
MIEX Resin Dosage: 6 ml/L
Raw Water Flow: 1.6 gal/min.
Makeup Resin Feed Pump: 240 ml/min. (10% On Time at 150 ml/L Resin Concentration)
Recycle Pump Flow: 240 ml/min. (90% On Time)
Reject Pump Flow: 240 ml/min. (10% On Time)

				On-Site Analyses					Laboratory Analyses						
				H_2S	pH	Color	UV	Temp.	Alkalinity	Chloride	Sulfate	TOC	Iron	THM FP	HAA FP
Date	Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L
4/20/01	3:00 PM	Raw	PP048	6.60	7.55	7	0.153	25.8	211	10.8	18.5	3.06	N/A	N/A	N/A
4/20/01	3:00 PM	Final	PP049	0.00	7.68	0	0.012	25.9	202	32.5	6.3	1.32	N/A	N/A	N/A
4/21/01	10:00 AM	Raw	PP050	6.99	7.57	7	0.145	25.3	211	11.4	18.2	3.12	N/A	N/A	N/A
4/21/01	10:00 AM	Final	PP051	0.00	7.65	0	0.015	24.7	198	47.6	4.8	1.27	N/A	N/A	N/A
4/21/01	9:50 AM	Brine	PP052	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8,600	1,740	N/A	N/A	N/A

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Trial 2
MIEX Resin Trial
Day 5
Start Time: April 21, 2001 @ 9:50 AM
End Time: April 22, 2001 @9:05 AM
Sitrred Tank Reactor
MIEX Resin Dosage: 6 ml/L
Raw Water Flow: 1.6 gal/min.
Makeup Resin Feed Pump: 240 ml/min. (10% On Time at 150 ml/L Resin Concentration)
Recycle Pump Flow: 240 ml/min. (90% On Time)
Reject Pump Flow: 240 ml/min. (10% On Time)

				On-Site Analyses					Laboratory Analyses							
				H_2S	pH	Color	UV	Temp.	Alkalinity	Chloride	Sulfate	TOC	Iron	THM FP	HAA FP
Date	Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L
4/21/01	2:10 PM	Raw	PP053	6.71	7.58	8	0.157	26.2	202	12.0	18.4	3.18	N/A	N/A	N/A
4/21/01	2:10 PM	Final	PP054	0.00	7.71	0	0.006	26.4	203	26.9	8.6	1.45	N/A	N/A	N/A
4/22/01	9:05 AM	Raw	PP055	6.58	7.59	7	0.162	24.3	208	13.2	16.6	3.07	N/A	N/A	N/A
4/22/01	9:05 AM	Final	PP056	0.01	7.69	0	0.014	23.4	207	25.5	11.8	1.57	N/A	N/A	N/A
4/22/01	9:05 AM	Brine	PP057	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9,980	1,990	N/A	N/A	N/A

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Trial 2
MIEX Resin Trial
Day 6
Start Time: April 22, 2001 @ 9:05 AM
End Time: April 23, 2001 @1:00 PM
Sitrred Tank Reactor
MIEX Resin Dosage: 6 ml/L
Raw Water Flow: 1.6 gal/min.
Makeup Resin Feed Pump: 240 ml/min. (10% On Time at 150 ml/L Resin Concentration)
Recycle Pump Flow: 240 ml/min. (90% On Time)
Reject Pump Flow: 240 ml/min. (10% On Time)

				On-Site Analyses					Laboratory Analyses						
				H_2S	pH	Color	UV	Temp.	Alkalinity	Chloride	Sulfate	TOC	Iron	THM FP	HAA FP
Date	Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L
4/22/01	2:30 PM	Raw	PP058	6.27	7.52	7	0.171	26.7	208	13.3	15.7	3.15	N/A	N/A	N/A
4/22/01	2:30 PM	Final	PP059	0.02	7.68	0	0.019	26.3	198	25.6	10.8	1.54	N/A	N/A	N/A
4/23/01	12:45 PM	Raw	PP060	6.47	7.43	8	0.163	25.8	205	13.2	12.9	3.20	0.18	170	76
4/23/01	12:45 PM	Final	PP061	0.02	7.68	1	0.014	26.2	195	34.2	9.1	1.58	0.47	67	23
4/23/01	4:15 PM	Brine	PP062	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10,250	1,960	N/A	N/A	N/A

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140934

Project: Pilot Plant
Location: Well #9
Sample ID: PP033 Raw
Sampled By: D. Porter on 04/17/2001 @ 1530
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	204.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	13.6	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	13.2	mg/L	EPA 375.4	J. Cosgrave	04/26/2001 @ 0830	1.
Total Organic Carbon	3.64	mg/L	EPA 415.1	E84098	04/26/2001 @ 1026	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140935

Project: Pilot Plant
Location: Well #9
Sample ID: PP034 Final
Sampled By: D. Porter on 04/17/2001 @ 1530
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	197.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	35.0	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	11.8	mg/L	EPA 375.4	J. Cosgrave	04/26/2001 @ 0830	1.
Total Organic Carbon	1.14	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140936

Project: Pilot Plant
Location: Well #9
Sample ID: PP035 Raw
Sampled By: K. Schneider on 04/18/2001 @ 0930
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	204.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	13.1	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	13.9	mg/L	EPA 375.4	J. Cosgrave	04/26/2001 @ 0830	1.
Total Organic Carbon	2.62	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140937

Project: Pilot Plant
Location: Well #9
Sample ID: PP036 Final
Sampled By: K. Schneider on 04/18/2001 @ 0930
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	202.	mg/L	EPA 310.1	J. Lair	04/19/2001 @ 1415	0.5
Chloride	33.4	mg/L	EPA 325.3	J. Lair	04/23/2001 @ 1400	0.5
Sulfate	12.6	mg/L	EPA 375.4	J. Cosgrave	04/26/2001 @ 0830	1.
Total Organic Carbon	1.17	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/05/2001

Laboratory Number: 140938

Project: Pilot Plant
Location: Well #9
Sample ID: PP037 Brine
Sampled By: K. Schneider on 04/18/2001 @ 1130
Received: 04/18/2001 @ 1730

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Sulfate	3360.j	mg/L	EPA 375.4	J. Cosgrave	04/26/2001 @ 0830	1.
Total Organic Carbon	618.	mg/L	EPA 415.1	E84098	04/27/2001 @ 1034	0.1

j = Estimated value

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.

10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141216

Project: Pilot Plant
Location: Well #9
Sample ID: PP 038 Raw
Sampled By: K. Schneider on 04/18/2001 @ 1530
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	209.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	12.4	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	18.5	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	2.91	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.

10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141217

Project: Pilot Plant
Location: Well #9
Sample ID: PP 039 Final
Sampled By: K. Schneider on 04/18/2001 @ 1530
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	203.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	41.2	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	11.8	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	1.29	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

Laboratory Number: 141218

Project: Pilot Plant
Location: Well #9
Sample ID: PP 040 Raw
Sampled By: K. Schneider on 04/19/2001 @ 1015
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	207.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	12.2	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	17.8	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	2.97	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141219

Project: Pilot Plant
Location: Well #9
Sample ID: PP 041 Final
Sampled By: K. Schneider on 04/19/2001 @ 1015
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	205.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	43.2	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	11.7	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	1.31	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141220

Project: Pilot Plant
Location: Well #9
Sample ID: PP 042 Brine
Sampled By: D. Porter on 04/19/2001 @ 1145
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Sulfate	5140.	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	999.	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141221

Project: Pilot Plant
Location: Well #9
Sample ID: PP 043 Raw
Sampled By: D. Porter on 04/19/2001 @ 1600
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	211.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	12.4	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	17.5	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	3.00	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.

10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141222

Project: Pilot Plant
Location: Well #9
Sample ID: PP 044 Final
Sampled By: D. Porter on 04/19/2001 @ 1600
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	202.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	33.5	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	9.9	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	1.33	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 FDOH# E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Pam Yacobelli

07/05/2002

Laboratory Number: 141223

Project: Pilot Plant
Location: Well #9
Sample ID: PP 045 Raw
Sampled By: D. Porter on 04/20/2001 @ 0920
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	210.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	13.5	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	17.9	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Phosphorus (P)	0.05	mg/L	EPA 365.2	J. Cosgrave	04/30/2001 @ 1730	0.01
Total Organic Carbon	2.96	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1
Iron	0.05	mg/L	EPA 236.1	J. Mansell	05/01/2001 @ 1017	0.02
Manganese	0.01u	mg/L	EPA 243.1	J. Mansell	05/01/2001 @ 1120	0.01
Bromoacetic acid	1.0u	ug/L	EPA 552.2	E84129	05/04/2001 @ 0000	1.0
Bromochloroacetic acid	6.8	ug/L	EPA 552.2	E84129	05/04/2001 @ 0000	1.0
Chloracetic acid	1.0u	ug/L	EPA 552.2	E84129	05/04/2001 @ 0000	1.0
Dibromoacetic acid	1.0u	ug/L	EPA 552.2	E84129	05/04/2001 @ 0000	1.0
Dichloroacetic acid	43.	ug/L	EPA 552.2	E84129	05/04/2001 @ 0000	1.0
Trichloroacetic acid	44.	ug/L	EPA 552.2	E84129	05/04/2001 @ 0000	1.0
HAA Formation Potential	94.	ug/L	EPA 552.2	E84129	05/04/2001 @ 0000	6.0
THM Formation Potential	150.	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	1.5
Chloroform (FP)	130.	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	0.2
Bromodichloromethane (FP)	18.	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	0.3
Dibromochloromethane (FP)	2.2	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	0.5
Bromoform (FP)	0.5u	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	0.5

Revised

u = Parameter was analyzed for but not detected

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 FDOH# E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Pam Yacobelli

