

7/7/99

ICR Treatment Studies Coordinator
US Environmental Protection Agency
Technical Support Center (MS 140)
26 West Martin Luther King Dr.
Cincinnati, Oh. 45268
Attn: Steven Allgeier

Re: ICR Treatment Study Final Treatment Study Report for PWSID #3640275, Plant
ICR#1074

Enclosed please find the Final Treatment Study Report for the membrane pilot study conducted by the City of Daytona Beach. Included in this submittal is the ICR Treatment Study Summary Report, the ICR Treatment Study Data Collection Spreadsheets (on diskette) and the ICR Treatment Study Report Spreadsheets (diskette).

Sincerely,

James C. Thurrott, Chief Chemist

SECTION I: Conclusions and Recommendations

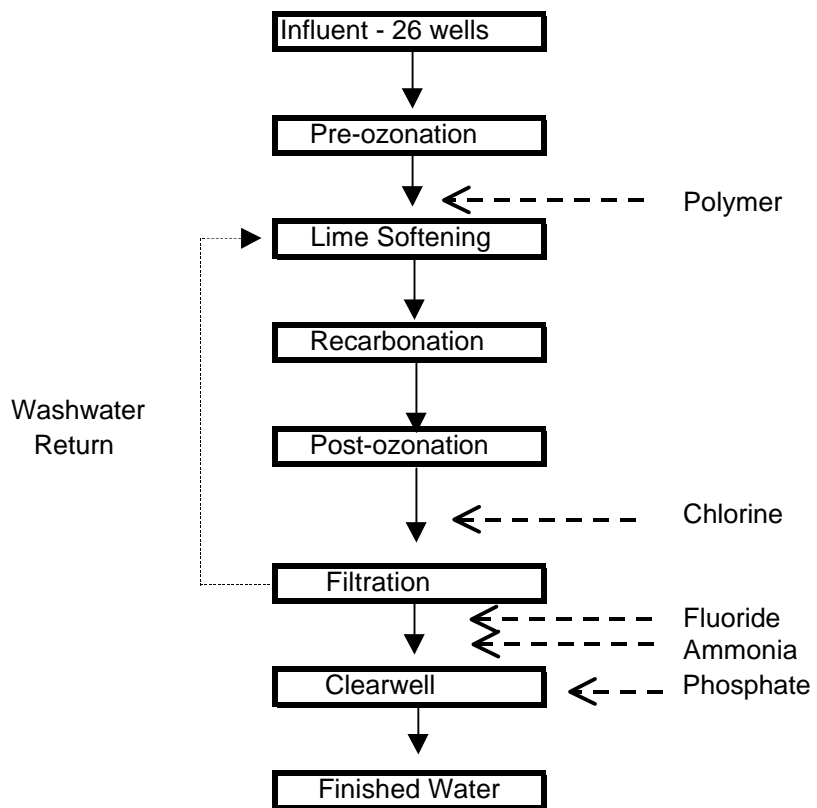
Operation of a membrane treatment plant on a pilot-scale at Daytona Beach, FL. has demonstrated that highly colored groundwater found in the Floridan Aquifer in this area can easily be treated to a level that meets proposed disinfection by-product limitations for a public water supply while still using chlorine for disinfection. Furthermore, it is likely that this water system will be able to comply with future water quality limitations through use of a blend of waters produced from an existing lime softening treatment plant and a membrane treatment train proposed to be constructed in the future when additional capacity is needed.

It is recommended that the results of this pilot study be incorporated by the utility into an engineering report to establish future needs, identify costs associated with meeting anticipated regulations and establish a time frame for design, permitting and construction to assure timely completion of necessary system modifications.

SECTION II: Background Information

The City of Daytona Beach owns and operates a 24 MGD water treatment plant constructed in 1973. Source water for the plant is 26 wells which draw from the Floridan Aquifer. Treatment provided includes pre-ozonation, lime softening, post-ozonation, recarbonation, rapid sand filtration and chloramination. In addition, a polyphosphate compound is added for corrosion control. Water quality produced by this treatment system consistently meets current limitations, however future (Stage 2 Disinfection Byproduct) rules and the relatively high TOC level of the treated water (6.5mg/l annual average) suggest that process changes will likely be required.

Future conceptual plans for expansion of this water plant are to maintain the 24 MGD of lime softening treatment and add a separate train of membrane treatment sized for additional required capacity. Product waters from the two streams will be combined with the expectation that the blend will meet future disinfection by-product regulations. Reject (concentrate) waters could be disposed of either by blending directly into a wastewater reuse system, by discharge to a 15 MGD wastewater treatment plant owned by the City, or routing to a permitted discharge point (Class III marine waterway). Deep well injection is not a likely alternative for this site due to a lack of appropriate geological formations in the area to separate potable water quality from saline zones.



