



# Advanced Medical Systems, Inc.

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Cleveland, OH 44110  
(216) 692-3270

DOROTHY

June 29, 1995

Mr. James Caldwell  
Nuclear Materials Inspection, Section 2  
United States Nuclear Regulatory Commission  
801 Warrenville Road  
Lisle, Illinois 60523-4351

**Re: Application to Amend License No. 34-19089-01**

Dear Mr. Caldwell:

On March 22, 1995, Advanced Medical Systems, Inc. (AMS) requested an amendment of License No. 34-19089-01 to permit evaporation of water stored in the warehouse of the London Road facility. On June 8, 1995, Mr. Wayne Slawinski forwarded to us a series of questions that pertained to this request. On that same day, we provided you with our response to those questions.

We heard nothing further from the USNRC until June 26, 1995, when Mr. John Madera provided verbal authorization to purchase and install the evaporator.<sup>1</sup> Even though AMS does not need USNRC approval to purchase and install an evaporator at the London Road facility, the USNRC nonetheless issued Amendment No. 37 to License No. 34-19089-01 (received by AMS on June 29, 1995) wherein authorization to install but not operate the evaporator was given.

In the cover letter to Amendment 37, it was stated that operation of the device would not be granted until additional information was submitted on "(1) safety and spill-control procedures, (2) procedures for removal and analysis of solids from the evaporator, (3) procedure for operation and surveillance of the evaporator, (4) final decision on hours of operation, and (5) a roof area survey program near and around the exhaust point for the evaporator". To provide this additional information, AMS has modified the responses to the June 8, 1995 questions. The following are our revised responses.

**D. Is system use planned during unoccupied hours? What are the system's automatic operation and shutdown capabilities? Specifically, if the system is not continually monitored during its operation, what features detect excessive heat buildup and actuate system shutdown?**

AMS intends to operate the evaporator for 24 hours per day until all of the water in the collapsible storage tanks is evaporated. The application to the City of Cleveland to permit operation of the evaporator (submitted previously as Attachment 2, Enclosure 2 to our June 8, 1995 letter) indicated that the normal operating schedule would be 24 hours per day, seven days per week, for a total of six weeks per year.

<sup>1</sup> At that time, Mr. Madera stated that the operation of the evaporator, once installed, would be contingent on AMS providing additional information to supplement certain of our June 8, 1995 responses (e.g., responses to questions D, E, F, G, and H).

The evaporator is equipped with sufficient shutdown features to permit continuous operation. These include, but are not limited to the following:

- High stack limit control - Used to indicate stack temperature and shut down the burner if set-point is exceeded.
- Dual Liquid level control - Used to indicate the level of liquids in the evaporator and shut down the unit if the level reaches a low-level cut off or a high-level cut-off.
- Over-spray/foam control pump - Used to detect foam on the sensor and automatically start the pump to break down the foam and draw heat from the boiling liquid.

The evaporator unit will operate continuously until the unit runs out of water (evaporator will be stopped by the low level cut off switch), the unit is overfilled (evaporator will be stopped by the high level cut off switch), or the high stack limit temperature is reached. During a high- or low-level shut down, the burner, transfer pump and spray pump will all shut off and lock out. To restart, the water level must be returned to the normal operating level, either by draining or adding fluid, and the "reset" button must be depressed.

**E. Describe the water feed system from the 25,000 gallon collapsible storage bladders to the evaporator. If the feed system is automatic and will be operated unattended, also describe its automatic shutdown and safety features to prevent spills and overflows.**

The evaporator is equipped with a continuous pump that will transfer water directly from the storage bladders. Our response to Questions D contains a description of the automatic shutdown procedures.

**F. Where will evaporator effluents for "water vapor" and "burner exhaust" be discharged? Is water vapor exhaust discharged to the atmosphere or a condenser? Does the system generate airborne radioactive effluents; if yes, how will these effluents be evaluated for compliance with 10 CFR Part 20?**

The stack description and discharge mechanism is described in the permit applications (see Attachment 2 to our June 8, 1995 letter). The system to be installed is a small-scale system (e.g., capable of evaporating less than 40 gallons in an hour) that is constructed so that there is no mist carryover from the unit. Therefore, radionuclide emissions will not occur. However, for the purposes of permitting and demonstrating compliance with USNRC (10 CFR 20) and USEPA (40 CFR 61, Appendix D) requirements, and to permit the use of a computer model for determining off-site population doses, a mist carryover rate and an emission factor of 100% was assumed. Using both the COMPLY code (Level 4 Compliance) and the CAP-88 code, for postulated annual emissions equivalent to the total radionuclide content in the storage tanks, the effective dose equivalent calculated for the maximally-exposed individual is well below the USEPA compliance level (10 millirem). This also demonstrates, "by calculation, that the total effective dose equivalent to the individual likely to receive the highest dose from the licensed operation does not exceed the annual dose limit" of 100 millirem, as required in 10 CFR 20.1302.

**G. Describe the methods and equipment that will be used to conduct a radiological analysis of the solids removed from the evaporator. How will these solids be removed from the evaporator system?** Solids will be removed from the evaporator system pursuant to the vendor's instructions, included herein as Attachment 1. The vendor recommends that when the sludge reaches a depth of three (3) to four (4) inches, it should be drained. In addition, AMS intends to drain the sludge if an external exposure rate

100 microR per hour at a distance of one foot from the lower surface of the evaporator is reached.<sup>2</sup> The sludge removal process will be performed under a Radiation Work Permit pursuant to ISP-29, "Radiation Work Permits". A one-liter aliquot of the sludge that is drained from the system will be analyzed using the AMS gamma spectrometer as described in ISP-XXX, "Operation of the Gamma Spectrometer" (draft).