07/05/2002

Laboratory Number: 141224

Project: Pilot Plant
Location: Well #9
Sample ID: PP 046 Final
Sampled By: D. Porter on 04/20/2001 @ 0920
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	206.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	13.2	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	17.9	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Phosphorus (P)	0.03	mg/L	EPA 365.2	J. Cosgrave	04/30/2001 @ 1730	0.01
Total Organic Carbon	2.00	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1
Iron	0.04	mg/L	EPA 236.1	J. Mansell	05/01/2001 @ 1017	0.02
Manganese	0.01u	mg/L	EPA 243.1	J. Mansell	05/01/2001 @ 1120	0.01
Bromoacetic acid	1.0u	ug/L	EPA 552.2	E84129	05/04/2001 @ 0000	1.0
Bromochloroacetic acid	5.1	ug/L	EPA 552.2	E84129	05/04/2001 @ 0000	1.0
Chloracetic acid	1.0u	ug/L	EPA 552.2	E84129	05/04/2001 @ 0000	1.0
Dibromoacetic acid	1.0u	ug/L	EPA 552.2	E84129	05/04/2001 @ 0000	1.0
Dichloroacetic acid	20.	ug/L	EPA 552.2	E84129	05/04/2001 @ 0000	1.0
Trichloroacetic acid	20.	ug/L	EPA 552.2	E84129	05/04/2001 @ 0000	1.0
HAA Formation Potential	45.	ug/L	EPA 552.2	E84129	05/04/2001 @ 0000	6.0
THM Formation Potential	106.	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	1.5
Chloroform (FP)	80.	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	0.2
Bromodichloromethane (FP)	21.	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	0.3
Dibromochloromethane (FP)	5.0	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	0.5
Bromoform (FP)	0.5u	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	0.5

Revised

u = Parameter was analyzed for but not detected

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141225

Project: Pilot Plant
Location: Well #9
Sample ID: PP 047 Brine
Sampled By: D. Porter on 04/20/2001 @ 1200
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Sulfate	6960.	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	1380.	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141226

Project: Pilot Plant
Location: Well #9
Sample ID: PP 048 Raw
Sampled By: D. Porter on 04/20/2001 @ 1500
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	211.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	10.8	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	18.5	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	3.06	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141227

Project: Pilot Plant
Location: Well #9
Sample ID: PP 049 Final
Sampled By: D. Porter on 04/20/2001 @ 1500
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	202.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	32.5	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	6.3	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	1.32	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141228

Project: Pilot Plant
Location: Well #9
Sample ID: PP 050 Raw
Sampled By: D. Porter on 04/21/2001 @ 1000
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	211.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	11.4	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	18.2	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	3.12	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141229

Project: Pilot Plant
Location: Well #9
Sample ID: PP 051 Final
Sampled By: D. Porter on 04/21/2001 @ 1000
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	198.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	47.6	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	4.8	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	1.27	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141230

Project: Pilot Plant
Location: Well #9
Sample ID: PP 052 Brine
Sampled By: D. Porter on 04/21/2001 @ 0950
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Sulfate	8600.	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	1740.	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.

10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141231

Project: Pilot Plant
Location: Well #9
Sample ID: PP 053 Raw
Sampled By: D. Porter on 04/21/2001 @ 1410
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	202.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	12.0	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	18.4	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	3.18	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141232

Project: Pilot Plant
Location: Well #9
Sample ID: PP 054 Final
Sampled By: D. Porter on 04/21/2001 @ 1410
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	203.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	26.9	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	8.6	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	1.45	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141233

Project: Pilot Plant
Location: Well #9
Sample ID: PP 055 Raw
Sampled By: D. Porter on 04/22/2001 @ 0905
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	208.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	13.2	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	16.6	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	3.07	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.

10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141234

Project: Pilot Plant
Location: Well #9
Sample ID: PP 056 Final
Sampled By: D. Porter on 04/22/2001 @ 0905
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	207.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	25.5	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	11.8	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	1.57	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141235

Project: Pilot Plant
Location: Well #9
Sample ID: PP 057 Brine
Sampled By: D. Porter on 04/22/2001 @ 0905
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Sulfate	9980.	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	1990.	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

Laboratory Number: 141236

Project: Pilot Plant
Location: Well #9
Sample ID: PP 058 Raw
Sampled By: D. Porter on 04/22/2001 @ 1430
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	208.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	13.3	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	15.7	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	3.15	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141237

Project: Pilot Plant
Location: Well #9
Sample ID: PP 059 Final
Sampled By: D. Porter on 04/22/2001 @ 1430
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	198.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	25.6	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	10.8	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	1.54	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.

10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 FDOH# E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Pam Yacobelli

07/05/2002

Laboratory Number: 141238

Project: Pilot Plant
Location: Well #9
Sample ID: PP 060 Raw
Sampled By: D. Porter on 04/23/2001 @ 1245
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	205.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	13.2	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	12.9	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Phosphorus (P)	0.04	mg/L	EPA 365.2	J. Cosgrave	04/30/2001 @ 1730	0.01
Total Organic Carbon	3.20	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1
Iron	0.18	mg/L	EPA 236.1	J. Mansell	05/01/2001 @ 1017	0.02
Manganese	0.01u	mg/L	EPA 243.1	J. Mansell	05/01/2001 @ 1120	0.01
Bromoacetic acid	1.0u	ug/L	EPA 552.2	E84129	05/07/2001 @ 0000	1.0
Bromochloroacetic acid	5.2	ug/L	EPA 552.2	E84129	05/07/2001 @ 0000	1.0
Chloracetic acid	1.0u	ug/L	EPA 552.2	E84129	05/07/2001 @ 0000	1.0
Dibromoacetic acid	1.0u	ug/L	EPA 552.2	E84129	05/07/2001 @ 0000	1.0
Dichloroacetic acid	36.	ug/L	EPA 552.2	E84129	05/07/2001 @ 0000	1.0
Trichloroacetic acid	35.	ug/L	EPA 552.2	E84129	05/07/2001 @ 0000	1.0
HAA Formation Potential	76.	ug/L	EPA 552.2	E84129	05/07/2001 @ 0000	6.0
THM Formation Potential	170.	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	1.5
Chloroform (FP)	150.	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	0.2
Bromodichloromethane (FP)	18.	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	0.3
Dibromochloromethane (FP)	2.0	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	0.5
Bromoform (FP)	0.5u	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	0.5

Revised

u = Parameter was analyzed for but not detected

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 FDOH# E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Pam Yacobelli

07/05/2002

Laboratory Number: 141239

Project: Pilot Plant
Location: Well #9
Sample ID: PP 061 Final
Sampled By: D. Porter on 04/23/2001 @ 1245
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	195.	mg/L	EPA 310.1	J. Lair	04/26/2001 @ 1200	0.5
Chloride	34.2	mg/L	EPA 325.3	J. Lair	04/27/2001 @ 1500	0.5
Sulfate	9.1	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Phosphorus (P)	0.03	mg/L	EPA 365.2	J. Cosgrave	04/30/2001 @ 1730	0.01
Total Organic Carbon	1.58	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1
Iron	0.47	mg/L	EPA 236.1	J. Mansell	05/01/2001 @ 1017	0.02
Manganese	0.01u	mg/L	EPA 243.1	J. Mansell	05/01/2001 @ 1120	0.01
Bromoacetic acid	1.0u	ug/L	EPA 552.2	E84129	05/07/2001 @ 0000	1.0
Bromochloroacetic acid	4.1	ug/L	EPA 552.2	E84129	05/07/2001 @ 0000	1.0
Chloracetic acid	1.0u	ug/L	EPA 552.2	E84129	05/07/2001 @ 0000	1.0
Dibromoacetic acid	1.0u	ug/L	EPA 552.2	E84129	05/07/2001 @ 0000	1.0
Dichloroacetic acid	11.	ug/L	EPA 552.2	E84129	05/07/2001 @ 0000	1.0
Trichloroacetic acid	8.2	ug/L	EPA 552.2	E84129	05/07/2001 @ 0000	1.0
HAA Formation Potential	23.	ug/L	EPA 552.2	E84129	05/07/2001 @ 0000	6.0
THM Formation Potential	67.	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	1.5
Chloroform (FP)	43.	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	0.2
Bromodichloromethane (FP)	18.	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	0.3
Dibromochloromethane (FP)	5.6	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	0.5
Bromoform (FP)	0.5u	ug/L	EPA 510.1	E84129	05/06/2001 @ 0000	0.5

Revised

u = Parameter was analyzed for but not detected

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

05/20/2001

Laboratory Number: 141240

Project: Pilot Plant
Location: Well #9
Sample ID: PP 062 Brine
Sampled By: D. Porter on 04/23/2001 @ 1345
Received: 04/25/2001 @ 1615

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Sulfate	10250.	mg/L	EPA 375.4	J. Cosgrave	05/03/2001 @ 0830	1.
Total Organic Carbon	1960.	mg/L	EPA 415.1	E84098	05/02/2001 @ 1511	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Control Trial

Start Trial: May 2, 2001 @ 10:45 AM
Stop Trial: May 2, 2001 @ 11:30 AM
Upflow Fluidized Bed Reactor
No Resin Added
Raw Water Flow: 2.0 gal/min.
Makeup Resin Feed Pump: N/A
Recycle Pump Flow: N/A
Reject Pump Flow: N/A

			On-Site Analyses					Laboratory Analyses		
			H_2S	pH	Color	UV	Temp.	Alkalinity	Sulfate	TOC
Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L
11:30 AM	Raw	PP063	6.71	7.54	8	0.151	25.9	N/A	N/A	N/A
11:30 AM	Final	PP064	6.67	7.57	8	0.159	26.2	N/A	N/A	N/A

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Trial 3
MIEX Resin Trial
Start Time: May 3, 2001 @ 11:00 AM
End Time: May 3, 2001 @12:00 PM
Upflow Fluidized Bed Reactor
MIEX Resin Dosage: 230 ml/L @ 18" Resin Extraction Take-off Point
Resin Column Height: 26"
Raw Water Flow: 2.0 gal/min.
Makeup Resin Feed Pump: 160 ml/min. @ 10% On-Time @ 280 ml/L Make-Up Resin Tank Concentration
Recycle Pump Flow: N/A
Reject Pump Flow: 160 ml/min. @ 10% On-Time

				On-Site Analyses					Laboratory Analyses							
				H_2S	pH	Color	UV	Temp.	Alkalinity	Chloride	Sulfate	TOC	Iron	THM FP	HAA FP
Date	Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L
5/3/01	12:00 PM	Raw	PP065	5.34	7.58	8	0.166	26.6	205	10.3	15.0	3.53	N/A	N/A	N/A
5/3/01	12:00 PM	Final	PP066	3.69	7.55	1	0.069	25.7	191	22.9	6.2	2.60	N/A	N/A	N/A