Ralph Brennan Plant Treatment Schematic

Unit Process

Pre-ozone basins #1, #2, #3
Constructed - 1985

Process Description

Rectangular, poured in place concrete tanks (3), horizontal flow, baffled
Dimension: 24' wide, 23.7' deep, 24.5' long
Volume: 13,936 cu. ft.
Liquid Volume (gal.): 104,241
Ozone supplied from ambient air. 3 - 300lb/day Emery ozone generators

Softeners #1, #2
Constructed - 1972

Cylindrical, prestressed concrete, upflow, solids contact (2)
Eimco drive mechanisms
Dimensions: 65' Diameter, 15.98' depth
Volume: 53,000 cu. ft.
Liquid Volume (gal): 396,440
Lime received as CaO, slaked on site, added at approx. 220mg/l dose
Cationic polymer added to improve turbidity capture

Softener #3
Constructed - 1985

Cylindrical, prestressed concrete, upflow, solids contact (1)
Eimco drive mechanism
Dimensions: 88' Diameter, 16.9' depth
Volume: 102,736 cu. ft.
Liquid Volume (gal): 768,465
Lime received as CaO, slaked on site, added at approx. 220mg/l dose

Recarbonation #1
Constructed - 1972

Rectangular, poured in place concrete, horizontal flow
Dimensions: 24' wide, 17.7' depth, 37.3' length
Volume: 15,845 cu.ft.
Liquid Volume (gal): 118,521
Carbon dioxide source: liquid carbon dioxide

Recarbonation #2
Constructed - 1985

Rectangular, poured in place concrete, horizontal flow
Dimensions: 24' wide, 23' depth, 49' length
Volume: 27,043 cu. ft.
Liquid Volume (gal): 202,319

Post Ozone
Constructed - 1985

Rectangular, poured in place concrete, horizontal flow, baffled
Dimensions: 24' wide, 23' depth, 49' length
Volume: 27,043 cu. ft.
Liquid Volume (gal): 202,319

Filtration
Constructed - 1972

Dual media - sand, anthracite (6)
Dimensions: 22.5' wide, 8.3' depth, 28.7' length
Volume: 5,360 cu. ft.
Liquid Volume (gal): 40,093

Disinfection

Chemical type: chlorine gas, anhydrous ammonia
Measured as: total chlorine
Chlorine doseage: 15 mg/l
Chlorine to ammonia ratio: 7:1

Clearwell
Constructed - 1972

Irregular form concrete, poured in place
Volume: 46,791 cu. ft.
Liquid Volume (gal): 350,000

Corrosion Control
Begun - 1995

Liquid polyphosphate
Doseage: 1 mg/l

Fluoride enhancement

Dry chemical feeder
Chemical type: sodium silicofluoride
Doseage (as fluoride): 0.8 mg/l

Raw Water

Daytona Beach Source Water Quality - Average

(All results in milligrams per liter unless otherwise noted)

| <u>Constituent</u> | <u>Results</u> | <u>Constituent</u> | <u>Results</u> |
|--------------------|----------------|------------------------|-----------------------------|
| Arsenic | <0.005 | Chloride | 29 |
| Barium | 0.019 | Color* | 20-30 color units |
| Cadmium | 0.00045 | Copper | <0.004 |
| Chromium | 0.006 | Foaming Agents | 0.046 |
| Fluoride | 0.173 | Iron | 0.17 |
| Lead | 0.003 | Manganese | 0.014 |
| Mercury | <0.0002 | Odor | <1 |
| Nitrate | <0.005 | pH | 7.3 s.u. |
| Nitrite | <0.005 | Silver | <0.00005 |
| Selenium | <0.005 | Sulfate | 6 |
| Sodium | 16.6 | Total Dissolved Solids | 351 |
| Volatiles | None detected | Zinc | <0.005 |
| Pesticides/PCBs | None detected | Alkalinity | 255 (as CaCO ₃) |
| Total Coliform | 1/100ml | Calcium Hardness | 252 (as CaCO ₃) |
| Gross alpha | 0.7pCi/l | TOC* | 10 |
| Unregulateds | none detected | Total Hardness | 286 (as CaCO ₃) |
| | | Turbidity | 0.33ntu |

* varies with wells in service

Finished Water

Daytona Beach Finished Water Quality - Average

(All results in milligrams per liter unless otherwise noted)

| <u>Constituent</u> | <u>Results</u> | <u>Constituent</u> | <u>Results</u> |
|--------------------|-----------------|------------------------|------------------------|
| Antimony | <0.001 | Volatiles | none detected |
| Arsenic | <0.002 | Pesticides/PCBs | none detected |
| Asbestos | <0.17M fibers/l | Total Coliform | <1/100ml |
| Barium | 0.008 | Aluminum | <0.05 |
| Beryllium | <0.0001 | Chloride | 35 |
| Cadmium | 0.00009 | Color | 3 color units |
| Chromium | <0.0005 | Copper | <0.01 |
| Cyanide | <0.005 | Foaming Agents | <0.025 |
| Fluoride | 0.97 | Iron | <0.020 |
| Gross Alpha | 1.1 pCi/l | Manganese | <0.005 |
| Lead | 0.0016 | Odor | 0 threshold odor units |
| Mercury | <0.0002 | pH | 8.45 s.u. |
| Nickel | 0.002 | Silver | <0.01 |
| Nitrate | 0.054 | Sulfate | <1.0 |
| Nitrite | <0.01 | TOC | 6.5 |
| Selenium | <0.0025 | Total Dissolved Solids | 138 |
| Sodium | 21.3 | Turbidity | <1ntu |
| Thallium | <0.001 | Zinc | <0.01 |
| | | Unregulateds | none detected |
| Alkalinity | 40 (as CaCO3) | | |
| Calcium Hardness | 37 (as CaCO3) | | |
| Total Hardness | 57 (as CaCO3) | | |

SECTION III: Materials and Methods


The pilot membrane treatment unit used in this study was leased from American Engineering Services, Inc. Specifications used in procuring the lease are attached. Also attached are pages from the operating manual for the treatment system relating to design parameters. Pretreatment consisted of filtration through a 5 micron cartridge filter, sulfuric acid pH adjustment, and addition of a polyacrylic acid antiscalant.

