START

DON'T SAY IT --- *Write It!*

DATE: March 12, 1993

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SUBJECT: RD&D PERMIT FINAL CHANGES

Attached are marked-up pages showing proposed changes to the RD&D permit application. These changes will be included in the modified permit application certified by Mr. Wagoner of DOE-RL.

Should you have any questions, please call me at the above number.

The membrane pore size, composition, surface charge, and thickness, permit the water molecules to preferentially diffuse through the membrane while retaining the contaminant molecules (principally inorganics) in a concentrated waste solution. This concentrated waste solution, which does not pass through the membrane, is called the retentate or concentrate stream, and the portion that passes through the membrane is called the permeate stream. The retentate stream can be processed through several membranes in series to recover more of the waste water as permeate. Likewise, the permeate can be processed through several membranes to increase permeate purity.

Reverse osmosis does have a limitation as to how much separation can occur. This limiting factor depends on the solubility of the inorganic contaminants and the flowrate. When the solubility point is reached for a certain inorganic compound, a precipitate will form. If the flowrate is not adequate there will be a decrease in the effectiveness of the reverse osmosis operation by fouling the membrane. In most cases chemicals can be used to restore the membrane to the same condition as before fouling.

4.1.5.3.1.1 Equipment Description. The main test apparatus is a 12 gallon (45.2 liter) per minute reverse osmosis unit manufactured by Applied Membranes, Inc. This system uses spiral wound, tangential flow, thin film composite membranes. These membranes are anticipated to offer the highest strength and excellent permeate volume generation when compared to hollow fiber and plate and frame configurations. The unit uses FT-30 series thin film composite membranes manufactured by Filmtec, Incorporated. The membrane cartridges are 4 inches (10.2 centimeters) in diameter and 40 inches (101.6 centimeters) long. The reverse osmosis unit dimensions are approximately 16½ feet (5.03 meters) long, 4½ feet (1.37 meters) wide and 6½ feet (1.98 meters) high. The unit has two stages with four pressure vessels in the first stage and three pressure vessels in the second stage. Each pressure vessel can contain three membranes. Membrane spacers can be used in pressure vessels when less than three membranes are needed. A flow schematic and piping and instrumentation diagram of the system is presented in Figure 4-6.

The retentate from each stage can be recycled back to a preceding stage. This recycle increases the velocity over the membranes and minimizes the retentate volume. The system is designed to provide flexibility on how much retentate is recycled and to where it is fed. A portion of the retentate from stage 1 is returned to the influent of stage 1, second array. The retentate from stage 2 is returned to the influent of stage 1. Retentate is discharged from stage 1 and treated as secondary waste. The high velocity resulting from recycling the retentate will help to minimize fouling by sweeping away precipitate or biological material off the membrane surface. This increases the membrane surface area available for pure water to pass through.

The reverse osmosis unit contains all the piping, pumps, monitoring equipment, instrumentation, and chemical feed equipment necessary for operation. All pressure vessels, housings, and piping are stainless steel for chemical resistance. Flow, conductivity, and temperature instruments are stainless steel. The pH probes are polypropylene and provide adequate

resistance to all chemicals in these tests. Pressure gages are liquid filled for shock absorbance.

The system instrumentation permits data collection from initial feed and final permeate and retentate points, and also from intermediate points to give online evaluation of the performance of individual stages. All instruments except pressure gages have 4 to 20 milliamperes output so data can be logged automatically. All instruments have continuous readouts located on a central panel board. The control panel is shown in Figure 4-7.

The reverse osmosis unit contains approximately 50 gallons (189 liters). A catch pan will be placed under the entire unit to provide secondary containment in case of any leaks or spills. No gases will be generated during reverse osmosis operation.

4.1.5.3.1.2 Critical Parameters and Safety Features. Pressure is the most critical parameter in the reverse osmosis system. Pressure provides the driving force to concentrate the waste stream by 'pushing' water through the membrane. The operating pressure of reverse osmosis is nominally 200 to 550 pounds per square inch gage (1,379 to 3,792 kilopascals). Pressure regulating valves are provided to control the desired operating pressure. The system is specified for operation up to 700 pounds per square inch gage (4,827 kilopascals).

Spray containment for the reverse osmosis module will be provided by a housing constructed of clear plastic panels (e.g., plexiglass) hung from the existing module framework (extended where necessary). The panels will be approximately 4 foot (1.2 meters) wide and will be removable for maintenance on the module. The bottom of the panels will extend to just inside the catch pan walls. Fans may have to be installed to provide for ventilation of the module.