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

06/26/2001

Laboratory Number: 141937

Project: Pilot Plant
Location: Well #9
Sample ID: PPO 65 Raw
Sampled By: D. Porter on 05/03/2001 @ 1200
Received: 05/09/2001 @ 1700

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	205.	mg/L	EPA 310.1	J. Lair	05/10/2001 @ 1200	0.5
Chloride	10.3	mg/L	EPA 325.3	J. Lair	05/14/2001 @ 1200	0.5
Sulfate	15.0	mg/L	EPA 375.4	J. Cosgrave	05/11/2001 @ 0845	1.
Total Organic Carbon	3.53	mg/L	EPA 415.1	E84098	05/18/2001 @ 1021	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

06/26/2001

Laboratory Number: 141938

Project: Pilot Plant
Location: Well #9
Sample ID: PPO 66 Final
Sampled By: D. Porter on 05/03/2001 @ 1200
Received: 05/09/2001 @ 1700

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	191.	mg/L	EPA 310.1	J. Lair	05/10/2001 @ 1200	0.5
Chloride	22.9	mg/L	EPA 325.3	J. Lair	05/14/2001 @ 1200	0.5
Sulfate	6.2	mg/L	EPA 375.4	J. Cosgrave	05/11/2001 @ 0845	1.
Total Organic Carbon	2.60	mg/L	EPA 415.1	E84098	05/18/2001 @ 1021	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Trial 4
MIEX Resin Trial
Start Time: May 3, 2001 @ 1:00 PM
End Time: May 3, 2001 @ 2:50 PM
Upflow Fluidized Bed Reactor
MIEX Resin Dosage: 230 ml/L @ 18" Resin Extraction Take-off Point
Resin Column Height: 39"
Raw Water Flow: 2.0 gal/min.
Makeup Resin Feed Pump: 300 ml/min. @ 10% On-time @ 150 ml/L Make-Up Resin Tank Concentration
Recycle Pump Flow: N/A
Reject Pump Flow: 300 ml/min. @ 10% On-Time

				On-Site Analyses					Laboratory Analyses						
				H_2S	pH	Color	UV	Temp.	Alkalinity	Chloride	Sulfate	TOC	Iron	THM FP	HAA FP
Date	Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L
5/3/01	2:50 PM	Raw	PP067	6.58	7.55	8	0.170	26.6	203	10.9	15.2	3.74	N/A	N/A	N/A
5/3/01	2:50 PM	Final	PP068	4.15	7.53	1	0.070	26.5	197	24.6	5.9	2.29	N/A	N/A	N/A

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

06/26/2001

Laboratory Number: 141939

Project: Pilot Plant
Location: Well #9
Sample ID: PPO 67 Raw
Sampled By: D. Porter on 05/03/2001 @ 1450
Received: 05/09/2001 @ 1700

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	203.	mg/L	EPA 310.1	J. Lair	05/10/2001 @ 1200	0.5
Chloride	10.9	mg/L	EPA 325.3	J. Lair	05/14/2001 @ 1200	0.5
Sulfate	15.2	mg/L	EPA 375.4	J. Cosgrave	05/11/2001 @ 0845	1.
Total Organic Carbon	3.74	mg/L	EPA 415.1	E84098	05/18/2001 @ 1021	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

06/26/2001

Laboratory Number: 141940

Project: Pilot Plant
Location: Well #9
Sample ID: PPO 68 Final
Sampled By: D. Porter on 05/03/2001 @ 1450
Received: 05/09/2001 @ 1700

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	197.	mg/L	EPA 310.1	J. Lair	05/10/2001 @ 1200	0.5
Chloride	24.6	mg/L	EPA 325.3	J. Lair	05/14/2001 @ 1200	0.5
Sulfate	5.9	mg/L	EPA 375.4	J. Cosgrave	05/11/2001 @ 0845	1.
Total Organic Carbon	2.29	mg/L	EPA 415.1	E84098	05/18/2001 @ 1021	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Trial 5
MIEX Resin Trial
Start Time: May 4, 2001 @ 9:30 AM
End Time: May 4, 2001 @ 11:00 AM
Upflow Fluidized Bed Reactor
MIEX Resin Dosage: 240 ml/L @ 18" Resin Extraction Take-off Point
Resin Column Height: 74"
Raw Water Flow: 2.0 gal/min.
Makeup Resin Feed Pump: N/A
Recycle Pump Flow: N/A
Reject Pump Flow: N/A

				On-Site Analyses					Laboratory Analyses						
				H_2S	pH	Color	UV	Temp.	Alkalinity	Chloride	Sulfate	TOC	Iron	THM FP	HAA FP
Date	Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L
5/4/01	11:00 AM	Raw	PP069	5.99	7.54	8	0.149	26.2	205	10.7	13.5	3.61	N/A	N/A	N/A
5/4/01	11:00 AM	Final	PP070	2.40	7.50	1	0.030	26.0	166	49.5	2.0	2.20	N/A	N/A	N/A

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

06/26/2001

Laboratory Number: 141941

Project: Pilot Plant
Location: Well #9
Sample ID: PPO 69 Raw
Sampled By: D. Porter on 05/04/2001 @ 1100
Received: 05/09/2001 @ 1700

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	205.	mg/L	EPA 310.1	J. Lair	05/10/2001 @ 1200	0.5
Chloride	10.7	mg/L	EPA 325.3	J. Lair	05/14/2001 @ 1200	0.5
Sulfate	13.5	mg/L	EPA 375.4	J. Cosgrave	05/11/2001 @ 0845	1.
Total Organic Carbon	3.61	mg/L	EPA 415.1	E84098	05/18/2001 @ 1021	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

06/26/2001

Laboratory Number: 141942

Project: Pilot Plant
Location: Well #9
Sample ID: PPO 70 Final
Sampled By: D. Porter on 05/04/2001 @ 1130
Received: 05/09/2001 @ 1700

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Alkalinity	166.	mg/L	EPA 310.1	J. Lair	05/10/2001 @ 1200	0.5
Chloride	49.5	mg/L	EPA 325.3	J. Lair	05/14/2001 @ 1200	0.5
Sulfate	2.0	mg/L	EPA 375.4	J. Cosgrave	05/11/2001 @ 0845	1.
Total Organic Carbon	2.20	mg/L	EPA 415.1	E84098	05/18/2001 @ 1021	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Control Trial

Start Trial: July 9, 2001 @ 11:30 AM
Stop Trial: July 9, 2001 @ 1:30 PM
Upflow Fluidized Bed Reactor - High Dosage
No Resin Added
Raw Water Flow: 2.0 gal/min.
Makeup Resin Feed Pump: N/A
Recycle Pump Flow: N/A
Reject Pump Flow: N/A

			On-Site Analyses					Laboratory Analyses		
			H_2S	pH	Color	UV	Temp.	Alkalinity	Sulfate	TOC
Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L
1:30 PM	Raw	PP083	6.06	7.45	11	0.151	29.7	N/A	N/A	N/A
1:30 PM	Final	PP084	5.78	7.48	11	0.145	29.5	N/A	N/A	N/A

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Trial 6
MIEX Resin Trial
Start Time: July 10, 2001 @ 8:30 AM
End Time: July 10, 2001 @11:00 AM
Upflow Fluidized Bed Reactor - High Dosage
MIEX Resin Dosage: 8.5 L Resin in Column
Resin Column Height: 196" (Entire Column Height)
Raw Water Flow: 2.0 gal/min.
Makeup Resin Feed Pump: N/A
Recycle Pump Flow: N/A
Reject Pump Flow: N/A

				On-Site Analyses					Laboratory Analyses							
				H_2S	pH	Color	UV	Temp.	Alkalinity	Chloride	Sulfate	TOC	Iron	THM FP	HAA FP
Date	Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L
7/10/01	11:00 AM	Raw	PP085	5.99	7.46	10	0.156	29.9	N/A	N/A	N/A	5.39	N/A	N/A	N/A
7/10/01	11:00 AM	Final	PP086	2.84	7.38	6	0.046	28.9	N/A	N/A	N/A	2.74	N/A	N/A	N/A

Aloha Utilities, Inc.
Seven Springs Water System
MIEX Pilot Trial Data

Trial 7
MIEX Resin Trial
Start Time: July 10, 2001 @ 11:35 AM
End Time: July 10, 2001 @ 2:15 PM
Upflow Fluidized Bed Reactor - High Dosage
MIEX Resin Dosage: 8.5 L Resin in Column
Resin Column Height: 50"
Raw Water Flow: 1.0 gal/min.
Makeup Resin Feed Pump: N/A
Recycle Pump Flow: N/A
Reject Pump Flow: N/A

				On-Site Analyses					Laboratory Analyses						
				H_2S	pH	Color	UV	Temp.	Alkalinity	Chloride	Sulfate	TOC	Iron	THM FP	HAA FP
Date	Time	Sample Type	Sample ID	mg/L	S.U.	PtCo Units	Abs.	°C	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L
7/10/01	2:15 PM	Raw	PP087	6.21	7.47	10	0.145	29.3	N/A	N/A	N/A	5.39	N/A	N/A	N/A
7/10/01	2:15 PM	Final	PP088	3.40	7.40	4	0.040	28.6	N/A	N/A	N/A	2.74	N/A	N/A	N/A

SHORT ENVIRONMENTAL LABORATORIES, INC.