Analytical Methods and MRL's Used During the Study:

| Analyte | Method | MRL |
|-----------------------|---------------------|---------------------------------|
| Alkalinity | SM2320B | 3.6 mg/l |
| Ammonia | EPA350.1 | 0.02mg/l |
| Bromide | EPA300.0 | 0.02mg/l |
| Calcium Hardness | SM3500CaD | 4.0mg/l (as CaCO ₃) |
| SDS Chlorine Residual | SM5710C | 0.2mg/l |
| HAA6 | SM6251B | 1ug/l for each analyte |
| pH | SM4500H+B | NA |
| TDS | SM2510B (TDS meter) | 5mg/l |
| Temperature | SM2550B | NA |
| THM4 | EPA551.1 | 1ug/l for each analyte |
| Total Hardness | SM2340C | 4.0mg/l |
| TOC | SM5310D | 0.50mg/l |
| SDS TOX | SM5320B | 25ug/l |
| Turbidity | SM2130B | 0.2NTU |
| UV ₂₅₄ | SM5910 | 0.009cm-1 |

The City of Daytona Beach

COMMISSION-MANAGER PLAN
POST OFFICE BOX 2451
DAYTONA BEACH, FLORIDA 32115-2451

To: Edmund Stepnowski, Purchasing Agent
From: Dennis R. Colby, Water and Wastewater Plants Manager 
Date: April 17, 1997
Subject: Negotiated Lease of Equipment to Perform Pilot Scale Membrane Study

Attached are nine (9) copies of the specifications for Pilot Scale Membrane Study Equipment. The following is a suggested list of suppliers we are aware of who can supply this equipment:

American Engineering Services, Inc.
5912 -F Breckenridge Parkway
Tampa, Fl. 33610
FAX No. 813-621-4085
Attn: Robert Kadaj

CH2MHILL
3011 S. W. Williston Road
Gainesville, FL 32608-3928
FAX No. 352-335-2959
Attn: Robert Bergman

Montgomery Watson - Applied Research Dept.
560 Herndon Parkway
Suite 300
Herndon, Va. 22070-5240
FAX No. 703-478-3375
Attn: Joseph G. Jacangelo

Applied Membranes Inc.
110 Bosstick Blvd.,
San Marcos, CA 92069
FAX No. 619 727 4427
Attn: Rohit Joshi

Ionics, Inc.
64 Grove St.
Watertown, Ma. 02172
FAX No. 617-926-8254
Attn: Peter Waldron

Advertisements for this Request for Proposals should be placed in at least the Daytona Beach News Journal and the Daytona Times. Should you have any questions on the more technical aspects of the specifications, please contact James Thurrott at extension 3143.

Attachments

cc: Frank Gummey, III, City Attorney
Stan Lemke, Public Works Director -

THE CITY OF DAYTONA BEACH
P.O. BOX 2451
DAYTONA BEACH, FL. 32115-2451

INVITATION TO SUBMIT PROPOSAL NO. _____

REQUEST FOR PROPOSAL FOR LEASE OF EQUIPMENT TO PERFORM PILOT SCALE
MEMBRANE STUDY

INSTRUCTIONS TO PERSONS SUBMITTING PROPOSALS: To ensure consideration of your proposal, please follow these instructions. Proposals shall be signed by the proposer or his authorized representatives. Any corrections to entries made on proposal forms should be initialed by the person signing the proposal. All proposals not in compliance with the conditions specified herein are subject to rejection.

PROPOSAL ENVELOPE: an envelope addressed to The City of Daytona Beach should contain on its face:

1. Name and address of proposer.
2. Proposal number.
3. Date and time of proposal.

PLEASE NOTE: The walk-in address of the Purchasing Department is 301 S. Ridgewood Avenue, mailing address is P.O. Box 2451, Daytona Beach, Florida 32115-2451, or 301 S. Ridgewood Avenue, Room 146, Daytona Beach, Florida 32114.

EXECUTION OF PROPOSAL: The proposal must contain a manual signature of an individual or of an authorized representative of the Company represented, in the space provided on the Proposal Form. The name of the representative submitting the proposal shall be inserted on all other sheets requiring proposer's name. In order to insure uniformity, proposals must be submitted on this Proposal Form and the attached pages.

PROPOSAL OPENING-LATE PROPOSALS: Proposals will be publicly opened, read aloud and recorded, on _____. Any proposal received thereafter will be returned unopened.

INVITATION TO SUBMIT PROPOSALS

NOTICE IS HEREBY GIVEN that sealed proposals will be received in the Office of the Purchasing Agent, Central Purchasing, 301 South Ridgewood Avenue, Daytona Beach, Florida, until 2:00 p.m. _____, at which time they will be publicly opened and read aloud for the following:

LEASE OF EQUIPMENT TO PERFORM PILOT SCALE MEMBRANE STUDY

AWARD OF CONTRACT subject to Article II, section 13-1/2, code of The City of Daytona Beach, Florida, "Minority and Women Owned Business Enterprises," (Ordinance No. 84-131) and related "Minority and Women Owned Business Enterprises Policy Procedures" (Resolution No. 85-79) and Article III, Negotiated Purchases.

SPECIFICATIONS MAY BE OBTAINED at the Purchasing Division, City Hall.

THE CITY RESERVES THE RIGHT to reject any or all proposals or parts thereof, or to accept the proposal(s) or parts thereof, when considered by it to be in the best interest of the City. Any proposal received after the time and date specified will not be considered. No person submitting a proposal may withdraw his proposal for a period of sixty (60) days after the date of the proposal opening. This time period is reserved for the purpose of reviewing proposals and investigating the qualifications of the proposers.

PROPOSALS SHALL BE ADDRESSED to The City of Daytona Beach, Purchasing Agent, P.O. Box 2451, Daytona Beach, Florida 32115-2451, and all proposals plainly marked on the outside of the envelope.