**H. Develop and submit a Standard Operating Procedure for monitoring and surveillance of the evaporator system.**

The standard operating procedure (ISP) for operation and surveillance of this unit, to be issued immediately after installation and check-out is complete, will contain the instructions provided by the vendor (see Attachment 1). Radiological surveillance of the system will be performed by the methods and at the frequency described in ISP-2, "Area Survey Procedure". A contamination survey of the stack exit duct will be performed at a frequency of once per month by the methods described in ISP-2. These surveillance activities will be incorporated into the monthly check list described in ISP-7.

In the cover letter accompanying Amendment 37, and in regard to the USEPA permit to operate the evaporator, the USNRC registered "concern that the information in the application may not reflect recent changes in the water processing project as it relates to the concentration of cobalt-60 and total volume of processed water". The letter also stated that it was the USNRC's understanding that there were "greater than 60,000 gallons of water, with varying concentration of cobalt-60, possibly up to 1000 pCi/l". AMS is confused about where the USNRC might have arrived at this erroneous understanding.

Please recall that on June 19, 1995, a fax communication was sent to John Madera from Carol Berger in regard to this issue. In that communication, the USNRC was provided with the following information about the contents of the collapsible storage tanks:

Tank Number	Mean <sup>60</sup> Co concentration (pCi/l)	Volume of water currently in Tank (gallons)	Total <sup>60</sup> Co Activity (μCi)
1	79.5	25,000	7.9
2	106.5	25,000	10.7
3	100	25,000	10.0
4	228.5	11,500	10.5
Total		86,500	39.1

From this information, it is easy to see that the total amount of <sup>60</sup>Co in the individual collapsible storage tanks is nowhere near the USNRC's understanding of 1,000 pCi/l. More importantly, however, the total volume of water contains only 39.1 microcuries in 86,500 gallons of water, for a mean concentration of

<sup>2</sup> The water that currently exists in the collapsible storage tanks contains less than 40 microcuries of <sup>60</sup>Co. Using the Microshield code (Grove Engineering, Version 4.10), it can be shown that this total activity, when placed in the evaporator, generates an exposure rate of 90.8 microR per hour at a location that is one foot (30.5 cm) from the outside of the stainless steel surface.

113 pCi of  $^{60}\text{Co}$  per liter of water. This concentration is below the concentration referenced in our permit application (e.g., up to 1,000 pCi/l for routine operations).

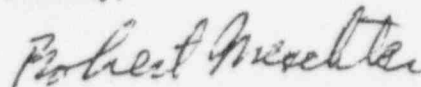
Once the water treatment project is finally complete, there may be as much as 100,000 gallons of water in the storage tanks, which is the upper limit of our storage capacity for treated water. However, the total activity in that volume is not likely to exceed 40 microcuries, for a radionuclide concentration of 100 pCi per liter. This concentration is still below that referenced in our permit application. While delays in receiving regulatory approvals has resulted in the total volume of water to be evaporated exceeding our original expectation, the total radionuclide activity will be below our original expectation (e.g., 45.4 microcuries).

Like other frequently-used gaussian plume models, the release rate input parameter required by the COMPLY code is in units of "total curies released in a year". Since AMS intends to evaporate the entire 100,000 gallons of water in a single year, the input parameter used to generate the COMPLY code reports in our permit application has not changed, regardless of the fact that the total volume of water has increased. Therefore, there is no need to re-submit a permit application to the USEPA.<sup>3</sup>

Because we are rapidly approaching our maximum storage capacity for the treated water, AMS is again asking the USNRC to take prompt action on our March 22, 1995 amendment request so that we may feel secure in purchasing an evaporator that we will eventually be able to operate. Timely action on your part will also ensure that we can begin evaporating the stored water as soon as the evaporator becomes operational. Because of the financial risk associated with this issue, AMS does not intend to purchase the evaporator until authorization to operate is given.

No amendment fees are included with this transmittal since it contains additional information to Control Number 98334. I can be reached at (216) 692-3270 if additional information is required.

Sincerely,



Robert Meschter, RSO

cc: D. Cesar  
D. A. Miller, Esq., Stavole & Miller

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<sup>3</sup> This conclusion was confirmed by Mr. Michael Murphy, Air and Radiation Division, U. S. Environmental Protection Agency (Region 5) on June 29, 1995.

**ATTACHMENT 1**  
**EVAPORATOR INSTALLATION, OPERATIONS AND MAINTENANCE MANUAL**

# **Installation, Operations and Maintenance Manual**

**Lakeview Engineered Products  
Waste-Water Evaporator**

**Model E-300 "Hot Tube"  
Natural Gas**

*for*

**Integrated Environmental Management, Inc.**

**Serial #**

**Manufactured by  
Power Plant Service, Inc.  
2500 W. Jefferson Blvd.  
Fort Wayne IN 46802**

**Tel: 219-432-6716  
Fax: 219-436-3340**



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**WARNING!** This symbol indicates a potentially hazardous situation which, if not avoided, would result in serious personal injury or death!

**CAUTION!** This symbol indicates a potentially hazardous situation which, if not avoided, could result in damage to the equipment!

## Introduction

This manual contains operation and maintenance instructions with part list for the Waste-Water Evaporator manufactured by Power Plant Service, Inc. of Fort Wayne Indiana. The equipment has been thoroughly checked and tested by the quality control department and is warranted to meet or exceed the specifications under which it was manufactured. (see "Terms and Conditions of Sale" for complete text and details of manufacturer's warranty.)