10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 FDOH# E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

09/04/01
Page 1

Laboratory ID Number: 144904-144909
Project : Pilot Plant
Location : New Port Richey
Sample type: Drinking Water
Sampled By : D. Porter on 07/09/01 @ 1330
Received : 07/11/01 @ 1600

REPORT OF ANALYSIS

LABORATORY DATA
Parameter - Total Organic Carbon

Lab ID#	Sample ID	Date & Time of Sample Collection	Analytical Result	Units	Method	Analyst	Date/Time of Analysis	MDL
144904	PPO 83 raw	07/09/01 @ 1330	4.22	mg/L	EPA 415.1	E84098	07/16/01 @ 1226	0.1
144905	PPO 84 final	07/09/01 @ 1330	3.68	mg/L	EPA 415.1	E84098	07/16/01 @ 1226	0.1
144906	PPO 85 raw	07/10/01 @ 1100	5.39	mg/L	EPA 415.1	E84098	07/16/01 @ 1226	0.1
144907	PPO 86 final	07/10/01 @ 1100	2.74	mg/L	EPA 415.1	E84098	07/16/01 @ 1226	0.1
144908	PPO 87 raw	07/10/01 @ 1415	4.09	mg/L	EPA 415.1	E84098	07/16/01 @ 1226	0.1
144909	PPO 88 final	07/10/01 @ 1415	4.44	mg/L	EPA 415.1	E84098	07/16/01 @ 1226	0.1

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

Laboratory Number: 141943

Project: Pilot Plant
Location: New Port Richey
Sample ID: PPO 71 Brine
Sampled By: D. Porter on 05/04/2001 @ 1030
Received: 05/09/2001 @ 1700

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Biochemical Oxygen Demand	812.	mg/L	EPA 405.1	D. Gillis	05/11/2001 @ 1100	2.
Chemical Oxygen Demand	10,310.	mg/L	HACH 8000	D. Morton	05/15/2001 @ 1254	10.
Total Dissolved Solids	165,548.	mg/L	EPA 160.1	J. Lair	05/10/2001 @ 1430	10.
pH	7.83	S.U.	EPA 150.1	J. Lair	05/10/2001 @ 1245	
Conductivity	185,100.	umho/cm	EPA 120.1	J. Lair	05/10/2001 @ 1100	10.
Chloride	84,820.	mg/L	EPA 325.3	J. Lair	05/14/2001 @ 1200	0.5
Sulfate	10,280.	mg/L	EPA 375.4	J. Cosgrave	05/11/2001 @ 0845	1.
Iron	18.4	mg/L	EPA 236.1	J. Mansell	05/14/2001 @ 1039	0.02
Sodium	60,750.	mg/L	EPA 273.1	J. Mansell	05/16/2001 @ 0956	1.0
Gross Alpha	64.	pCi/L	SM 7110 B	E84100	05/30/2001 @ 0000	+/-12.

Respectfully Submitted,

Bruce Cummings
Laboratory Director

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33876
(800) 833-4022 HRS# 85344 & E85458, FDEP QAP# 880516 (863) 655-4022

For: Aloha Utilities, Inc.
6915 Perrine Ranch Road
New Port Richey, FL 34655-
Attn: Connie Kurish

06/26/2001

Laboratory Number: 141944

Project: Pilot Plant
Location: New Port Richey
Sample ID: PPO 72 Brine
Sampled By: D. Porter on 05/04/2001 @ 1030
Received: 05/09/2001 @ 1700

REPORT OF ANALYSIS

LABORATORY DATA

Parameter	Result	Units	Method	Analyst	Date/Time of Analysis	MDL
Biochemical Oxygen Demand	711.	mg/L	EPA 405.1	D. Gillis	05/11/2001 @ 1100	2.
Chemical Oxygen Demand	9350.	mg/L	HACH 8000	D. Morton	05/15/2001 @ 1254	10.
Total Dissolved Solids	134,568.	mg/L	EPA 160.1	J. Lair	05/10/2001 @ 1430	10.
pH	7.97	S.U.	EPA 150.1	J. Lair	05/10/2001 @ 1245	
Conductivity	156,000.	umho/cm	EPA 120.1	J. Lair	05/10/2001 @ 1100	10.
hloride	70,380.	mg/L	EPA 325.3	J. Lair	05/14/2001 @ 1200	0.5
Sulfate	10,420.	mg/L	EPA 375.4	J. Cosgrave	05/11/2001 @ 0845	1.
Iron	10.5	mg/L	EPA 236.1	J. Mansell	05/14/2001 @ 1039	0.02
Sodium	49,150.	mg/L	EPA 273.1	J. Mansell	05/16/2001 @ 0956	1.0
Gross Alpha	52.	pCi/L	SM 7110 B	E84100	05/30/2001 @ 0000	+/-10.

Respectfully Submitted,

Bruce Cummings
Laboratory Director

Appendix D
MIEX® Brine Disposal Options Information

MIEX® Regeneration Waste Disposal Options for Aloha Utilities

March 2002

MIEX Regeneration Waste Disposal Options for Aloha Utilities

Background

Disposal options for a waste generated by a MIEX plant at Aloha Utilities have been evaluated for the following scenarios as requested by David Porter:

1. A 500gpm system that operates at capacity for an average of 8 hours per day,
2. A 500gpm system that operates at capacity for an average of 16 hours per day, and
3. A 500gpm system that operates at capacity for an average of 24 hours per day

A proposal has also been submitted to Aloha Utilities for a MIEX system that would operate at 200gpm for 24 hours per day. The volume of waste generated from this system would be almost the same as for Option 1 above, so a separate analysis for this scenario is not required.

Waste Volumes Generated

The assumptions made in calculating the waste volumes are as follows:

- An average resin dose of 6 ml/l
- A regeneration rate of 10%
- Regenerant is reused 9 times (Note that this is a conservative estimate based on trial results – it may be possible to reuse the regenerant more times which will in turn reduce waste volumes. This can be determined during the 12 month demonstration period.)

A summary of the waste volumes generated from the different plant throughput scenarios is as follows:

Plant Capacity (gpm)	500	500	500
Ave Daily Operation (hrs)	8	16	24
Waste Volume (gal/d)	87	175	262
Waste volume (gal/yr)	31,900	63,800	95,600

Waste Composition

An example of the waste composition is shown in Appendix 1. This particular waste was generated after 9 reuses of regenerant for a groundwater in Western Australia. This particular water has a much higher TOC (9-15mg/l) than the ground water at Well #9, so the brine waste TOC level after 9 reuses would be expected to be much lower at Aloha Utilities. Based on the trial at Well #9 where the brine was reused 5 times (resulting a TOC concentration of 2000 mg/l - see trial report), it is expected that the TOC level would be around 4000 mg/l after reusing the brine 9 times.

Waste Disposal Options

1. Off-site Disposal

A number of liquid waste disposal contractors in the Tampa area have been identified who can pick up and dispose of waste regenerant. Jamson Environmental will take 2000 gallon loads of waste at a cost of approx. $0.35 per gallon. Annual waste disposal costs would therefore be as follows:

Plant Capacity (gpm)	500	500	500
Ave Daily Operation (hrs)	8	16	24
Disposal Cost ($pa)	$18,807	$37,615	$56,422
	$1,600/mth	$3,100/mth	$4,700/mth

2. Sewer Disposal

Sewer disposal is an option if a sewer is available and the chloride, sodium and TOC levels in the waste are acceptable to the utility managing the sewerage system and do not cause problems with DEP discharge permits.

The waste volumes requiring disposal are quite small and may result in insignificant increases in sewage Cl, Na and TOC levels after dilution in the sewer. Note that there would be a much greater contribution of Cl and Na to the sewage from home softening systems.

An example of possible concentration increases in the sewage is as follows:

Waste Volume (gal/d)	87			175			262		
Sewage Increase (mg/l)*	Cl	Na	TOC	Cl	Na	TOC	Cl	Na	TOC
Sewer Flow – 1 MGD	4.4	4.4	0.3	8.7	8.7	0.7	13.1	13.1	1.0
Sewer Flow – 2 MGD	2.2	2.2	0.2	4.4	4.4	0.3	6.5	6.5	0.5

*Assumes waste composition of 50,000 mg/l Cl and Na and 4000 mg/l TOC.

3. Pasco County Leachate Treatment Facility

A longer term option is the use of Pasco County's leachate treatment facility. This facility is only operating at about 50% capacity and could easily accommodate any volume of regeneration waste that Aloha Utilities would produce from a MIEX plant. At present the facility does not have the ability to accept wastes delivered by tanker and discussions have not been held with Pasco County to determine the willingness of the County to accept waste from an external source. This could be a cost effective longer term option, assuming Pasco County is willing to take the waste at a reasonable price.

4. Flash Evaporator

Another waste disposal option would be to use a flash evaporator on-site to reduce the waste to a solid that is easier to dispose of. Flash evaporators are available at capacities as low as 60 gal/hr. This is potentially a longer term option for a MIEX plant located on a permanent site.
The costs for this system would be as follows:
Operating Cost ($/1000 gal): TBD
Capital cost (60gal/hr): TBD
Solids disposal Cost: TBD

<u>Recommendations for 12 Month Demonstration Plant</u>

The most cost effective and convenient method of waste disposal would be sewer disposal. Due to the small volume of waste generated, the impact on the sewage composition will be insignificant.

If sewer disposal is not allowed by the DEP or local utility then the preferred option for the 12 month demonstration plant at Well #9 would be to collect the waste so that a contractor can periodically collect and dispose of this.

It is also recommended that discussions be held with Pasco County to determine the availability of the leachate treatment facility for future acceptance of brine waste.

Appendix 1: Waste Brine Analysis for Wanneroo Groundwater after 9 Reuses

All units in mg/L unless otherwise stated.