Flow rate also is an important operating parameter. Adequate flow over the membranes is important to keep the membranes clean and fully functional. Flow control valves are provided so proper flow rates can be maintained.

Temperature is another important parameter. Temperature affects the flux (permeate generation rate per membrane surface area) and the purity of the permeate stream. The system is designed for an operating temperature of 86 °F ±27 °F (30 ±15 °C). This range is sufficient for the waste water pilot plant operation. Should the operating temperature exceed 104 °F (40 °C), the integrity of the membranes could be compromised by reducing the effective membrane life. However, no safety hazards are presented to the operating personnel.

There are two conditions that will shut down the system. The conditions are high and low pressure. When either of these conditions are met, the high pressure reverse osmosis pumps are shut down along with the feed pump. The high pressure shutdown is adjustable with a maximum of 700 pounds per square inch gage (4,827 kilopascals). This will prevent equipment damage and leakage. The reverse osmosis stainless steel pressure vessels are over designed to a pressure rating of 1,000 pounds per square inch gage

Contaminated equipment or other secondary waste not returned to the LERF, which is destined for treatment and/or disposal will be placed in U.S. Department of Transportation-compliant containers. The containers will be labeled as necessary and will be managed in compliance with 40 CFR 262.34(c)(1) in a ~~satellite accumulation area.~~ When the waste ~~container is filled~~, the waste generation date will be marked on the container and the waste will be moved to a RCRA-compliant ~~less-than-90-day-storage~~ area and the waste will be managed in accordance with all 40 CFR 262.34 conditions. ~~The waste will be designated.~~ Upon designation of the containerized waste, ~~additional labeling will~~ be placed on the container as necessary and the waste will be transferred to a Hanford Facility TSD unit in accordance with onsite procedures.

Contaminated equipment that is destined for reuse will be stored in an area equipped with secondary containment.