### CONGRATULATIONS

You have purchased the best available equipment on the market for your evaporation needs. This unit is designed and intended to give you trouble free service for a long time. For optimum performance, follow the component manufacturer's instructions and maintenance schedules as well as the instructions and maintenance information supplied within this booklet.

If you have any question please contact our product support/sales team at (219) 432-6716

**Thank You!**

### Purpose

The purpose of the manual is to provide instructions necessary to ensure proper operation of the evaporator. Close adherence to these instructions will promote the satisfactory operation of the evaporator. The Waste-Water Evaporator has been designed as a dependable means to facilitate the efficient evaporation of water based liquids using one of the following: natural gas, LPG, oil, steam, electricity or waste heat.

### Note

The owner and operator of the Waste-Water Evaporator are cautioned and reminded that the evaporator is designed to evaporate water. The owner and operator are cautioned and reminded that flammable liquids and other volatile compounds are to be strictly monitored so as to prevent their inclusion in the water based waste stream that enters the evaporator. The owner and operator are also cautioned and reminded that emissions from the evaporator and adherence to local, state and national environmental laws are the responsibility only of the owner and operator of the evaporator.

The owner and operator are further cautioned and reminded that the result of evaporation is a concentrated waste that may be more corrosive and aggressive to construction materials and personnel than the original waste. The owner and operator are advised to use caution in handling the concentrated waste and to regularly inspect their equipment for signs of corrosion.

Power Plant Service, Inc. assumes no responsibility for corrosion resistance or life span of construction material in any solution. We warrant the equipment to be free from defects in material and workmanship for a period of one year from shipment. Construction material is documented to be of the type and quality specified by the buyer or advertised by the manufacturer, whichever is appropriate.



## **Introduction, *cont.***

### **Note on evaporation rate**

Every waste stream is unique and will respond to evaporation in its own specific way. It is, therefore, impossible to guarantee evaporation rates under individual situations. Your E-Series evaporator was tested and certified to achieve a rate of evaporation at the factory. This rate was based upon clean water.

Your specific waste-water stream may result in a different rate of evaporation than was achieved and certified at the factory. This is normal. Your rate of evaporation, however, should be within a reasonable range, relative to the certified rate. If it is not, please consult the "Troubleshooting" section of this manual or call the factory.

### **Note on maintenance schedule**

Your maintenance schedule will be unique to your waste stream and situation. Due to the individual make-up of waste streams it is impossible to recommend precise clean-out and maintenance schedules for optimal evaporation rates. You will customize this to your specific situation, based upon your observations. Suggestions and a helpful charting system are to be found in the "Maintenance Schedule" section of this manual.

## **Physical Description**

*Description of Standard unit, fittings and connections. See "Specifications for this Unit" later in this manual.*

The Waste-Water Evaporator consists of a single unit which includes the evaporator tank, heat source and electrical control panel. All of the control components used during evaporation are mounted in the control panel and on the cover assembly of the unit. The control panel also houses relays, fuses and other electrical equipment associated with the main power distribution.

This equipment is constructed from several major sub-assemblies into a rigid unit. All components (except the burner tube on the "Hot Tube"® model) are so located and mounted that any major item may be removed without the necessity of removing any other major item.

**NOTE: Coalescing Filter (19½" x 9½" x 1½") stainless steel -  
owner option for installation**

The E-Series evaporator comes supplied with a coalescing filter. It is to be mounted at the intake of the water vapor exhaust blower (access is through the evaporator tank). This may be installed or left off at the owner/operator's option. It effectively removes oil droplets that may be swept up in the air stream passing over the evaporating water in the tank. It is designed to prevent oil droplets from being carried over with the water vapor, coating the stack or exiting to the atmosphere.

The filter, when in place, will reduce the rated evaporation output of the evaporator. It is up to you to determine whether or not you have oil carry-over and whether the filter is necessary or not.

### **Major Sub Assemblies**

### Available Optional Equipment, Major Items

**Stainless Steel Construction** Grade 304: Good resistance to corrosives conditions.

Grade 316: Best corrosion resistance of the standard stainless steels.

Other Specialty Alloys: Other special, high performance alloys available for specific needs.

Note: 304 Stainless Steel std., all wetted parts of top and lid, including blower & housing.

**Stack, Dual Design** Stainless Steel stack within a stack for "Hot Tube"® models that exhaust water vapor through the inner stack and the burner exhaust through the outer stack. Prevents water vapor from condensing and the unlikely occurrence of stack fires.

**Exhaust Stack** Stainless Steel single walled stack used to exhaust water vapor to the atmosphere from "Hot Bottom"® or "Hot Shot"® models. May also be used as side by side stacks on the "Hot Tube" model.

*The above must be ordered as original equipment.*

*The following may be added as after-market options.*

**Special Application PLC Controls** Remote operating controls or remote reading.

**Skimmer/Sludge Pump and controls** 2" inlet Air operated diaphragm pump plumbed into clean-out and oil skimmer, all piping and ball valves for easy operation, transfer and removal of skimmed oils and evaporator residue. Ready to pipe to your final waste tank.

**Vapor Recovery Condenser** Sized specifically the evaporation rate of your unit. Condenser will recover the water vapor coming off the evaporator. This clean water can then be used within your facility. Requires cooling medium and increases your operational costs.