	Typical Analysis	Range
pH (units)	8.27	7.0 – 10.0
Conductivity at 25 ^{0}C	10,250	
Colour (@400 nm) (TCU)	> 200	
Turbidity (NTU)	> 400	
Aluminium – Unfiltered ICP	56	
Iron – Unfiltered ICP	350	
Manganese – Unfiltered ICP	0.30	
Calcium ICP	130	
Potassium ICP	250	
Magnesium ICP	25	
Sodium ICP	41,610	40,000 – 90,000
Sulphate ICP	11,700	2,000 – 20,000
Alkalinity (milliequiv./L)	134	
Total Alkalinity as $CaCO_3$	6,700	
Dissolved Organic Carbon	10,189	5,000 – 20,000
Silicon (as SiO_2)	83	
Total Anions (milliequiv./L)	1619	
Nitrate + Nitrite as Nitrogen	0.51	
Total Kjeldhal Nitrogen	75	
Total Phosphorus	18	
Ammonia as Nitrogen	1.1	
Chloride	48,760	45,000 – 75,000
Alkalinity as HCO_3	8,040	
Total Filt. Solids by Sum	133,360	
Total Filt. Solids – CO_2	129,340	
Hardness as $CaCO_3$	414	

Appendix E
MIEX® Demonstration Plant Cost Proposal

WESTECH AN EMPLOYEE OWNED COMPANY

FOR:

ALOHA UTILITIES

FLORIDA

DEMONSTRATION EQUIPMENT:

One (1) 500 gpm Forced Draft Degassifier
One (1) 500 gpm MIEX DOC™ Contact Reactor
One (1) 1000 gpm Regeneration System

EQUIPMENT FURNISHED BY:

WESTECH ENGINEERING INC.
SALT LAKE CITY, UTAH
CONTACT: JACOB BLATTMAN / REX PLAIZIER
PHONE: (801) 265-1000
FAX: (801) 265-1080

MOSS-KELLEY, INC.
LAKE MARY, FLORIDA
Contact: Brian Schuette
Phone: (407) 805-0063
Fax: (407) 805-0062

WESTECH PROPOSAL NUMBER 011391 REV 1

MIEX DOC™ CONTACT REACTOR EQUIPMENT PROPOSAL
WesTech Model Number: MI500-A
- Aloha Utilities -

One (1) Forced Draft Degassifier (rated for 500 gpm)
One (1) MIEX DOC™ Contact Reactor (rated for 500 gpm)
One (1) Regeneration System (rated for 1000 gpm)

GENERAL

There shall be furnished one (1) full scale skid mounted MIEX DOC™ reactor and recovery unit, model number MI200-A, designed for treatment of an inlet flow of 500 gpm. There shall be a complete skid mounted regeneration system designed for 0.7 gpm of 25% v/v concentration of resin. There shall be a forced draft degassifier designed to remove the dissolved hydrogen sulfide gas from the raw water.

DESIGN FEATURES

Raw water will be introduced into the forced draft degassifier for removal of soluble hydrogen sulfide gas. This process (often referred to as gas stripping) is used to remove hydrogen sulfide from water. This is accomplished in a rectangular vessel where a counter-current flow of air and water is created. To increase contact surface area and exposure time, media is used in the form of loose fill of special shapes. Water is discharged into a tray at the top of the aerator that evenly distributes flow over the unit cross section with orifices or nozzles. It then drops into the gas exchange zone, that contains the appropriate media and provides space for the air to move up through the finely dispersed water droplets.

The air counter current is produced by an electric operated blower by forcing the air flow through screened air inlet baffles near the bottom of the vessel, up through the media/water mix of aeration section, through air stacks located in the distributor tray to insure even collection, and finally through a vane style moisture separator and exhausts it through a screened hood located at the unit top.

From the aerator, the water will gravity flow into the bottom of the contact reactor. The water will be injected into the contact reactor through a media retention inlet diffuser. The contact rector is designed to have a diminishing rise rate through the conical shaped base which transitions from a rate of 7 gpm/ft^2 to a constant rise rate of 4 gpm/ft^2 in the cylindrical top section. The high rise rate in the lower section results in a fluidized MIEX DOC™ media bed. The design resin empty bed contact time is 15 minutes. As the water leaves the fluidized bed it enters a 20 inch deep section of 60 degree tube settlers to remove any remaining fine particulates. The water is then collected in the submerged orifice launder.
The overflow water is pumped with a centrifugal pump designed to pump 500 gpm at 70 psi

through two (2) bag filters to recovery and recycle any remaining resin. One (1) bag collector is designed to be online with one collector on standby to allow for rapid filter bag replacement.

The contact clarifier is designed to operate continuously with batch regeneration of the MIEX DOC™ resin. To maintain a high quality and consistent finished water, fresh resin, at a concentration of 25% volume resin per volume slurry (v/v), is continually pumped into the clarifier at a flow rate of 1.75 gpm from the fresh resin tank. Resin is continually removed from the contact clarifier for regeneration at a flow rate of 1.75 gpm at a concentration of 25% v/v by the peristaltic pump.

The regeneration system is operating in batch mode every five hours. A filter incorporated as a false bottom in the vessel separates partially treated water from the resin. The partially treated water is returned to the process. The resin is then regenerated with 2 Molar sodium chloride solution. The resin is mixed with a variable speed mixer to suspend and mix the resin. The spent brine is pumped to the brine tank through a air-operated diaphragm pump. The strength of the brine concentration is maintained by pumping saturated 5 M sodium chloride solution from the salt saturation tank with an air-operated diaphragm pump. After the brine solution is reused nine times it is pumped to waste and a new brine solution is made in the brine tank by adding 5 M saturated solution and make up water from the raw water line.

After the spent brine solution is removed from the regeneration vessel one bed volume of rinse water is added to the regeneration vessel to rinse the resin. The rinse water is then wasted or may be pumped to the rinse tank for reuse (only after the initial use of fresh brine solution). The regenerated MIEX DOC™ resin is then pumped via a peristaltic pump to the fresh resin tank completing the regeneration cycle.

THIS SYSTEM IS FURNISHED COMPLETE WITH THE FOLLOWING COMPONENTS:

FORCED AIR DEGASSIFIER (rated for 500 gpm):

Requirements: Total of one (1) Aluminum Forced Draft Aerator

The following information was used in the design of the aerator to provide the proposal. The following values were used, some of them are assumed, so all information should be verified by the engineer.

Design Peak Capacity	500 gpm	(given)
Water Temperature	70° F	(given)
Site Elevation	15 ft above sea level	(given)
Water Loading Rate	<25 gpm/sq. ft.	(recommended)
Air/Water Ratio	3.75 cfm/1 gpm	(recommended)
Iron	0.1 mg/L	(given/maximum)
Size	5 ft sq x 13 ft high	(recommended)
Media	Loose Fill Media	(recommended)

EACH UNIT FURNISHED COMPLETE WITH THE FOLLOWING COMPONENTS:

- One (1) 5'-0 "square by 13'-0" high (inside) aluminum aerator housing shell, anchor flange with bolt holes, screened air intakes, hinged and bolted side with removable bottom panel, ¼" fixed cover, 13" x 15" inspection port below the internals, 8" flanged top inlet connection, 10" diameter plain end effluent pipe. Inspection manhole in cover and one (1) air exhaust connections with moisture separators in the cover. There will be an air seal mounted internally on the water effluent. The aerator is sized for 98.19% Hydrogen Sulfide removal for a maximum flow of 500 gpm. The aerator interior shell will be coated with two (2) coats of Tnemec 20 series polyamide epoxy, which is approved for potable water in accordance with ANSI/NSF Std. 61 and AWWA D 102 Inside Systems No. 1 and No. 2. The exterior will be left as aluminum.

- One (1) Aluminum distribution tray complete with velocity breaker box, and aluminum air stacks.

- Two hundred (200) cubic feet of 2" loose fill plastic media for H_2S stripping.

- One (1) Peerless Electric model 122D Ultrafan-Pak forced draft blower (or equal) rated at 1875 scfm at ½" static pressure, ½ HP, 208/3/60, with aluminum hooded screened intake. The blower will be of the non-overloading centrifugal type. The blower wheel will be of welded construction and will be dynamically balanced. Bearings will be anti-friction, self-aligning, grease packed, pillow block type with grease and dirt seals. Transition hood between the blower and the aerator shell are provided. Blowers are belt drive, and are licensed to bear the AMCA Seal.

- One (1) lot type ¾" stainless steel anchor bolts with nuts for mounting the unit.

CONTACT REACTOR and RECOVERY SYSTEM (rated for 500 gpm):

- The reactor shall have a media retention inlet diffuser system and a 20 inch section of 60 degree PVC tube settlers.

- The contact reactor will be fabricated of 1/4" thick 304 stainless steel and measure 12'-0" diameter x 20'-0" high. An access ladder with a cage shall be side mounted on the clarifier allowing access to the degassifier and top of the reactor. Seven sample ports shall be provided on the clarifier at various vertical locations all draining to a common 304 stainless steel sink mounted on the clarifier. The contact reactor will be skid mounted and factory assembled prior to shipment to simplify handling and installation at job site. The rector will have the following nozzle connections:

  One (1) 8" dia Influent nozzle
  One (1) 10" dia Effluent nozzle
  One (1) 18" dia Inspection port
  One (1) 6" dia drain connection

- The submerged overflow launders constructed of PVC with variable spaced inlet orifices.

- The supplied overflow pump will be an end suction top discharge centrifugal pump rated for 500 gpm and 70 psi discharge with a TEFC 380/460 volt 60 Hz, 3 phase motor.

- The resin transfer pump will be a low shear hose pump with a nominal flowrate of 1.75 gpm. The resin transfer pump will have speed variation capabilities.

- Two (2) Bag Filter Vessels each rated for a minimum of 500 gpm with pressure gauges and 10 micron filter bags shall be furnished for resin collection. Isolation valves for each filter vessels will allow for online bag changes.

REGENERATION SYSTEM (rated for 1000 gpm):

The regeneration system shall consist of two skids containing all tankage, transfer pumps, and mechanisms needed to regenerate and return the resin to the process. Regeneration skid #2 will be 8' x 20' and regeneration skid #1 will be 8' x 12'. All piping containing brine solution will be sch 80 PVC to prevent corrosion. All necessary valving to direct flow for the regeneration skid shall be supplied.

- One (1) 10,000 gallon salt saturation tank measuring 11' -10" diameter x 13' tall made of HDPE with. An air-operated diaphragm transfer pump with a nominal flow rate of 20 gpm will be supplied to transfer and mix the contents of the brine tank.

- One (1) open top polyethylene brine solution (regenerant) tank with dimensions 66" dia x 72" tall and capacity of 1,000 gallons shall be provided. An air-operated diaphragm transfer pump with a nominal flow rate of 40 gpm will be supplied with the tank.

- The supplied regeneration vessel shall be an open top polyethylene tank with dimensions of 66" dia x 72" with a capacity of 1,000 gallons. A mixer will be provided with the regeneration vessel with a TEFC 380/460 volt 60 Hz, 3 phase motor. A low-shear variable speed hose pump rated for 18 gpm will be provided to transfer regenerated resin.
- An air compressor shall be supplied to provide backflush and valve air.