WASTE WATER PILOT PLANT

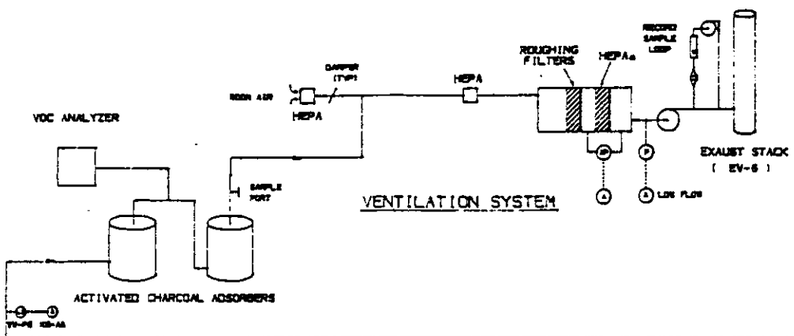
STREAM CHARACTERISTICS

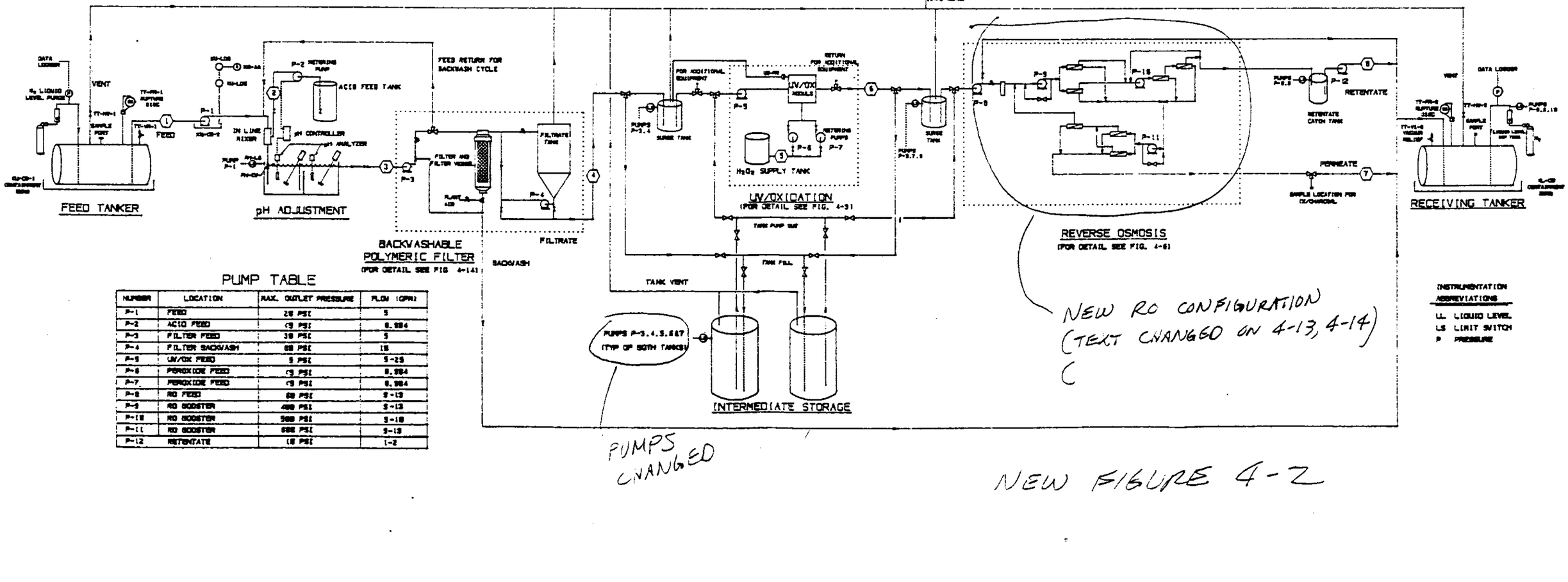
LOCATION	① FEED	② ACID FEED	③ pH OUT	④ FILTRATE	⑤ PEROXIDE FEED	⑥ UV/OX OUT	⑦ RO PERMEATE	⑧ RO RETENTATE
FLOW (GPM)	5	0.004	5	5	0.004	5-25	4.5	0.5
TEMP (F)	AMBIENT	60 - 70	60 - 70	60 - 70	60 - 70	90 - 90	60 - 70	60 - 70
pH	7 - 11	-	5 - 6.5	5 - 6.5	5 - 6.5	5 - 6.5	5 - 6.5	5 - 6.5
VOC (PPM)	11.0	-	11.0	11.0	-	<1.0	<1.0	<1.0
OTHER	-	93% H2SO4	-	-	50% H2O2	-	-	-

NOTE: DOTTED LINES AROUND UNIT OPERATIONS DENOTE THE BOUNDARIES OF THE REFERENCED FIGURES

TANK TABLE

TANK	QUANTITY	CAPACITY (GALLONS)
FEED TANKER	1	5,000
H2SO4 ACID FEED	1	30
FILTRATE STORAGE	1	100
UV/OX FEED SURGE	1	200
H2O2 SUPPLY	1	55
RO FEED SURGE	1	100
RETENTATE CATCH	1	55
INTERMEDIATE STORAGE	2	3,000
RECEIVING TANKER	1	5,000





PUMP TABLE

NUMBER	LOCATION	MAX. OUTLET PRESSURE	FLOW (GPM)
P-1	FEED	20 PSI	5
P-2	ACID FEED	<5 PSI	0.004
P-3	FILTER FEED	30 PSI	5
P-4	FILTER BACKWASH	60 PSI	15
P-5	UV/OX FEED	5 PSI	5-25
P-6	PEROXIDE FEED	<5 PSI	0.004
P-7	PEROXIDE FEED	<5 PSI	0.004
P-8	RO FEED	60 PSI	5-13
P-9	RO BOOSTER	400 PSI	5-13
P-10	RO BOOSTER	500 PSI	5-10
P-11	RO BOOSTER	600 PSI	5-13
P-12	RETENTATE	10 PSI	1-2