**Over-spray System, Foam Control** Electric operated centrifugal pump that pumps hot water from the evaporator and sprays it over the surface of the liquid waste. This helps to break up surface tension and allow the water to evaporate through any surface film. It also exposes more surface area to the air being pulled across the surface of the fluid assisting in the evaporative rate. Foam sensor operates in the area above the normal operating fluid level and detects foaming conditions as they occur in the tank. This sensor then activates overspray system to break down the foam. All components, pump, strainers, nozzles, piping and controls included.

**Remote Tank Sensing System** (1) The feed tank can be set up with sensors to determine oil and sludge layers and permit pumping only aqueous wastes to the evaporator.  
(2) The feed tank can be set up with level controls to determine presence of fluid.

**Transfer Pump & Controls (Standard on E-300 & above)** An option on the E-100 and E-200. An air operated diaphragm pump set up to automatically transfer fluid to the evaporator.

**Misc.** Diaphragms for pumps - Santoprene standard, options include Viton, Teflon. Specific nature of the waste stream will determine the appropriate specification.

## Capacities and Operating Data

### General Specifications<sup>a</sup>

Model Number	Evap. <sup>1</sup> Rate (gph) <sup>a</sup>	Tank <sup>2</sup> Cap. (gal)	Weight <sup>3</sup> lbs.	Dimensions <sup>4</sup>		
				Length	Width	Height
E-100	8-12	160	1100	36"	54"	70"
E-200	18-24	250	1600	52"	54"	70"
E-300	30-37	300	2100	72"	54"	70"
E-600	50-65	625	4500	96"	66"	70"
E-900	85-100	900	8500	192"	66"	70"
E-1200	125-150	1200	10000	240"	66"	70"
E-1500	170-200	1800	15000	192"	102"	70"
E-1800	250-300	2400	18000	240"	102"	70"

<sup>a</sup> Evaporative rates on electric units are as follows:

E-100 5-7 GPH, E-200 8-12 GPH, E-300 15-20, E-600 24-30.

<sup>1</sup> Evaporation rates will vary per waste make-up. Rates are based on clean equipment evaporating water.

<sup>2</sup> Tank capacity is approximate for normal operating level. Total capacity will vary dependent upon model and energy source.

<sup>3</sup> Weight is approximate, it will vary upon the energy source, construction material and various options.

<sup>4</sup> Dimensions represent the size of the evaporator unit with control panel. Length of the oil or gas powered units will be as much as 4 feet longer due to the addition of a burner to one end.

<sup>a</sup> standard models and specifications as of 11-94

### Minimum Recommended Clearances

Front (Access Lid Clean-out) —————	36 inches
Left Side with Electrical Panel —————	36 inches
without Electrical Panel —————	24 inches
Right Side —————	24 inches
Rear —————	48 inches

### Service Requirements

Compressed Air (units with air operated transfer pump or sludge pump) — 90 psi

Electrical Service (208, 240/480VAC 3Ø, 60 Hz) ( available 120VAC 1Ø, 60Hz)

Heat Source: Natural Gas, LPG, No. 2 Oil, Steam, Waste Heat

*See "Specifications for this Unit" section later in this manual.*

*See Table of Contents for page number.*

**Service Connections, Standard (*see Specifications for This Unit*)**

Air Pump Inlet	—————	½" NPT
Steam Connection	———	2" NPT
Condensate Return	———	½" NPT
Gas Supply	—————	1" NPT
Waste-Water Inlet	———	½" NPT
Drain	—————	4" NPT
Skimmer Outlet	—————	2" NPT
Stack Connection	———	Flanged connection

**Special Tools and Test Equipment**

A non-metallic scraper (plastic or wood) is required for cleaning the polymer coated tank and burner tube assembly.

No other special tools, equipment, accessories or test equipment are required for normal operation and maintenance of the evaporator.

## Receiving

**Caution:** *Before attempting to move the equipment to the installation site, check the transportation route to make certain that there is adequate clearance.*  
*Exercise care when unpacking the unit to prevent damage to the painted skin, burner, control panel, instruments or protruding parts.*

### Unpacking

Locate the shipping document (packing list) and verify all items listed are accounted for. Carefully remove and unpack all boxes, verifying the contents against the packing list.

While unpacking the equipment, be sure to avoid damaging components. Do not remove padding, shipping blocks or shock protective devices until the equipment is properly located at the installation site. Premature removal of these materials may result in damage to burner, control panel, etc.

### Receiving Inspection

After unpacking, thoroughly inspect the entire assembly, both internally and externally, for possible indications of damage. During inspection, ensure that the following items are checked:

- \* The frame is not bent or distorted
- \* Gages and instrumentation are not damaged
- \* All piping, tubing, cables, conduit and hose assemblies are undamaged and secured
- \* Panel-mounted components are firmly in place
- \* Frame mounted components are securely in place
- \* All valves, controls and switches operate freely without excessive looseness.
- \* All set screws and collars of shaft mounted items are secure



## Installation and Leveling - "Hot Tube"

- \* Move the evaporator equipment to the permanent location. The unit is designed to be lifted by fork lift truck from either side of the unit. The forks should be long enough to extend across the entire width of the tank.
- \* Remove all padding, tape, shipping blocks and shock-protecting devices. Untie any cable, hoses and piping that have been secured for shipping.
- \* Install leveling feet and counterweights supplied with the unit.
- \* Level the equipment by adjusting leveling feet located on each leg. Use a level to check various points around the equipment. Install unit level with respect to top edge of skimming weir (located on the interior tank wall on the access lid end of the unit). **Weir must be level for proper skimming.** Install shim, if needed.
- \* Connect compressed air supply to units with air operated pumps. Compressed air should be at least 90 psi and should be clean and dry.
- \* Proper voltage supply is marked on disconnect inside of control panel. Failure to supply proper voltage could result in damage to the unit. Be sure to check blower motor (and over spray pump motor) for proper rotation. Proper rotation of component is noted by arrow either on motor or component part.
- \* Gas supply should be adequate for burner to operate at full rate. The pressure should not be less than 10" W.C.