- The fresh resin feed tank will be polyethylene, measuring 64" diameter x 127", with a capacity of 1,500 gallons. A top mounted mixer with a low shear hydrofoil type 304 stainless steel impeller will be driven by a TEFC 380/460 volt 60 Hz, 3 phase motor. The fresh resin transfer pump shall be a variable speed low-shear hose pump rated for 1.75 gpm

- One (1) NEMA 4X local control panel in a stainless steel enclosure with equipment controls and motor starters will be provided. Wiring for the panel will be brought to a terminal strip for the customers hookup. All wiring on the skids will be brought to junction boxes for field connection.

INSTRUMENTATION:

- Two (2) 1720-D Hach Turbidimeters for turbidity measurement of the clarified water and filtered finished water.

- One (1) influent orifice type flow meter, indicator and controller for use with an automatic flow control valve.

- One (1) Thermocouple and indicator for water temperature measurement.

- Required pressure gauges to monitor pressure loss in filter bags and final pressure to distribution header

VALVES AND PIPING:

- All valves to operate the contact clarifier and regeneration system will be supplied including: Modulating influent flow control valve, contactor and bag filter isolation valves, skid ball valves.

- All piping on the regeneration skid will be supplied. Piping to the contact clarifier from the regeneration skid will be supplied. Piping for the raw water to the unit and piping for the finished water to the distribution header is by others. Piping will be sch 80 PVC.

TOTAL SERVICE: To include four (4) trips and ten (10) days for offloading, setting supervision, inspection, start-up and training of plant personnel.

CLARIFICATIONS/COMMENTS:

- The contact reactor and recovery unit and regeneration skids will ship as fully assembled as possible without risking damage to the components or exceeding shipping limitations. The mixers, instrumentation, ladders, and interconnections will require field assembly.

- Aerator is shipped fully assembled except for blower assemblies, transition hood, and exhaust hood which will require field mounting.

- Aerator influent flanged connection is not designed to support the weight of the influent piping. Alternate means of influent pipe support should be provided.

WesTech will provide a vent to allow blending off of some of the air supply in order to allow for control of one of the variables that will affect the H_2S stripping. A pilot tube (by others) will be required in the exhaust ducting to determine what the air flow to the unit is. Ducting to, and provision for, GAC adsorption from the exhausted air stream is by others.

NOTE: ANY ITEM NOT LISTED ABOVE TO BE FURNISHED BY OTHERS.

ITEMS NOT BY WESTECH: Offloading, setting of skids, electrical shop or field wiring, conduit, piping, valves, or fittings to and from the skids, lubricating oil or grease, field painting or touch up, field welding, erection, performance testing, unloading, storage, concrete work, field service, (except as specifically noted).

These proposal sections have been reviewed for accuracy and are approved for issue:

By: Jacob [signature] Date: March 7, 2002

PRICING

Prices are firm for a period not to exceed 90 days from date of proposal.

Unless otherwise indicated, prices listed below are for equipment only.

EQUIPMENT	PRICE
Sell Price	**$ 327,550.00**
Monthly Lease Price w/ a Minimum 12 month Lease Period	**$ 18,780.00 / month**
Rebate for purchase of equipment at the end 12 months (90% of total lease paid)	**$ (203,800.00)**
Purchase Price of Equipment at end of lease	**$ 123,750.00**

Sales Tax: No sales or use taxes have been included in our pricing.

Freight: Prices quoted are F.O.B. shipping point with freight allowed to the jobsite. All claims for damage or loss in shipment shall be initiated by purchaser.

Equipment Payment Terms: Terms net 30 days from shipment with no retentions allowed.

Schedule: Approval drawings will be submitted within 6 to 8 weeks after receipt and acceptance of purchase order.

Shipment: Equipment will ship within 16 to 18 weeks after approved submittal drawings are received in our office.

Field Service: Additional field service is available at $750.00 per day plus reasonable and customary expenses.

WARRANTY

Form WT 1002

WesTech equipment is backed by WesTech's reputation as a quality manufacturer, and by many years of experience in design of reliable equipment.

Equipment manufactured and sold by WesTech Engineering, Inc. and paid for in full is backed by the following warranty:

For the benefit of the original user, WesTech warrants all new equipment manufactured by WesTech Engineering, Inc. to be free from defects in material and workmanship; and will replace or repair, F.O.B. at its factories or other location designated by it, any part or parts returned to it which WesTech's examination shall show to have failed under normal use and service by the original user within one (1) year following initial start-up or eighteen (18) months from shipment to the purchaser, whichever occurs first. Such repair or replacement shall be free of charge for all items except for those items, such as resin, filter media and the like that are consumable and normally replaced during maintenance with respect to which repair or replacement shall be subject to pro-rata charge based upon WesTech's estimate of the percentage or normal service life realized from the part. WesTech's obligation under this warranty is conditioned upon its receiving prompt notice of claimed defects which shall in no event be later than thirty (30) days following expiration of the warranty period; and is limited to repair or replacement as aforesaid.

THIS WARRANTY IS EXPRESSLY MADE BY WESTECH AND ACCEPTED BY PURCHASER IN LIEU OF ALL OTHER WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE, WHETHER WRITTEN, ORAL, EXPRESS, IMPLIED, OR STATUTORY. WESTECH NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR IT ANY OTHER LIABILITY WITH RESPECT TO ITS EQUIPMENT. WESTECH SHALL NOT BE LIABLE FOR NORMAL WEAR AND TEAR, NOR FOR ANY CONTINGENT, INCIDENTAL, OR CONSEQUENTIAL DAMAGE OR EXPENSE DUE TO PARTIAL OR COMPLETE IN OPERABILITY OF ITS EQUIPMENT FOR ANY REASON WHATSOEVER.

This warranty shall not apply to equipment or parts thereof which have been altered or repaired outside of a WesTech factory, or damaged by improper installation or application, or subjected to misuse, abuse, neglect or accident.

This warranty applies only to equipment made or sold by WesTech Engineering, Inc.

WesTech Engineering, Inc. makes no warranty with respect to parts, accessories, or components manufactured by others. The warranty which applies to such items is that offered by their respective manufacturers.

FORM WT1001

Termsand Conditions appearing in any order based on this proposal which are inconsistent herewith shall not be binding on WesTech. The sale and purchase of equipment described herein shall be governed exclusively by the foregoing proposal and the following provisions:

1 SPECIFICATIONS: WesTech Engineering Inc. is furnishing its standard equipment as outlined in the proposal and as will be covered by final approved drawings. The equipment may not be in strict compliance with the Engineer's/Owner's plans, specifications, or addenda as there may be deviations. The equipment will, however, meet the general intention of the mechanical specifications of these documents.

2 ITEMS INCLUDED: This proposal includes only the equipment specified herein and does not include erection, installation, detail shop fabrication drawings, detail shop fabrication drawings, accessory or associated materials such as controls, piping, etc., unless specifically listed.

3 PARTIES TO CONTRACT: WesTech Engineering Inc. is not a party to or bound by the terms of any contract between WesTech's customer and any other party. WesTech's undertakings are limited to those defined in the contract between WesTech and its direct customers.

4. PRICE AND DELIVERY: All selling prices quoted are subject to change without notice after 30 days from the date of this proposal unless specified otherwise.

Unless otherwise stated, all prices are F.O B. WesTech or its supplier's shipping points. All claims for damage, delay or shortage arising from such equipment shall be made by Purchaser directly against the carrier. When shipments are quoted F.O.B jobsite or other designation, Purchaser shall inspect the equipment shipped, notifying WesTech of any damage or shortage within forty-eight hours of receipt, and failure to so notify WesTech shall constitute acceptance by Purchaser, relieving WesTech of any liability for shipping damages or shortages.

5. PAYMENTS: All invoices are net 30 days Delinquencies are subject to a 1.5 percent service charge per month or the maximum permitted by law, whichever is less on all past due accounts. Pro rata payments are due as shipments are made. If shipments are delayed by the Purchaser, invoices shall be sent on the date when the Company is prepared to make shipment and payment shall become due under standard invoicing terms. If the work to be performed hereunder is delayed by the Purchaser, payments shall be based on the purchase price and percentage of completion Products held for the Purchaser shall be at the risk and expense of the Purchaser. Unless specifically stated otherwise, prices quoted are for equipment only. These terms are independent of and not contingent upon the time and manner in which the Purchaser receives payment from the owner

6. PAYMENT TERMS: Credit is subject to acceptance by our Credit Department if the financial condition of the Purchaser at any time is such as to give the Company, in its judgment, doubt concerning the Purchaser's ability to pay The Company may require full or partial payment in advance or may suspend any further deliveries or continuance of the work to be performed by the Company until such payment has been received.

7. ESCALATION: If shipment is, for any reason, deferred by the customer beyond the normal shipment date, stated prices set forth herein are subject to escalation. The escalation shall be based upon increases in labor and material and other costs to WesTech that occur in the time period between quotation and shipment by WesTech, except as hereinafter set forth in subparagraph (b) below.

(a) The total quoted revised price is based upon changes in the indices published by the United States Department of Labor, Bureau of Labor Statistics. Labor will be related to the Average Hourly Earnings indices found in the Employment and Earnings publication and material will be related to the Metal and Metal Products indices published in wholesale Prices and Prices Indices.

(b) Price revision for items furnished to, and not manufactured by WesTech, which exceed the above escalation calculation will be passed along by WesTech to Buyer based upon the actual increase in price to WesTech for the period from the date of quotation to the date of shipment by WesTech. Any item that is so revised will be excluded from the index escalation calculations set forth in subparagraph (a) above.

8. APPROVAL: If approval of equipment submittals by Purchaser or others is required, a condition precedent to WesTech supplying any equipment shall be such complete approval.

9. INSTALLATION SUPERVISION: Prices quoted for equipment do not include erection supervision. WesTech recommends and will, upon request, make available, at WesTech's then current rate, an experienced erection supervisor to act as the Purchaser's employee and agent to supervise installation of the equipment. Purchaser shall at its sole expense furnish all necessary labor equipment, and materials needed for installation.