NEW RO CONFIGURATION
(TEXT CHANGED ON 4-13, 4-14)
C

PUMPS CHANGED

NEW FIGURE 4-2

1ST ARRAY

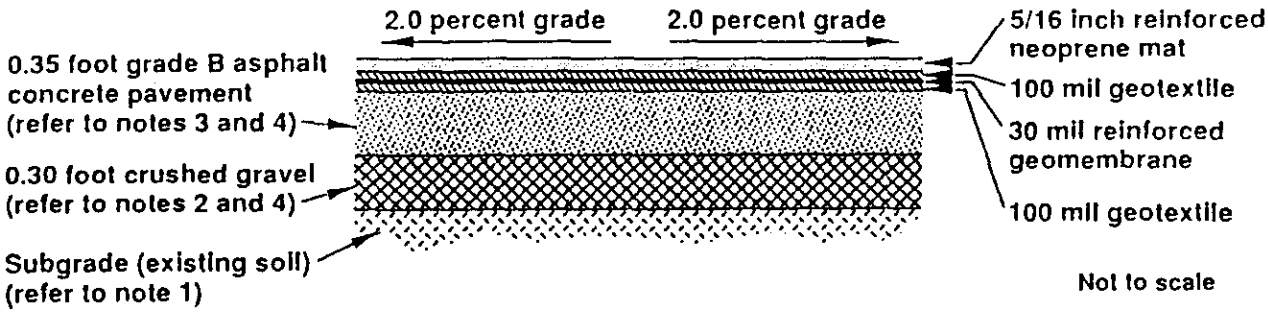
RO-PUMP P-8
RO-AV-01
RO-PI-01
5 Micron Cartridge Filter
RO-PI-02
RO-PHI-01
RO-FI-01
RO-CI-01
RO-SV-01
RO-FI-02
RO-CI-02
RO-TI-01
RO-LPS-01
RO-SV-02
RO-PUMP P-9
RO-V-11
RO-V-01
RO-HPS-01
RO-PI-03
RO-CP-01
RO-PI-04
RO-CV-01
RO-FI-03
RO-CI-03
RO-TI-02
RO-SC-03
RO-LPS-02
RO-PUMP P-10
RO-V-02
RO-HPS-02
RO-PI-06
RO-FI-05
RO-CI-05
RO-TI-04
RO-PI-07
RO-CV-02
RO-SC-05
RO-V-13
RO-PI-09
RO-PI-10
RO-PHI-02
RO-CI-07
RO-TI-06
RO-CV-03
RO-FI-08
RO-SC-07
RO-CV-04
RO-FI-07
RO-FI-06
RO-CI-06
RO-TI-05
RO-PI-08
RO-SV-06
RO-V-04
RO-FI-09
RO-CI-08
RO-TI-07
RO-PI-11
RO-SV-08
RO-V-05
RO-FI-04
RO-CI-04
RO-TI-03
RO-PI-05
RO-V-03
RO-SV-04
RO-CV-06
RO-FI-13
RO-CI-12
RO-TI-11
RO-PI-16
RO-SC-12
RO-V-10
RO-FI-11
RO-CI-10
RO-TI-09
RO-PI-15
RO-CV-05
RO-PI-13
RO-PI-17
RO-FI-14
RO-CI-13
RO-TI-12
RO-SV-13
RO-SC-10
RO-FI-15
RO-CI-14
RO-TI-13
RO-PIII-04
RO-SV-14
RO-V-14
2ND ARRAY
RO-FI-12
RO-CI-11
RO-TI-10
RO-SV-11
RO-PI-14
1ST ARRAY
RO-PI-12
RO-HPS-03
RO-V-08
RO-PUMP P-11
RO-LPS-03
RO-PHI-03
RO-FI-10
RO-CI-09
RO-TI-08
RO-SV-09
RO-V-12
RO-V-07
RO-CP-02
RO-V-09
2ND STAGE

KEY

RO = REVERSE OSMOSIS
AV = AUTOMATIC VALVE
PI = PRESSURE INDICATOR
PHI = pH INDICATOR
FI = FLOW INDICATOR
CI = CONDUCTIVITY INDICATOR
TI = TEMPERATURE INDICATOR
CV = CONTROL VALVE
V = VALVE
PUMP = PUMP
LPS = LOW PRESSURE SWITCH
HPS = HIGH PRESSURE SWITCH
SV = SAMPLE VALVE
CP = CLEANING PORT
SC = DUAL SAMPLE VALVE/ CLEANING PORT

NEW FIGURE 4-6 (BEING DRAFTED)

NOTE: FIGURE 4-7 ALSO BEING MODIFIED



Notes:

1. Prepare the subgrade per Washington State Department of Transportation (WSDOT) (ref. 1) Section 2-06.3(1).
2. Crushed surfacing will conform to WSDOT (ref. 1) Section 9-03.9.3 base course. Place and compact in accordance with Section 4-04.3(4) and 4-04.3(5).
3. The asphalt concrete pavement will be spread and finished in accordance with WSDOT (ref. 1) Sections 5-04.3(9) and 5-04.3(10).
4. Crushed surfacing and asphalt concrete pavement thicknesses meet the minimum required thicknesses for truck parking per reference 2.

References:

1. WSDOT 1991, "Standards and Specifications for Road Bridge and Municipal Construction", M41-10.
2. WSDOT 1988, "Design Manual", M22-01, June 1988. Appendix 1, Figure 326-3, p. 16.