**Optional:** \* **Installation of the Skimmer/Sludge Pump - (2" Air operated diaphragm pump)** For shipping reasons, the Skimmer/Sludge pump has been disconnected at the unions provided. Unpack the diaphragm pump (base attached) and set aside. Assembly goes as follows (see schematic):

1. Untie the upper pipe assembly and rotate clockwise until the union halves line up, tighten union securely.
2. Move pump to line up with pipe union from pipe assembly (from # 1 above). Adjust the leveling pads on the pump base to line up union halves connecting the pump to the pipe assembly. Tighten union securely. Make sure pump is level and tighten lock nuts on leveling pads.
3. Connect purge air tubing at the ball valve connector.
4. Fill evaporator tank with clean water and check for leaks. Tighten fittings as required.
5. Connect air supply hose whip to ½" NPT air supply.
6. Connect discharge line to outlet of pump, minimum pipe or hose ID should be 2 inches and as short in length as possible to minimize clogging.

**\* Installation of Foam Control/Overspray Pump -** (Centrifugal pump with attached motor) For shipping reasons, the Foam Control/Overspray Pump has been disconnected at the unions provided. (see schematic):

1. Remove pump and strainer assembly from shipping pallet being careful of electrical connections.
2. Place pump and strainer assembly with attached base on the floor and loosely connect to unions provided.
3. Adjust leveling pads on pump base to line up with piping, tighten unions and lock nuts on leveling pads.

**WARNING:** *All wiring and conduits must be in accordance with local and National Electrical Code for the installation area. Ground the equipment solidly. Failure to adequately ground the equipment can result in serious injury or death on contact during electrical malfunction. Be sure to disconnect main power at supply when servicing. All electrical installation and burner service must be performed by competent and experienced personnel in their fields.*

**CAUTION:** *Check the phase rotation of motors, rotation is noted by arrows attached to motor or component. The direction of the blower motor shall be counter clockwise as viewed from the top. If motor rotation is incorrect, reverse two of the phase terminals at the appropriate contactor. (see electrical schematic)*

## Safety Considerations

### General Safety Guidelines

Operators and service personnel should read the entire manual for this evaporator before attempting to operate or service the equipment. Familiarization with the manual will minimize exposure to accidents or injury. Although the procedures in this manual have been proven safe in use, Power Plant Service, Inc. assumes no responsibility for personal injury or damage to equipment resulting from application or use. After reading this manual, personnel should review all instruction concerning company safety procedures provided at the installation location. It is not possible to cover all safety conditions in this manual, therefore, always be alert and work safely. Only qualified operators and maintenance personnel should perform the procedures covered in this manual.

Know the location of the Safety Disconnect lever before operating the unit or proceeding with any service work. Be sure electrical power is disconnected before servicing unit.

Wear safety glasses, approved by your company, at all time.

Close doors on the electrical enclosures during normal operation. Ensure that the operator's work area is kept clean. Do not work on slippery floors and surfaces.

Stop the evaporator completely by disengaging the electrical disconnect switch before performing any service or interior maintenance.

Only remove guards for maintenance or cleaning. Never remove guards during operation.

Read and observe all signs posted on the evaporator.

Only qualified service technicians should tune or adjust the burner and burner controls.

**WARNING! NEVER USE WASTE WATER EVAPORATOR WITH FLAMMABLE OR VOLATILE WASTE OF ANY KIND!**

## Start-up and Operating Instructions - "Hot Tube"® model

1. Be sure that all control panel switches are in the off position. Turn main power "ON" by pushing up and arming the disconnect switch on the evaporator control panel. Locate the "HIGH STACK LIMIT" control in the lower left corner of the control panel. This is a digital temperature control and is used to indicate the stack temperature and shut down the burner if the temperature becomes excessive.

Check the alarm set point by depressing the button marked "INDEX" on the temperature control. The display will alternate between the letters "SP" and its numerical value. It should be set for 1150°F. If it is, depress "INDEX" to return to the stack temperature display and proceed to the next paragraph. If not, depress the proper "up" or "down" arrow on the control to change the "SP" value. After setting, DEPRESS THE "ENTER" BUTTON! If enter is not pressed, the new value will not be entered into the control. An error message (CHECK) will appear if you attempted to enter a "SP" value less than 400 or greater than 1200. Change the "SP" value to eliminate the error message. Depress the "INDEX" button to return to the stack temperature display.

The LED marked "AL" should be flashing. This will occur during power up or high stack temperature conditions. Reset by depressing the buttons marked "INDEX AL" and "down arrow AL". Hold both buttons for 4 seconds and the "AL" light will go out.

2. Turn on the air supply to the transfer pump. Turn on "Transfer Pump" by placing switch on the control panel in the "FILL" position. The pump will start and fill the unit until the level has raised the primary fill float valve to the full off (raised) position. At this point the pump will shut off and stop filling.

3. Move gas supply valve and pilot gas valve to the open position.

4. Set the temperature on the (optional) foam control switch (located on the face of the control panel and labeled "foam control") to 170°F.

5. Set the temperature on the water temperature monitor thermostat to 220°F (located on the face of the control panel and labeled "temp monitor")

6. Check to see that the evaporator is filled with liquid. The level should be high enough so that the level indicating rod is above the low level cutoff switch or in the normal operating level range indicated by the scale on the side of the switch bracket.