**PROPOSAL FOR: LEASE OF EQUIPMENT TO PERFORM PILOT SCALE
MEMBRANE STUDY**

PROPOSAL NUMBER: _____

THE CITY OF DAYTONA BEACH

**By: EDMUND J. STEPNOWSKI, CPPO
Purchasing Agent**

WITHDRAWAL OF PROPOSALS: Proposals may be amended or withdrawn only by written notice prior to the proposal opening. Amendments must be sealed. Amendments or withdrawals received after the proposal opening will not be effective, and the original proposal submitted will be considered.

CONSIDERATION OF PROPOSALS: Telegraphic or telephonic proposals will not be considered. The proposer agrees that his proposal will not be withdrawn within sixty (60) calendar days following the opening of proposals, and that during such time his proposal will remain firm and irrevocable. The City reserves the right to reject any or all proposals, and to waive any technical defects in proposals.

NEGOTIATED LEASE: Pursuant to Section 13 1/2-15 lease of this equipment will be sought in accordance with the following procedure:

Information provided by the proposers on the Proposal Forms and other supporting materials will be the principal source of evaluation material.

Specifications shall be provided by the City to any person desiring same. These specifications reflect the minimum standards established by the Environmental Protection Agency (EPA) in the Information Collection Rule (ICR) (61 FR 24354, May 14, 1996), and in the EPA publication "ICR Manual for Bench-and Pilot -Scale Treatment Studies" (EPA 814-B-96-003). The specifications shall require the submission of detailed cost information. Proposers should understand that those persons negotiating on behalf of the City are without authority to bind the City and that the City will only be bound by the terms of a written contract for the lease of the equipment that has been approved in public meeting of the City Commission and executed by the mayor and city clerk and approved by the City Attorney. The City Commission reserves the right to modify or reject any contract for the lease of equipment to perform pilot scale membrane studies.

The proposals shall be opened and evaluated utilizing the previously established evaluation criteria, and ranked in accordance with the qualifications and ability of the proposer and the responsiveness to the criteria of the specifications.

In accordance with the ranking, negotiations shall be commenced with up to three (3) proposers submitting the most highly ranked proposals in order to achieve a contract for the lease of equipment which meets or exceeds the City's needs and provides a cost which is fair, competitive, and the most efficient use of City funds.

If the City staff is unable to negotiate a contract meeting the criteria established above, they may terminate negotiations with any of the selected vendors and undertake negotiations in the same

manner by selecting vendors ranked immediately below those previously selected to fill the vacated positions of those vendors of which negotiations have been terminated.

Upon completion of satisfactory negotiations of a contract for the lease of equipment the City Manager shall submit such contract to the City Commission with his recommendation.

Upon the recommendation of the City Manager and the certification of sufficiency of funds for the contract by the Finance Director, the City Commission may approve, approve with modifications, or reject the contract for insurance coverage.

CRITERIA FOR EVALUATION OF PROPOSALS:

- Cost of lease of equipment
- Availability of equipment to meet City timctables
- Delivery capabilities and cost of delivery
- Availability of professional assistance in start-up and troubleshooting
- Configuration of the pilot plant equipment to meet EPA specifications
- Past experience and reputation of vendor in providing pilot plant equipment
- Availability and cost to the City of consumable items and repair items used in connection with pilot studies

Lease Specifications

SECTION 1

GENERAL REQUIREMENTS

A. Specifications Are Minimum Standards

The City of Daytona Beach, Daytona Beach, Florida, is interested in receiving proposals for lease of equipment to perform a Pilot Scale Membrane Study.

It is not the purpose of the specifications to inhibit suggestions for a better program with improved suggestions. Instead, these specifications attempt to indicate certain minimum standards for compliance to the Information Collection Rule (ICR), in the Environmental Protection agency (EPA) publication "*ICR Manual for Bench - and Pilot -Scale Treatment Studies*" (EPA 814-B-96-003).

B. Configuration

The pilot plant, as a minimum configuration, shall be composed of a two stage array. The first stage shall consist of two pressure vessels. The second stage shall have one. Each pressure vessel shall contain at least three membrane elements.

C. Cartridge Filtration

Cartridge filters shall be able to remove particulates greater than five (5) microns. Cartridges shall be installed prior to membrane elements.

D. Membrane Elements

Membranes shall consist of standard spiral-wound elements no smaller than four (4) inches in diameter by forty (40) inches in length. Each membrane shall have a manufacturer reported Molecular Weight Cutoff (MWCO) of less than 1000 Daltons. Actual MWCO of elements shall be decided by plant designer to achieve at minimum a 75 % system recovery rate. Elements must meet membrane manufactures specifications for pressure, flux, minimum and maximum influent rates.

E. Pumps

System shall be supplied with two (2) pumps. First should be a low pressure pump capable of preventing cavitation of high pressure pump by providing Forty (40) PSI through the cartridge filters. The second pump shall be a high pressure pump capable of maintaining adequate flows through the two-stage pilot system.

F. Control Panel

The plant shall be designed to operate on a continuous basis. The actual hours of operation for the system will be recorded by an hour meter mounted on the front panel, which should only record when the pilot plant is operating.

The system should have an electrical control panel that monitors feed pressure, Total Dissolved Solids (TDS) of the feed and permeate streams. Also located on this panel should be a pH monitor and temperature gauge, located in line of the cartridge-filtered feed water (location # 3) and a second pH monitor in line of the influent to stage one (location # 4) .