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Figure 4-26. Cross-Section of the Portable Berm Components and the Berm Foundation.

Table 4-4. Control of Critical Parameters.
(sheet 3 of 6)

	Equipment location	Control parameter	Hazard	Control method(s)	Control device	Control setpoint	Alarm setpoint and response	Instrument Range	Expected Range	Accuracy
1 2 3 4	UV-vsl uv/ox reactor vessel	high pressure	vessel rupture followed by possible personnel injury and building or equipment contamination	bourdon tube type pressure indicator UV-pi-1	procedural control	15 psig	operator shuts down feed pump	0-30 psig	0-10 psig	±0.5 psig
5 6 7 8	UV-vsl uv/ox reactor vessel	high temperature	thermal stress on quartz sheaths and uv lamps resulting in breach of containment followed by personnel injury and building or equipment contamination	vendor installed temperature switch, alarm, and electrical interlock temperature indicator	temperature switches UV-TK-1,-2 for enclosure temperature and water temperature operator inspection	150 °F 150 °F	actuates visible alarm on module control panel and shuts down feed pump P-5 operator manually shuts down reactor	NA 0-200 °F	80-130 80-130	±5 °F ±5 °F
9 10 11 12	UV-vsl uv/ox reactor vessel	ultraviolet light	personnel exposure to intense uv light	uv filtration	uv filters on view ports	NA	NA	NA	NA	NA
13 14 15 16	UV-vsl uv/ox reactor vessel	ultraviolet light	personnel exposure to intense uv light	door closure	door closure limit switch UV-ls-1	NA	open door deactivates electric power to lamps	NA	NA	NA
17 18 19 20	LF. filtration module at LERF	high pressure	equipment rupture followed by possible personnel injury and equipment contamination	pressure switch shuts down feed pump	pressure switches LF-pi-1 LF-pi-2 LF-pi-3 LF-pi-6 LF-pi-7	150 psig	≥150 psig activates visible alarm and shuts down associated feed pumps	0-150 psig	0-130 psig	±5 psig

Table 4-4. Control of Critical Parameters.
(sheet 4 of 6)

Equipment location	Control parameter	Hazard	Control method(s)	Control device	Control setpoint	Alarm setpoint and response	Instrument Range	Expected Range	Accuracy
KF filtration at 1706-KE	high pressure	equipment rupture followed by possible personnel injury and equipment contamination	pressure relief	pressure relief valves	<150 psig	NA	0-150 psig	0-130 psig	±5 psig
RO reverse osmosis module	high pressure	equipment rupture followed by personnel injury and equipment or building contamination	vendor installed pressure switch shuts down feed pumps	pressure switch RO-hps-1, -2, -3 interlocked to feed pumps	600 psig	600 psig activates visible alarms, audible alarm KG-aa, and shuts down feed pumps P-8, P-9, and P-10	NA	0-550	±10 psig
RO reverse osmosis module	high pressure	equipment rupture followed by personnel injury and equipment or building contamination	procedural control	operator monitors system pressure indicators RO-pi-3, -6, and -12	600 psig	at pressure ≥600 psig operator shuts down feed pumps	0-1000	0-550	±25
PH-tk-1 pH adjustment tank	liquid level	waste water overflow resulting in equipment contamination	liquid level control	liquid level control loop consisting of conductivity type limit switch PH-ls and feed float control valve PH-cv	liquid level corresponding to 90% of tank volume	liquid level corresponding to 90% of tank volume activates high level visible alarm PH-lah, audible alarm KG-aa, and shuts down feed pump KU-pmp	NA	NA (tank levels described in Section 4.1.5.1)	±0.1 inch

APPENDIX 5A

WASTE WATER PILOT PLANT INSPECTION PLAN

During operation of the waste water pilot plant, inspections will be performed daily on containment systems and selected emergency equipment; weekly on emergency equipment, air monitoring equipment, and satellite accumulation areas; and monthly on selected emergency, ventilation, and process equipment. At times only part of the plant will be operating. At those times, only the required inspections will be performed. The plant status will be noted in the facility logbook.

Inspections associated with filtration pilot plant will be performed at the LERF basins. As long as waste is being stored or processed, daily inspections will be required per WAC 173-303-640. If waste is not present in the facility, then inspections will not be required. Other inspections will be performed as required to ensure the test equipment will operate safely.