7. If the level is at or below the low level cutoff switch (indicated by the disk resting on the low level switch) you can fill the unit by placing the "TRANSFER PUMP" switch on the main electrical panel in the "FILL" position. The transfer pump will start and fill until the level is above the low level cut-off switch. The burner cannot and will not run until the level is above this point.

A somewhat faster fill rate can be achieved by opening the hand valve located under the access lid, next to the float valve. **Be sure to close this valve after the filling operation. Do not leave unit unattended with this valve in the open position.**

8. To start evaporating, start the blower by depressing the green "BLOWER START" push button on the control panel. Blower should start. If it does not, *see the trouble shooting section.*

9. Place the "TRANSFER PUMP" switch on the main electrical panel in the "ON" position. Pump is activated and will maintain operating level by the action of the primary fill float valve located under the lid. Make sure the hand operated valve next to the float valve is in the closed position. **NOTE: Transfer pump switch must be in the "ON" position to operate burner.**

10. To start burner, make certain that the gas supply and the pilot valves are on and the off/on switch located on the burner control panel is in the "ON" position. Place the "BURNER" switch located on the main control panel in the "ON" position. Burner should pre-purge and then fire (*see burner operation manual for exact operating sequence*). If the burner fails to fire, indicated by the flame failure light in the burner control panel, *see the trouble shooting guide in the burner manual.* To turn the burner off, place the "BURNER" switch in the "OFF" position.

11. The (optional) Over Spray/Foam Control Pump "SPRAY PUMP" switch should be placed in the "AUTO" position. Should the fluid start to foam the sensor will detect this condition and start the pump automatically. This will mechanically break down the foam and draw heat from the boiling liquid, causing it to cool and the foam to settle. The pump is time delayed to shut off after the sensor is cooled. To operate the pump manually, place the switch in the "MAN." position. The pump will operate until the switch is placed in the "OFF" position.

**CAUTION! Do not operate Overspray/Foam Control Pump when sludge level reaches the intake to the pump. Continuing to operate this pump will cause it to overheat and fail. Measure depth of sludge in the area of the intake daily. Clean basket strainer on inlet to pump daily or as required to maintain proper spray from nozzles.**

12. The evaporator unit will continue to operate until:

- a. The unit runs out of waste fluid at which time it is stopped by the low level cut off switch and indicated by the red flashing strobe beacon.
- b. The unit is overfilled at which time it is stopped by the high level cut off switch and is indicated by the red flashing strobe beacon
- c. The High stack limit temperature is reached. It is indicated by the flashing LED at the bottom of the stack temperature limit control.

During a high or low level shut down, the burner, transfer pump and spray pump will all shut off and lockout. To restart, the level must be returned to the normal operating level, either by draining or adding fluid. Subsequently, the yellow "LEVEL RESET" button must be depressed. The flashing strobe will go out and the unit can be restarted.

The High Stack Limit will shut down the burner only. If you have a HIGH STACK LIMIT failure, check to see that the unit has a proper fluid level. *See trouble shooting guide for further*



help.

12. To stop the unit, place the "BURNER" and "TRANSFER PUMP" switches in the "OFF" position. The blower can be turned off by depressing the red "BLOWER STOP" button. It is recommended that the blower continue to run until the unit stops generating large amounts of steam.

13. **CAUTION!** To operate the **SKIMMER/SLUDGE PUMP** the evaporator heat source (burner, steam source, electric heaters) must be shut down and the water and sludge that is to be pumped off must not exceed a **maximum temperature of 190°F**. This is because the air motor in the diaphragm pump cannot operate above this temperature. The material in the evaporator tank can be aided in cooling to 190°F by continuing to operate the overspray pump and the blower after the heat source has been shut down. Note: In order for free oils to float to the surface, the unit must be shut down for a period of time.

**SKIMMING:** Manually raise the fluid level in the tank to the top of the weir by opening the fill control valve located at the right side, inside the evaporator tank. Opening this valve allows the transfer pump to rapidly fill the evaporator tank. Allow filling of the tank until no more oil flows over the built-in weir. At the same time as the oil is overflowing the weir, open valve leading to the skimmer/sludge pump and turn on the air supply to the skimmer/sludge pump. Direct the skimmed oil to the final storage or disposal site.

**WARNING!** Once oil has been skimmed from the evaporator tank you must shut off the oil skimmer cleanout valve before returning to normal evaporator operation. This is to avoid overflowing the weir with hot liquid during an unintentional high level condition, creating a hazard of hot pipes leading to the skimmer/sludge pump.

**SLUDGE REMOVAL:** When the waste-water has been reduced to the point where it is still a flowable sludge it is time to transfer the residue of evaporation to the final storage or disposal site. Remember! **Maximum allowable temperature of fluid going into the Skimmer/Sludge Pump is 190°F**. Open the ball valve at the lower clean out port and then turn on the air supply to the Skimmer/Sludge pump.

An air purging inlet is located up stream of the pump inlet to help clear the line of clogging solids. Open the air valve to the purge port and blow out clog. Close air port valve and return to normal operation.

Sludge tank may be scraped to the clean out port and/or washed there by a water spray.

**WARNING!** After unit is cleaned of sludge, the cleanout valve must be closed before resuming normal operation.

**CAUTION! When cleaning polymer coated tanks, use only wooden or plastic scraping tools with a water spray to prevent damage to the coating.**

**Note:** The agitator option may be required on units that will be evaporating waste streams containing larger concentrations of particulate with specific gravities greater than water.