G. Rotometers

In line flow Rotometers registering in gallons per minute (gpm), shall be installed at the following points: the permeate flow from each stage (locations # 12 and # 13), the concentrate waste flow from the system (location #14) and on the permeate flow from the system (location # 15).

H. Gauges

Gauges shall be liquid filled and calibrated, before installation onto a common front panel of the plant for the following locations: Pressure gauges shall read from 0 to 200 PSI for influent and concentrates lines. In line between acid addition and cartridge filtration (location # 2), in line between cartridge filtration and high pressure pump (location # 3), in line on influent line to stage one (location # 4), in line on influent line to stage two (location # 11) and in line on concentrate stage two line (location # 15). Pressure gauges shall read from 0 to 60 PSI for permeate lines. In line on the permeate stage one line (location # 12), in line on the permeate stage two line (location # 13) and in line on system permeate line (location # 15).

I. Sample Taps

Sample taps shall be located at the following locations, cartridge-filtered feed water line prior to high pressure pump (location # 3), on influent line going to stage one prior to reaching stage one (location # 4), on influent line going to stage two prior to reaching stage two (location # 5), on permeate line from stage one prior to stage two discharge (location # 13), on system waste line (location # 14) and on system permeate line (location # 15).

J. Operation and Maintenance Manual

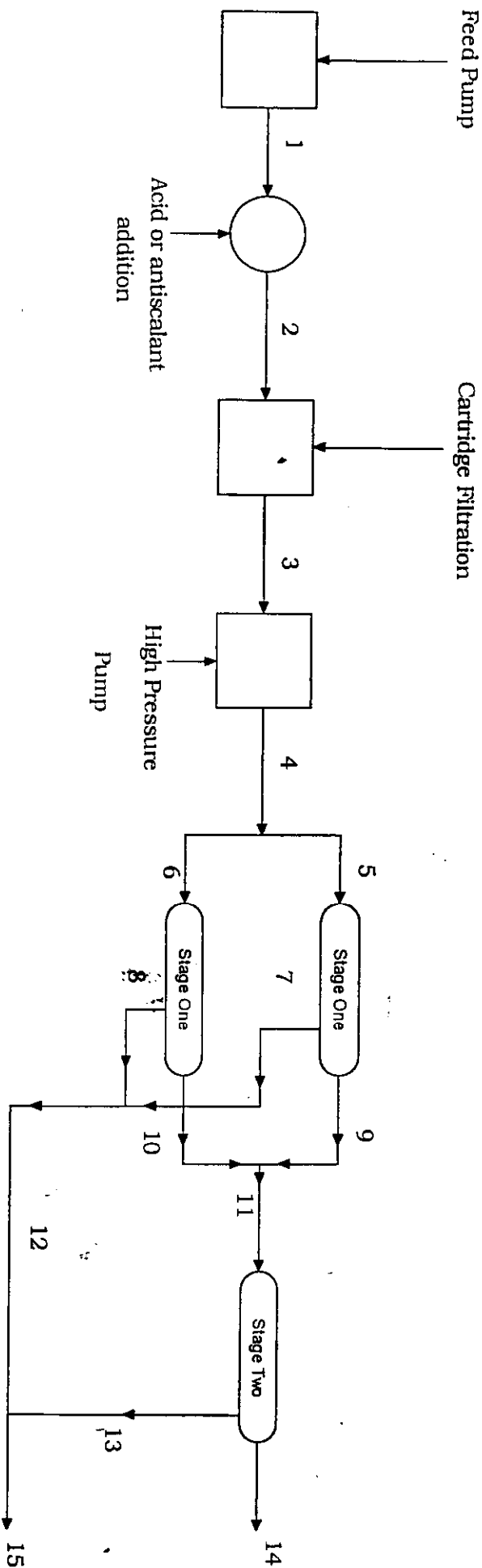
Supplier will provide two (2) sets of Operation and Maintenance manuals in the English language.

K. Startup and Training

Supplier shall be on site at start up and give at a minimum two (2) days training on Operation of plant following the start up.

Plant Schematic Two-Stage Pilot plant

Numerical Identification Chart on following page



Two-Stage Membrane Pilot Plant Numerical Identification Code

| Number | Description |
|--------|---|
| 1 | Feed Water |
| 2 | Acidified Feed Water |
| 3 | Cartridge-filtered feed water |
| 4 | Influent to stage 1 |
| 5 | Influent to pressure vessel 1, stage 1 |
| 6 | Influent to pressure vessel 2, stage 2 |
| 7 | Permeate from pressure vessel 1, stage 1 |
| 8 | Permeate from pressure vessel 2, stage 1 |
| 9 | Concentrate from pressure vessel 1, stage 1 |
| 10 | Concentrate from pressure vessel 2, stage 1 |
| 11 | Influent to stage 2 |
| 12 | Permeate from stage 1 |
| 13 | Permeate from stage 2 |
| 14 | System concentrate waste |
| 15 | System permeate |

INTRODUCTION

This manual provides the system-level operation and plant maintenance for the Reverse Osmosis (R/O) Water Treatment Plant. The design basis, process limitations, and major component descriptions are contained in this section.