Responsibility for proper operation of equipment if not installed by WesTech or installed in accordance with WesTech's instruction, inspected and accepted in writing by WesTech, rests entirely with Purchaser; and any work performed by WesTech personnel in making adjustment or changes must be paid for at WesTech's then current per diem rates plus living and traveling expenses

WesTech will supply the safety devices described in this proposal or shown in WesTech's drawings furnished as part of this order but excepting these, WesTech shall not be required to supply or install any safety devices whether required by law otherwise. The Purchaser hereby agrees to indemnify and hold harmless WesTech from any claims or losses arising due to alleged or actual insufficiency or inadequacy or the safety devices offered or supplied hereunder, whether specified by WesTech or Purchaser, and from any damage resulting from use of the equipment supplied hereunder.

10. ACCEPTANCE OF PRODUCTS: Products will be deemed accepted without any claim by purchaser unless written notice of non-acceptance is received by WesTech within 30 days of delivery if shipped F.O.B. point of shipment, or 48 hours of delivery if shipped F.O.B. point of destination. Such written notice shall not be considered received by WesTech unless it is accompanied by all

freight bills for such shipment, with Agent's notations as to damages, shortages and conditions of equipment, containers, and seals. Non-accepted products are subject to the return policy stated below.

11. TAXES: Any federal, state, or local sales, use or other taxes applicable to this transaction, unless specifically included in the price shall be for Purchaser's account.

12. TITLE: The equipment specified herein, and any replacements or substitutes therefor shall, regardless of the manner in which affixed to or used in connection with realty, remain the sole and personal property of WesTech until the full purchase price has been paid. Purchaser agrees to do all things necessary to protect and maintain WesTech's title and interest in and to such equipment; and upon Purchaser's default, WesTech may retain as liquidated damages any and all partial payments made and shall be free to enter the premises where such equipment is located and remove the same as its property without prejudice to any further claims on account of damages or loss which WesTech may suffer from any cause.

13. INSURANCE: From date of shipment until the invoice is paid in full, Purchaser agrees to provide and maintain at its expense, but for WesTech's benefit, adequate insurance on the equipment against any loss of any nature whatsoever

14. SHIPMENTS: Any shipment or delivery dates recited represent WesTech's best estimate but no liability, direct or indirect, is assumed by WesTech for failure to ship or deliver on such dates.

WesTech shall have the right to make partial shipments; and invoices covering the same shall be due and payable by Purchaser in accordance with the payment terms thereof If Purchaser defaults in any payment when due hereunder, WesTech may, without incurring any liability therefore to Purchaser or Purchaser's customers, declare all payments immediately due and payable with maximum legal interest thereon from due date of said payment, and at its option, stop all further work and shipments until all past due payments have been made, and/or require that any further deliveries be paid for prior to shipment.

If Purchaser requests postponements of shipments, the purchase price shall be due and payable upon notice from WesTech that the equipment is ready for shipment; and thereafter any storage or other charge WesTech incurs on account of the equipment shall be for the Purchaser's account.
If delivery is specified at a point other than WesTech or its supplier's shipping points, and delivery is postponed or prevented by strike, accident, embargo, or other cause beyond WesTech's reasonable control and occurring at a location other than WesTech or its supplier's shipping points.
If Purchaser refuses such delivery WesTech may store the equipment at Purchaser's expense. For all purposes of this agreement such tender of delivery or storage shall constitute delivery.

15. WARRANTY: WESTECH WARRANTS EQUIPMENT IT SUPPLIES ONLY IN ACCORDANCE WITH THE WARRANTY EXPRESSED IN THE ATTACHED COPY OF WESTECH WARRANTY AGAINST DEFECTS IN WORKMANSHIP AND MATERIALS WHICH IS MADE A PART HEREOF SUCH WARRANTY IN LIEU OF ALL OTHER WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE, WHETHER WRITTEN, ORAL, EXPRESS, IMPLIED OR STATUTORY, AND WESTECH SHALL NOT BE LIABLE FOR ANY CONTINGENT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES FOR ANY REASON WHATSOEVER.

16. PATENTS: WesTech agrees that it will, at its own expense, defend all suits or proceedings instituted against Purchaser and pay any award of damages assessed against it in such suits or proceedings, so far as the same are based on any claim that the said equipment or any part thereof constitutes an infringement of any apparatus patent of the United States issued at the date of this Agreement, provided WesTech is given prompt notice in writing of the institution or threatened institution of any suit or proceeding and is given full control of the defense, settlement, or compromise of any such action; and Purchaser agrees to give WesTech needed information, assistance, and authority to enable WesTech so to do. In the event said equipment is held or conceded to infringe such a patent, WesTech shall have the right at its sole option and expense to a) modify the equipment to be non-infringing, b) obtain for Purchaser the license to continue using said equipment, or c) accept return of the equipment and refund to the Purchaser the purchase price thereof less a reasonable charge for the use thereof. WesTech will reimburse Purchaser for actual out-of-pocket expenses, exclusive of legal fees, incurred in preparing such information and rendering such assistance at WesTech's request. The foregoing states the entire liability of WesTech, with respect to patent infringement; and except as otherwise agreed to in writing, WesTech assumes no responsibility for process patent infringement.

17. SURFACE PREPARATION AND PAINTING: If furnished, shop primer paint is intended to serve only as minimal protective finish. WesTech will not be responsible for condition of primed or finish painted surfaces after equipment leaves its shops. Purchasers are invited to inspect paint in shops for proper preparation and application prior to shipment WesTech assumes no responsibility for field surface preparation or touch up of shipping damage to paint. Painting of fasteners and other touch-up to painted surfaces will be by Purchaser's painting contractor after mechanism erection.

Motors, gear motors, and other components not manufactured by WesTech will be painted with that manufacturer's standard paint system. It is our intention to ship major steel components as soon as fabricated, often before drive, motors, and other manufactured components. Unless you can insure that shop primed steel shall be field painted within thirty (30) days after arrival at the jobsite, we encourage you to purchase these components bare.

Our prices are based on paints and surface preparations as outlined in the main body of this proposal. In the event that an alternate paint system is selected, we request that your order advise of your selection. With your agreement, we will than either adjust our price as may be necessary to comply or ship the material unpainted if compliance is not possible due to application problems or environmental controls.

18. CANCELLATION, SUSPENSION, OR DELAY: After acceptance by WesTech, this proposal, or Purchaser's order based on this proposal, shall be a firm agreement and is not subject to cancellation, suspension, or delay except upon payment by Purchaser of appropriate charges which shall include all costs incurred by WesTech to date of cancellation, suspension, or delay plus a reasonable profit. Additionally, all charges related to storage and/or resumption of work, at WesTech's plant or elsewhere, shall be for Purchaser's sole account; and all risks incidental to storage shall be assumed by Purchaser.

19. RETURN OF PRODUCTS: No product may be returned to WesTech without our prior written permission, said permission may be withheld by WesTech at its sole discretion

20. BACKCHARGES: WesTech will not approve or accept backcharges for labor, materials, or other costs incurred by Purchaser or others in modification, adjustment, service, or repair of WesTech-furnished materials unless such back charge has been authorized in advance in writing by a WesTech employee, by a WesTech purchase order, or work requisition signed by WesTech.

21 ENTIRE AGREEMENT: This proposal expresses the entire agreement between the parties hereto superseding any prior understandings, and is not subject to modification except by a writing signed by an authorized officer of each party.

22. MOTORS AND MOTOR DRIVES: In order to avoid shipment delays of our equipment, the motor drives may be sent directly to the jobsite for installation by the equipment erector. Minor fit-up may be required.

23. EXTENDED STORAGE: Extended storage instructions will be part of information provided to shipment. If equipment installation and start-up is delayed more than 30 days, the provisions of the storage instructions must be followed to keep WARRANTY in force.

24 ARBITRATION NEGOTIATION Any controversy or claim arising out of or relating to the performance of any contract resulting from this proposal or contract issued, or the breach thereof, shall be settled by arbitration in accordance with the Construction Industry, Arbitration Rules of the American Arbitration Association, and judgement upon the award rendered by the arbitrator(s) may be entered to any court having jurisdiction

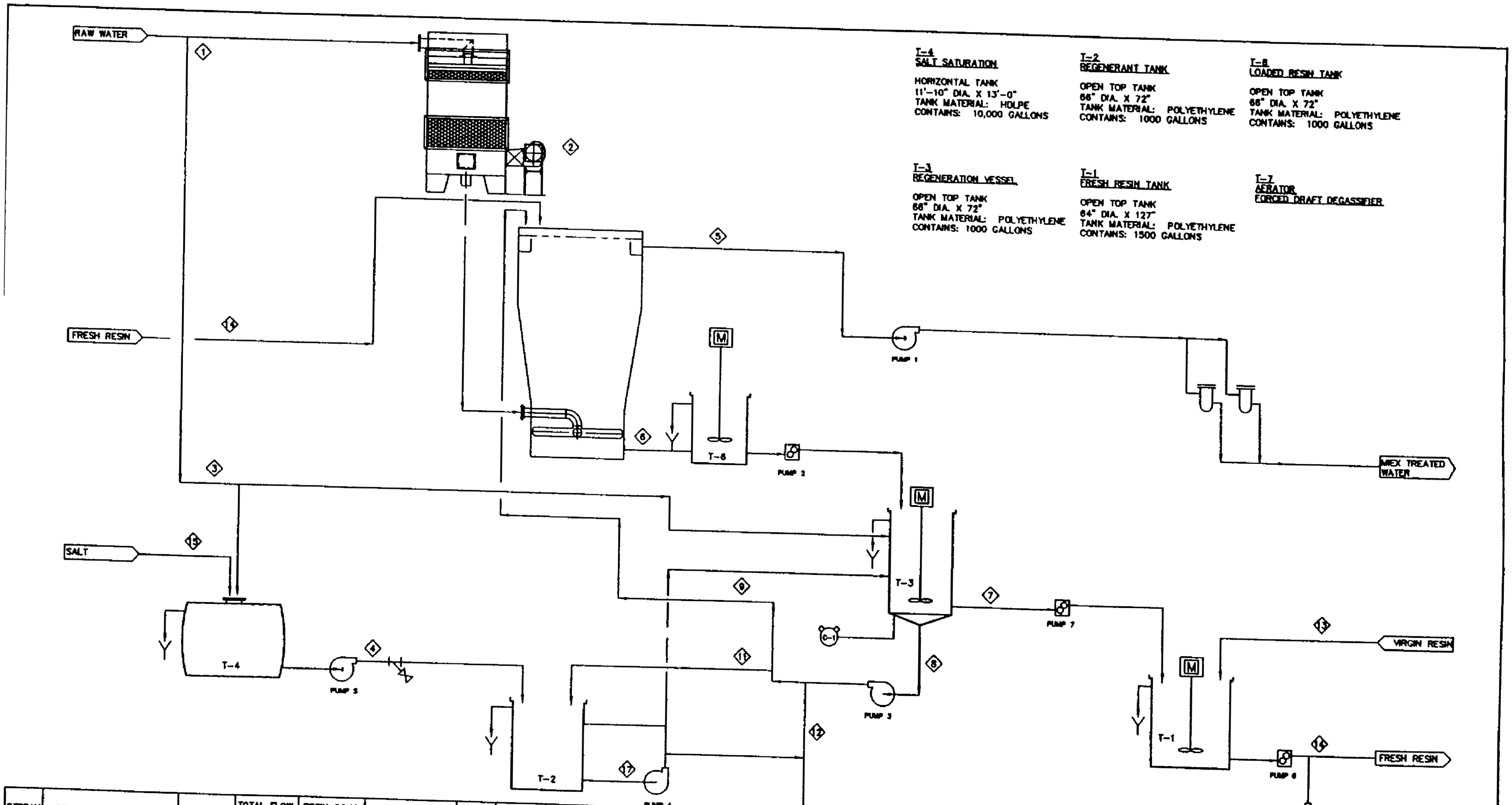
25. LIABILITY: Liability for errors and omissions shall be limited to the greater of $50,000 or the value of the particular piece of equipment (not the value of the entire order) supplied by WesTech against which a claim is sought.