## Troubleshooting Guide - "Hot Tube"® model

**1. HIGH STACK LIMIT:** This indicates an abnormal condition in the hot tube heat exchanger. If the exhaust reaches a temperature high enough to trip the limit, one must find the cause. If left unchecked, this will cause inefficient operation and may cause failure of the tube.

A High Stack Temperature Limit is indicated by the flashing "AL" light on the digital temperature control. To check the set point, depress the button marked "INDEX". The display will alternately show "SP" and its numerical value. To change, see instruction in the Start Up section (page 12) of this manual. Depress "INDEX" to return to the stack temperature display.

**The main causes for shut down are:**

(a) The tube has become scaled, slowing down heat transfer. This is normal and will happen with time. When it does, you must drain the unit and clean the tube. The stack temperatures should go down after the cleaning.

(b) The unit has run out of fluid. If this happens the low level cutoff has shut down the unit. Look for any obstruction on the float or check for a bad cutoff switch. Correct the problem.

(c) The burner has changed its combustion settings. The burner was set up from the factory but movement during shipping or a dirty air intake could change the settings. Please refer to a qualified burner technician or check the burner service manual for more detailed instructions.

(d) The thermocouple sensor in the stack has gone bad or "opened up." You can check the thermocouple for continuity but the unit should be checked for proper millivolt output. Please contact the factory for replacement.

After correcting the cause of the high stack limit trip, the temperature control must be reset. Depress "INDEX AL" and "down arrow AL" buttons at the same time and hold for 4 seconds. "AL" LED will go out.

**2. LOW AND HIGH LEVEL CUTOFF:** This is used to shut down the unit if the liquid level becomes too low or too high. The actual cut off level is determined by the action of the disk attached to the float rod acting on the high or low microswitch. When a level fault is detected, the burner, transfer pump and spray pump will shut down and the red strobe light will begin to flash. The improper level condition **MUST BE CORRECTED** in order to restart the unit. To reset, be sure the level is in the normal operation range and push the yellow "LEVEL RESET" push-button.

**The main causes for low level shutdowns are:**

- (a) The transfer pump has run out of fluid to pump. This type of shut down is normal.
- (b) The primary level control float valve becomes obstructed or stuck. Clear the obstruction and reset.
- (c) The transfer pump is not turned on. Turn on the pump.
- (d) Air supply to the transfer pump is off or air pressure is too low. Turn on the compressed air supply or check the pressure and remedy. Minimum pressure is 40 psi. (In case of non air operated transfer pump of owners own design or installation, check appropriate controls for operation.)

**The main causes for high level shutdowns are:**

- (a) The fast fill valve (manually operated valve used primarily for oil skimming) is left open. Close valve and drain down to normal level.
- (b) The primary level control float valve has become stuck open. Clean obstruction and restart.

**3. THE MAIN BLOWER:** This is used to exhaust steam from the unit. The unit will not evaporate at rate unless the blower is running. The burner will operate without this blower but it is not recommended. The "BLOWER STOP" and "BLOWER START" button control the motor. If the blower will not start when the button is depressed:

- (a) Check the motor overloads and press the "RESET" button. The "RESET" button is the black button located on the lower right hand side of the control panel.
- (b) Check to see that the power is on to the panel.
- (c) Check to see that the fuses are good.

If resetting the overloads or changing fuses, be sure to find the cause of the problem or consult with an electrician.

**4. THE SPRAY PUMP:** This is used to spray liquid across the top of the bath to suppress foam generation. It will come on when the set temperature on the foam sensor reaches 170°F and the "SPRAY PUMP" switch is in the "AUTO" position. It can also be turned to the "MANUAL" position for continuous operation as deemed by the operator. There is a time delay off timer for the connector so that when the sensor or manual switch is turned off, the pump will continue to run for about two (2) minutes.

**The main causes for failure are:**

- (a) The pump switch is not set to the auto position.
- (b) The pump contactor overload has tripped. Reset is on the IEC style connector labeled "M2". Push to reset.
- (c) The ATDR class CC fuses have opened. Replace fuses.

When resetting overloads or replacing fuses be sure to find the cause of the problem or

consult with an electrician.

5. If there is power to the control panel but nothing will work, check to see if the transformer fuses are good. Replace if necessary but determine the cause before continuing.

**CAUTION!** It is strongly advised to take a periodic look at the burner tube flange gasket. It forms a water tight seal where the burner and burner tube breach the evaporator tank. In case of any leakage at the burner tube flange take appropriate steps to correct the problem or contact Power Plant Service, Inc.

**CAUTION!** It is strongly advised to take a periodic look at the burner refractory cone for damage. This inspection should be performed at least once annually. In case of refractory damage, take appropriate steps to correct the problem or consult Power Plant Service, Inc.

## Maintenance Schedule

### Periodic Maintenance

- \* Daily check of normal operating level float and valve.
- \* Daily system check and freedom of movement check for the emergency high/low level shutdown operating rod assembly. Push disk down until it contacts the low fluid level micro switch. Strobe light should come on, burner shuts down, pumps shut down. Push the disk up until it contacts the high fluid level micro switch, strobe light should come on, pump shuts down. To restart, push reset button on control panel. This procedure checks shut-down and safety systems.
- \* Daily visual check of entire unit for loose wires, pulleys, abnormal noise or operating condition.
- \* Grease bearings on blower assembly every 200 operating hours. Grease fittings located at rear of unit, at base of cage surrounding blower assembly. Grease fittings may also be located on blower motor.
- \* Annual burner tune-up by qualified burner service technician.