A System Performance

System performance is based upon the design parameters given in subsequent paragraphs. Using these design parameters, the following system performance was obtained by computer projection, which provides an accuracy of "10 percent. It must also be noted that actual performance, during operation, may vary as the operating parameters vary and the age of the R/O membrane elements increases.

| | |
|--------------------------|----------------------|
| Product Water Output | 10,800 GPD (7.5 gpm) |
| Product Water Quality | < 100 ppm TDS |
| Product Water pH | 7.3 |
| Product Water Pressure | 5 Psi nominal |
| Brine Concentrate Output | 4608 GPD (3.2 gpm) |

B Design Parameters

The Water Treatment Plant was designed to be operated as specified under the following design parameters. Exceeding any critical value or limitation may void the warranty. Consult with American Engineering Services Inc. immediately, in the event that more demanding parameters are encountered.

a) Design Parameters

| | |
|------------------------------------|------------------------------|
| Design Temperature | 25°C |
| Initial R/O Pressure | 140 psi |
| Array | 2/1 with 3 elements per tube |
| Recovery | 70 percent |
| Raw Water Flow | 10.71 gpm |
| Recycle From 2 nd Array | 2.8 gpm |
| Permeate Flow | 7.5 gpm |
| Brine Discharge Flow | 3.2 gpm |

b) Feedwater Constituents (All values are ppm (mg/l) of the ion, except for pH)

| Constituent | <u>Amount*</u> |
|----------------|----------------|
| Calcium (Ca) | 99.2 |
| Magnesium (Mg) | 8.3 |

C. OF CALIFORNIA

| | |
|---------------------------------|-------|
| Sodium (Na) | 12.4 |
| Potassium (K) | 0.0 |
| Bicarbonates (HCO_3) | 318.0 |
| Sulfate (SO_4) | 6.0 |
| Chloride (Cl) | 29.0 |
| Silica (SiO_2) | 0.0 |
| Total Dissolved Solids | 473.0 |
| Temperature | 25°C |
| pH | 7.3 |

c) Feedwater limiting conditions

| | |
|--|------------------------|
| Allowable feedwater temperature range | 5 to 35EC (41 to 95EF) |
| Maximum operating pressure | 250 psig |
| Chlorine or similarly active oxidizing agents, (Iodine, Bromine or Ozone) | 0 ppm |
| Iron and Manganese | 0.1 ppm total, max. |
| Maximum allowable feedwater SDI | 4 |
| Recommended operating SDI | less than 1 |
| Maximum allowable feedwater turbidity | 1 NTU. |
| Recommended operating turbidity | less than 0.2 NTU. |
| Allowable operating pH range | 4 to 11 |
| Allowable cleaning pH range | 2.5 to 11 |
| Feedwater oil content | Undetectable |
| Feedwater inlet pressure at startup | 140 psi @ 25EC |
| Feedwater inlet pressure after 3 years | 160 psi @ 25EC |
| Feedwater Flow (w/ recycle) | 13.51 gpm |

C Chemical Usage

The following are the projected maximum chemical usages for the water treatment plant.

| | |
|-------------------------|----------------------------------|
| Sulfuric Acid | 0.68 Lb./day of 93% |
| Antiscalant (AWC A-151) | 0.39Lb/day based on 3 PPM dosage |

NOTE: USE OF ANY OTHER COMPONENTS OR CHEMICALS WILL VOID AES WARRANTY.

D Power Requirements

The following are the electrical power requirements for the water treatment plant.

| | |
|-------------------|--------------------------|
| Power Requirement | 230 VAC, 60 Hz, 3 Phase. |
|-------------------|--------------------------|

HP of electrical equipment:

| | |
|----------------------|--------------|
| 1 Booster pump | 3/4 HP |
| 1 High pressure pump | 3 HP |
| 2 Chemical pumps | 0.12 HP each |

Laboratories Involved During the Study:

| <u>Laboratory</u> | <u>Dates of Service</u> | <u>Analyses Performed</u> |
|--|--------------------------------|--|
| City of Daytona Beach ICRFL021 Contact: Hollis Zwart- Duryea 904/258-3145 FAX 904/258- 3108 | 1/5/1998 - 10/6/98 | Alkalinity Ammonia Calcium Hardness SDS Chlorine Residual pH TDS Temperature Total Hardness TOC Turbidity UV ₂₅₄ |
| E.S.Babcock & Sons, Inc. ICRCA009 Contact: Cyndi Moore 909/653-3351 FAX 909/653- 1662 | 1/5/1998 - 10/6/98 | Bromide HAA6 THM4 SDS TOX |

SECTION IV: Results and Discussion

The City of Daytona Beach has completed a pilot scale evaluation of membrane treatment using an untreated groundwater supply as the source water for the pilot. It should be noted that this project was internally funded and work was performed using City staff only without assistance from outside consultants. Total project costs were \$35,000 for the lease of the pilot unit, \$21,400 for outside laboratory work, and approximately \$1,000 for chemicals associated with plant operation - for a total of under \$60,000. A large portion of the laboratory work was handled in-house using City personnel. These costs were absorbed by the City Environmental Monitoring Lab operating budget. The pilot plant was operated by personnel from the City's Brennan Water Plant on the same site.

Operational problems were minimal during the trial. Plant downtime was restricted to occasional chemical feed pump malfunction, power failure to the plant and a single membrane cleaning episode. Since the pilot unit was continuously monitored by water plant personnel, repairs to feed pumps typically were handled within a few hours and power failures were noted immediately with restart of the pilot handled smoothly.

This project follows a pilot study by Dr. J. Taylor of the University of Central Fl. in 1989 in which 11 membranes were evaluated with respect to their capability of treating the source water to meet proposed Disinfection Byproduct limitations. Concerns identified in that project included a certain amount of irreversible membrane fouling and a high cost associated with concentrate disposal (deep well injection). Since that time, geological investigations have led local regulatory agencies to conclude that disposal of concentrate via this method is not feasible in this area.

Irreversible fouling of the membrane was not noted during this pilot run and water quality analyses of the concentrate suggests that blending this waste in an appropriate ratio with wastewater effluent for ultimate disposal in a reuse system may provide a reasonable alternative disposal method. The membranes were cleaned once during this pilot run, after approximately 6800hrs. of continuous service. This cleaning operation was successful in restoring flow through the membranes and the pilot trial was completed without further need for cleaning.