ACCEPTED BY PURCHASER

BY ______________________________

TITLE ______________________________

DATE ______________________________



T-4
SALT SATURATION
HORIZONTAL TANK
11'-10" DIA. X 13'-0"
TANK MATERIAL: HDLPE
CONTAINS: 10,000 GALLONS

T-2
REGENERANT TANK
OPEN TOP TANK
66" DIA. X 72"
TANK MATERIAL: POLYETHYLENE
CONTAINS: 1000 GALLONS

T-6
LOADED RESIN TANK
OPEN TOP TANK
66" DIA. X 72"
TANK MATERIAL: POLYETHYLENE
CONTAINS: 1000 GALLONS

T-3
REGENERATION VESSEL
OPEN TOP TANK
66" DIA. X 72"
TANK MATERIAL: POLYETHYLENE
CONTAINS: 1000 GALLONS

T-1
FRESH RESIN TANK
OPEN TOP TANK
64" DIA. X 127"
TANK MATERIAL: POLYETHYLENE
CONTAINS: 1500 GALLONS

T-7
AERATOR
FORCED DRAFT DEGASSIFIER

STREAM	DESCRIPTION	OPERATION	TOTAL FLOW (gpm)	RESIN CONC. % (V/V)	RESIN VOL. FLOW SETTLED (gpm)	BRINE g/L	AIR FLOW scfm	NaCL lbs/day
1	RAW WATER	CONTINUOUS	500					
2	FORCED AIR	CONTINUOUS						
3	RAW WATER (RINSE & MAKEUP)	INTERMITTENT	10					
4	SATURATED BRINE	INTERMITTENT	20			263		
5	MIEX TREATED WATER	CONTINUOUS	500	0	0			
6	MIEX TO REGENERATION	CONTINUOUS	1.75	25	0.437			
7	REGENERATED RESIN TO FEED TANK	INTERMITTENT	25	25	0.25			
8	REGENERATION VESSEL RETURN	INTERMITTENT	[illegible]					
9	DECANT WATER	INTERMITTENT	[illegible]					
10	REGENERATION RINSE WATER	INTERMITTENT	[illegible]			117		
11	BRINE MAKEUP	INTERMITTENT	[illegible]	0	0			
12	SPENT BRINE	INTERMITTENT	[illegible]			[illegible]		
13	VIRGIN MIEX RESIN MAKEUP	INTERMITTENT	0	25	0			
14	FRESH RESIN TO PROCESS	CONTINUOUS	1.75	25	0.437			
15	SODIUM CHLORIDE	INTERMITTENT						
16	OFF GAS TO [illegible] FILTER	CONTINUOUS						[illegible]
17	BRINE TO REGENERATION VESSEL	INTERMITTENT	[illegible]					

PREPARED FOR: ALOHA UTILITIES
500 GPM MIEX PLANT

CUSTOMER P.O. NO. .

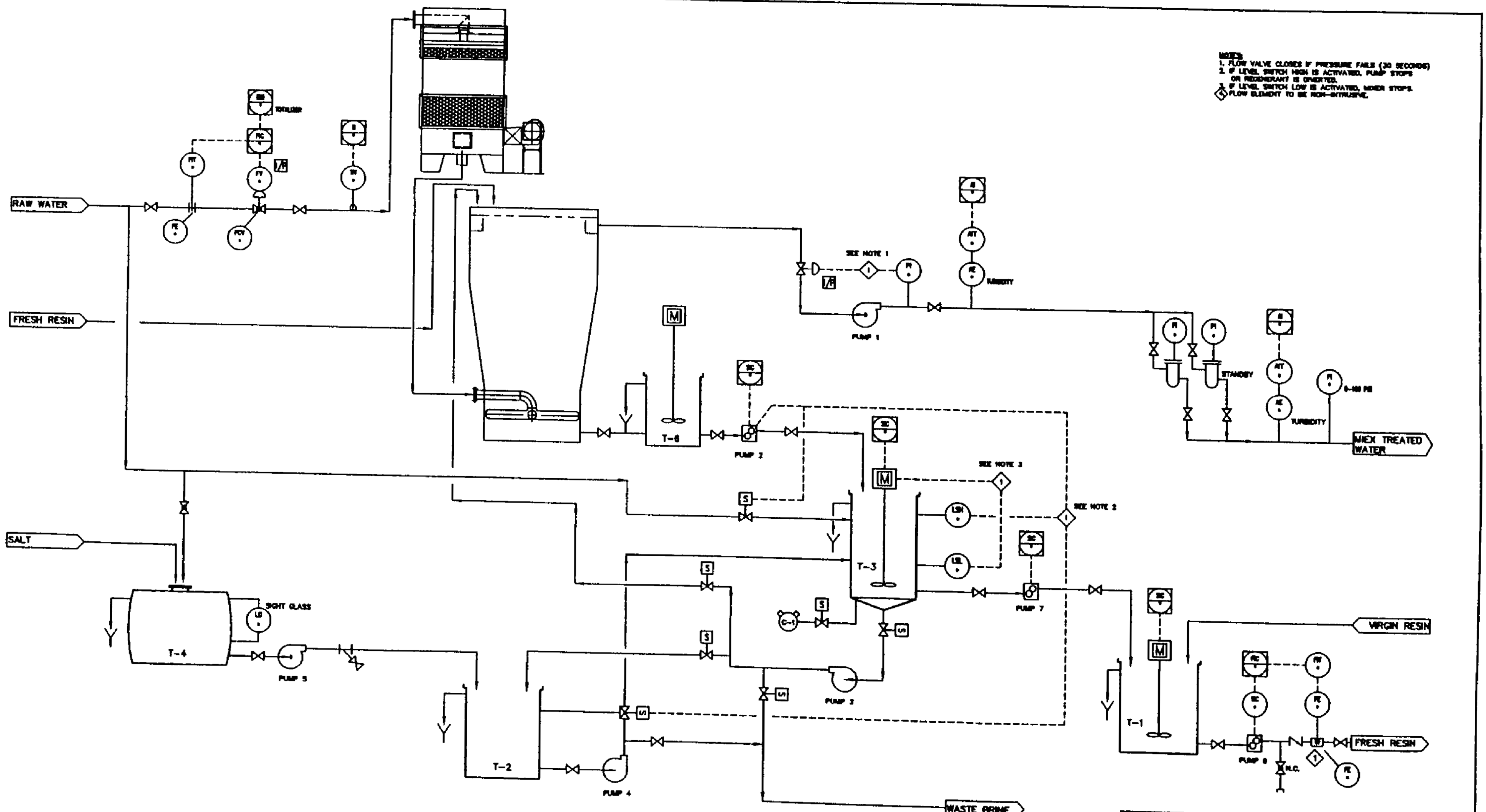
PROCESS FLOW DIAGRAM
MIEX RESIN MI200-A

NONE | 7/01 | BD

WesTech

PFD1

011391



AND RINSE WATER
FOR DISPOSAL
OR T-5
STORAGE TANK

T-4
SALT SATURATION

HORIZONTAL TANK
11'-10" DIA. X 13'-0"
TANK MATERIAL: HDLPE
CONTAINS: 10,000 GALLONS

T-2
REGENERANT TANK

OPEN TOP TANK
66" DIA. X 72"
TANK MATERIAL: POLYETHYLENE
CONTAINS: 1000 GALLONS

T-6
LOADED RESIN TANK

OPEN TOP TANK
66" DIA. X 72"
TANK MATERIAL: POLYETHYLENE
CONTAINS: 1000 GALLONS

T-3
REGENERATION VESSEL

OPEN TOP TANK
66" DIA. X 72"
TANK MATERIAL: POLYETHYLENE
CONTAINS: 1000 GALLONS

T-1
FRESH RESIN TANK

BLACK OPEN TOP TANK
64" DIA. X 127"
TANK MATERIAL: POLYETHYLENE
CONTAINS: 1500 GALLONS

T-7
AERATOR
FORCED DRAFT DEGASSIFIER

PREPARED FOR: ALOHA UTILITIES
500 GPM MIEX PLANT

CUSTOMER P.O. NO. .

PIPING AND INSTRUMENTATION DIAGRAM

MIEX RESIN MI200-A

NONE | 8/01 | JEB

WESTECH

PID1

011391 0