### Clean-out Maintenance

- \* Regular checks of evaporation rate are one of the best indicators of time to clean unit. When evaporation falls off from normal rates it is time to drain the unit and clean it.
- \* If an increase in stack temperature is noted, this generally indicates fouling of the heat transfer tube. It is time to drain the unit and clean it.
- \* Regular checks of sludge formation in the bottom of the tank should be performed. When sludge reaches a depth of 3-4 inches it is time to drain the unit and clean it. With sludge pump option, pump sludge to final storage tank for proper disposal.
- \* The depth and quantity of oil floating on the surface of the water should be checked each shift (or more often) and oil skimmed off when 2-3 inches has accumulated. Oil skimming schedule will depend upon quantity of oil in your waste

Use the following chart to help identify maintenance schedule:

Days/Week	Gallons fluid added	Hours of operation	Oil layer (in.) or oil removed (gal)	Inches of Sludge accumulation	

Good common sense should prevail regarding timely cleaning of the unit.

## Specifications for This Unit

The following is a description of your evaporator unit listing its specific options and variations from standard. It lists construction material, utility requirements dimensions, capacities and trim specific to this unit.

### Construction Material:

- Tank: Grade 316 Stainless Steel
- Burner tube: Grade 316 Stainless Steel
- Coating: none
- Top: All wetted parts including blower and blower housing, grade 304 stainless steel
- Insulation: 2" high density, foil backed fiberglass, pipe and tank lining

### Electrical:

- General: 240V 3Ø, 60 Hz
- Exhaust Blower motor: ¾ HP, 240V 3Ø, 60 HZ, 1725 RPM
- Overspray motor: ¾ HP, 240V 3Ø, 60 HZ, 1725 RPM
- Burner: 120V 1Ø, see burner manual
- Others: see schematic

### Fuel: Natural Gas

- Water Column, inches: 9.6" W.C. Gas Feed - 4" at Gas Head
- Inlet fitting: 1" NPT

### Compressed Air:

- P.S.I.: 100 psi max., 80 psi recommended
- Inlet fitting: ½" NPT

### Waste Water

- Inlet fitting: ½" NPT

### Skimming Weir

- Outlet fitting: 2" NPT

### Cleanout Port

- Outlet fitting: 4" NPT

### Stack Connection

- Flanged connection:

### Options:

**Transfer pump, high and low level controls:** An air operated diaphragm pump set up to automatically transfer fluid to the evaporator. This process is controled via a float activated valve and backed up by micro-switch controled, float activated high and low fluid level sensirs that will shut down and lock out the unit.

**Stack, Dual Design:** Stainless Steel stack within a stack for "Hot Tube" models that exhaust water vapor through the inner stack and the burner exhaust through the outer stack. Prevents water vapor from condensing and the unlikely occurrence of stack fires.

**Overspray/Foam Controls:** Electrically operated centrifugal pump that pumps fluid from the evaporator and sprays it over the surface of the liquid waste. This helps to break up surface tension and allows the water to evaporate through a surface film. It also exposes more surface area to the air being pulled across the surface of the fluid, assisting in the evaporation rate. Foam sensor operates in the area above the normal operating fluid level and detects foaming conditions as they occur in the tank. This sensor then activates the overspray system. All component, pump, stainer, nozzles, piping an controls included.

**Skimmer/Sludge Pump and controls:** 2" inlet, air operated diaphragm pump plumbed into clean-out and oil skimmer ports. All piping and ball valves included. For easy operation, trnasfer and removal of skimmed oils and evaporator residue.



## PARTS LIST

### VENDORS LITERATURE

*(follows this page)*

The below list references the major mechanical and electrical components. For further vendor information, see vendor literature following this page.

#### **Description:**

Evaporator Tank: Power Plant Service, Inc.  
Heat Transfer Burner Tube and Seal: Power Plant Service, Inc.  
Access Lid, tank: Power Plant Service, Inc.  
Blower Lid and Blower Housing: Power Plant Service, Inc.  
Blower: Power Plant Service, Inc., electronically balanced  
Float Switch Assembly: Power Plant Service, Inc.  
Stack: Power Plant Service, Inc., with rain cap  
Gas Burner: Industrial Combustion, SC/Series, Model SC-55G  
Burner Management Control: Fireye, Solid State, M Series II  
Pressure Reducing Valve: Maxitrol, RV 61  
Gas Pressure Switch: Antunes Controls, Model A.  
Diaphragm Gas Valve: Honeywell, Model V48A 2334  
Transfer Pump: ARO, 666053  
Skimmer/Sludge Pump: ARO, 6662  
Blower Motor: Marathon, 240/480V 3Ø, 1725 RPM  
High/Low Level Switches: Honeywell, Micro Switch, BZE6-2RN 9447  
Thermocouples: Pyromation, type J48004U-00-33  
Solenoid: ASCO, Red Hat II # 8210G2  
Temperature Controllers: Love, model 1511  
Overspray/Foam Control: Marathon, 240/480V 3Ø, 1725 RPM, Gould pump  
Control Panel: Square D, Nema 4 rating, 8538SB V3S8 V02  
Control Panel Switches: Square D, 9001 KR1U, KS43, B25 and KS11  
Contact Block: Square D, 9001KA1,2 & 3  
Transformer: Square D, 74001S1F  
Pillow Block Bearings: 1" NP-16T 1/8"NPT grease port  
Idler Pulley: AC2250 2½", 1" bore  
V-Belt: Gates, A30  
Combination Air Filter & Regulator: Wilkerson, CB6-04.000  
Ball Valves: Conbraco, Apollo ½" stainless steel 76-103-01