Water quality goals for this water system were easily achieved by the membrane treatment pilot unit. Water plant personnel obtained useful operating experience with membrane treatment during this trial and were impressed with the performance of the equipment and the water quality produced. Results from this trial support the concept of adding a membrane treatment train parallel to the existing lime softening plant currently providing water to this system. Sizing of the membrane train will be based on the goal of a blended water from the two trains meeting future disinfection by product regulations.

SECTION V

SM 5320 B Total Organic Halides - ICR Requirements Summary

- 1) Batch = 30 or fewer samples (not including QC samples).
- 2) Calibration: All method calibration requirements must be met. Perform 3 microcoulometer titration cell checks with NaCl standard solution at the beginning of each 8 hr work shift. Low level check standard to verify calibration before the analysis of the first sample. Verify calibration after every 7th sample (analyzed in duplicate) and after the last sample in the analysis batch alternating between the mid and high range check.

| <u>Analyte</u> | <u>Low</u> | <u>Mid</u> | <u>High</u> |
|---------------------|-------------|-------------|-------------|
| TOX | *50 ug Cl/L | 200 ug Cl/L | 500 ug/L |
| Acceptance Criteria | 75-125% | 85-115% | 85-115% |

*25 ug Cl/L during treatment studies.

- 3) Reagent (Method) Blanks: a) Two nitrate-washed activated carbon analyses at the beginning of each analysis batch, then one after every 7 samples (analyzed in duplicate)(minimum of 3/day). Maximum Allowable Background Contamination = < 0.80 ug Cl/40 mg of activated carbon; and b) Analyze 1 system blank per analysis batch. Maximum Allowable Background Contamination = <1/2 low level calibration check standard concentration from section 2.

- 4) Duplicates: All samples must be analyzed in duplicate. No RPD criteria.

- 5) Matrix Spike frequency = 5% (1 per 20) samples. Spikes should be at 1 of the levels (low, mid, or high) in section 2 above. Spikes should be as high or higher than the background analyte concentration in the sample if possible. (Check historical data)

- 6) pH: ≤ 2.0

- 7) Maximum Holding Times: Sample = 14 days.

- 8) Reporting levels: Same as low level calibration check standard concentration (Section 2).

- 9) Laboratory Control Sample: 1 per batch (not an ICR requirement)

EPA 551.1 Trihalomethanes: ICR Requirements Summary

- 1) Analytical Batch = 30 or fewer samples (not including QC samples)
Extraction Batch = 20 or fewer samples (not including QC samples)
- 2) Calibration: All method calibration requirements must be met. Low level calibration check standard to verify calibration before the analysis of the first sample. Verify calibration after every 10th sample and after the last sample in the analysis batch alternating between the mid and high range check.

| Standard | Low | Mid | High |
|-------------------------------------|----------|---------|---------|
| Concentration (for each analyte) | 1.0 ug/l | 20 ug/l | 40 ug/L |
| Acceptance Criteria | 50-150% | 80-120% | 80-120% |

- 3) Reagent (Method) Blanks: 1 per analysis batch (1 per extraction batch).
Maximum Allowable Background Contamination = < 0.50 ug/L for each analyte.
- 4) Duplicates: 1 laboratory duplicate per extraction batch.
- 5) Matrix Spike frequency: At least 1 sample in each extraction batch.
Spikes should be at 1 of the levels (low, mid, or high) in section 2 above.
Spikes should be as high or higher than the background analyte concentration in the sample if possible. (Check historical data)
- 6) Internal Standard: Internal standard use is optional.
- 7) Surrogate Standard: Decafluorobiphenyl. Add to each sample according to method specifications.
- 8) pH: ≥ 4.5 and ≤ 5.5
- 9) Maximum Holding Times: Sample = 14 days, Extract = 7 days.
- 10) Reporting levels: 1.0 ug/L for each analyte.
- 11) Laboratory Control Sample: 1 per batch (not an ICR requirement).

Standard Methods 6251 B (EPA 552. 1) - ICR Requirements Summary

1) Analytical Batch = 30 or fewer samples (not including QC samples).

Extraction Batch = 20 or fewer samples (not including QC samples).

2) Calibration: All method calibration requirements must be met. Low level check standard to verify calibration before the analysis of the first sample. Verify calibration after every 10th sample and after

the last sample in the analysis batch alternating between the mid and high range check.

| <u>Analyte</u> | <u>Low</u> | <u>Mid</u> | <u>High</u> |
|---------------------|------------|------------|-------------|
| DCAA | 1.0 ug/L | 20 ug/L | 40 ug/L |
| TCAA | 1.0 ug/L | 20 ug/L | 40 ug/L |
| MBAA | 1.0 ug/L | 20 ug/L | 40 ug/L |
| DBAA | 1.0 ug/L | 20 ug/L | 40 ug/L |
| BCAA | 1.0 ug/L | 20 ug/L | 40 ug/L |
| MCAA | 2.0 ug/L | 20 ug/L | 40 ug/L |
| BDCAA (optional) | 1.0 ug/L | 20 ug/L | 40 ug/L |
| CDBAA (optional) | 2.0 ug/L | 20 ug/L | 40 ug/L |
| TBAA (optional) | 4.0 ug/L | 20 ug/L | 40 ug/L |
| Acceptance Criteria | 50-150% | 80-120% | 80-120% |

3) Reagent (Method) Blanks: 1 per analysis batch (1 per extraction batch). Maximum Allowable Background Contamination = <1/2 low level calibration check standard concentration from section 2.

4) Duplicates: 1 laboratory duplicate (Sample/Sample duplicate) per extraction batch.

5) Matrix Spike frequency = Minimum 5% (1 in 20 or fewer) of quarterly samples from each utility (processed together).

Spikes should be at 1 of the levels (low, mid, or high) in section 2 above. Spikes should be as high or higher than the background analyte concentration in the sample if possible. (Check historical data)

6) Internal standard: 1,2,3-Trichloropropane OR (SM6251 B only) 1,2-Dibromopropane. Follow method and add to each extract as directed.

ICR Acceptance Criteria: 70-130% Recovery

7) Surrogate Standard Analyses: 2,3-Dibromopropionic acid OR (SM6251 B only) 2,3,5,6-Tetrafluorobenzoic acid. Add according to method specifications.

ICR Acceptance Criteria: 70-130 % Recovery.

8) Maximum Holding Times: Sample = 14 days, Extract = 2 days (EPA 552. 1) or 7 days (SM6251 B).

9) Reporting levels: Same as low level calibration standard concentration (Section 2).

10) Laboratory Control Sample: 1 per batch (not an ICR requirement)

EPA Method 300.0 (Inorganic Disinfection Byproducts) - ICR Requirements Summary

- 1) Batch = 30 or fewer samples (not including QC samples).
- 2) Calibration: All method calibration requirements must be met. Low level check standard to verify calibration before the analysis of the first sample. Verify calibration after every 10th sample and after the last sample in the analysis batch alternating between the mid and high range check.

| Analyte | <u>Low</u> | | <u>Mid</u> | <u>High</u> |
|---------------------|------------|----------|------------|-------------|
| Bromide | 0.020 mg/L | | 0.10 mg/L | 0.30 mg/L |
| Acceptance criteria | 50-150% | | 90-110% | 90-110% |
| Chlorite | 20 ug/L | 250 ug/L | 750 ug/L | |
| Chlorate | 20 ug/L | | 250 ug/L | 750 ug/L |
| Acceptance criteria | 75-125% | | 90-110% | 90-110% |
| Bromate | 5 ug/L | | 10 ug/L | 30 ug/L |
| Acceptance criteria | 50-150% | | 80-120% | 90-110% |

- 3) Reagent (Method) Blanks: 1 per analysis batch (1 per extraction batch). Maximum Allowable Background Contamination = <1/2 low level calibration check standard concentration from section 2.

- 4) Duplicates: 1 laboratory duplicate (Sample/Sample duplicate) per batch.

- 5) Matrix Spike frequency = Minimum 5% (1 in 20 or fewer) of samples from each batch. Spikes should be at 1 of the levels (low, mid, or high) in section 2 above. Spikes should be as high or higher than the background analyte concentration in the sample if possible. (Check historical data)
- 6) Maximum Holding Times: Bromide: 28 days; Chlorite, Chlorate and Bromate: 14 days.
- 7) Reporting levels: Same as low level calibration standard concentration (Section 2).
- 8) Laboratory Control Sample: 1 per batch (not an ICR requirement)

SM 5310D Total Organic Carbon

- 1) Batch=20 or fewer samples (not including QC samples).
- 2) Calibration: Calibration curves shall consist of at least 3 standards or the instrument manufacturer's recommendation. Curves shall be generated with each sample batch or as indicated by the calibration check standards. Low level (0.50 mg/l) must be analyzed prior to sample analysis. After no more than 10 samples the curve must be verified with either a mid-level (4.0 mg/l) or a high level (10.0 mg/l) continuing calibration standard.

| <u>Analyte</u> | <u>Low</u> | <u>Mid</u> | <u>High</u> |
|---------------------|------------|------------|-------------|
| TOC | 0.50 mg/l | 4.0 mg/l | 10.0 mg/l |
| Acceptance Criteria | 50-150% | 90-110% | 90-110% |

- 3) Reagent (Method) Blanks: 1 per analysis batch. Acceptance criteria <0.25 mg/l.
- 4) Duplicates: 1 field duplicate from one sample point shall be run with each sample batch. Every 5th set of samples shall have field duplicates from all sample points. Lab duplicates shall be run on each sample.
- 5) Matrix Spikes: A matrix spike with each sample set. Fortifying concentrations of 0.50 mg/l, 4.0 mg/l, or 10.0 mg/l TOC.

SM 5910 UV @ 254

- 1) Batch 20 or fewer samples (not including QC samples).

- 2) Instrument check standards: Low level (0.009 cm^{-1} / 0.50 mg/l) must be analyzed prior to sample analysis. After no more than 10 samples the instrument must be verified with a mid-level (0.088 cm^{-1} / 6.0 mg/l) or a high level (0.87 cm^{-1} / 60 mg/l) instrument check standard. The final analysis must be an instrument check standard.

| <u>Analyte</u> | <u>Low</u> | <u>Mid</u> | <u>High</u> |
|----------------------|-------------------------|-------------------------|------------------------|
| UV @254 | 0.009 cm^{-1} | 0.088 cm^{-1} | 0.87 cm^{-1} |
| Acceptance criteria: | 75-125% | 85-115% | 85-115% |

- 3) Reagent (Method) Blanks: Run as the initial zero and then after every 10 samples.
Acceptance criteria $< 0.0045 \text{ cm}^{-1}$
- 4) Duplicates: 1 field duplicate from one sample point shall be run with each sample batch. Every 5th set of samples shall have field duplicates from all sample points. Lab duplicates shall be run on each sample.
- 5) Matrix spikes: Not applicable.