Inspection Documentation. The daily, weekly, and monthly inspections will be documented on checklists. The inspector will sign the checklist, print their name, and record the date of the inspection. The checklists will be maintained at the facility in an Inspection Checklist Logbook. If discrepancies are noted on the checklist, a detailed description of the problem will be written on a Discrepancy Data Sheet. A separate notebook will be maintained for the Discrepancy Data Sheets. A note referencing the Discrepancy Data Sheet will be added to the facility operating logbook. The reference will be carried on each daily entry in the operating logbook until the discrepancy is resolved. The resolution to the discrepancy will be noted on the Discrepancy Data Sheet. The facility cognizant engineer will be responsible for determining if the problem is significant enough to warrant shutting down the plant.

The checklists have a column for titled "NA" which will be checked if that particular inspection is not warranted due to plant status. For example, if the feed tanker is not storing waste at the plant no inspection of the secondary containment leak detector is required.

Daily Inspections. Items to be inspected or monitored daily include containment systems and areas subject to spills, overfill and spill protection instruments, mechanical joints on waste transfer lines, and some emergency equipment. The process data collected will also be reviewed each day. All non-data logger critical parameters will be recorded and reviewed daily. A daily inspection checklist has been included in this appendix.

Weekly Inspections. Items to be inspected weekly include emergency equipment, hazard communication labels, and the ventilation system organic gas analyzer. The satellite accumulation area will also be inspected weekly. A weekly inspection checklist has been included in this appendix.

Table 5B-1. Maintenance Schedule.
(sheet 2 of 3)

	Equipment number	Type	Function	Maintenance requirement
1	UV-ps	Safety	Senses high pressure in the UV reactor and shuts power off to the pump if operating limits are exceeded.	No maintenance required.
2	UV-pi	Safety	Monitors pressure on UV reactor feed pump discharge.	No maintenance required.
3	UV-TK-1,2	Safety	Senses high temperature in the UV reactor and shuts of power.	No maintenance required.
4	UV-ls-1	Safety	Cuts off power to UV reactor if vessel door is opened while operating.	Functional test every 6 months.
5	UV-ti-2	Safety	Indicates temperature of reactor water effluent.	No maintenance required.
6	LF-ps	Safety	Cuts off power to LERF feed pump if discharge pressure exceeds operating limits.	Visual inspection every 6 months during functional test. No maintenance required.
7 8	RO-hps-1, 2, 3	Safety	Receives signals from pressure indicators and cuts off power to RO feed pump if discharge pressure exceeds operating limits.	Visual inspection every 6 months during functional test. No maintenance required.
9 10	RO-pi-1 through 12	Safety	Monitors feed RO feed pump discharges.	No maintenance required.
11	PH-ls	Process	Sends a signal to the control valve to shut off flow pH tank liquid level is too high.	Visual inspection with functional test every 3 months. No maintenance required.
12	PH-lah	Safety	Energizes a visible alarm light when liquid level in the pH tank is too high.	Visual inspection. Verify bulb has not been burned out. Maintenance to be performed with PH-ls every 3 months.

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Table 5B-2. Calibration Schedule.
(sheet 1 of 3)

Equipment number	Type	Function	Calibration requirement
KU-1de	Safety	When moisture is detected in the unload pump catch tank, it sends a signal to the leak detection switch.	Functional test every 3 months, no calibration required.
KU-1ds	Safety	When activated by a signal from the leak detector, shuts the transfer pump off.	Functional test with KU-1de every 3 months, no calibration required.
KU-1ah	Safety	Activates alarm light when the leak detector detects liquid in the secondary containment.	Functional test with KU-1de every 3 months, no calibration required.
KG-aa	Safety	Sends an audible signal when there is a problem in the pilot plant facility.	Functional test every 3 months, no calibration required.
UV-fk-1	Safety	Senses flow in the vent line from the rupture, and shuts off power to the unit.	Functional test every 6 months.
UV-ps	Safety	Senses high pressure in the UV reactor and shuts power off to the pump if operating limits are exceeded.	Functional check using line pressure every 6 months.
UV-pi	Safety	Monitors pressure on UV reactor feed pump discharge.	Vendor calibrated. No calibration required.
UV-TK-1,2	Safety	Senses high temperature in the UV reactor and shuts of power.	Functional check every 6 months by immersing the sensors in 150 degree water bath. Frequency: Every 6 months.

Table 5B-2. Calibration Schedule.
(sheet 2 of 3)

	Equipment number	Type	Function	Calibration requirement
1	UV-ti-2	Safety	Indicates temperature of reactor water effluent.	Multipoint calibration against a certified temperature indicator, or, replace with a calibrated temperature indicator. Frequency: every 6 months.
2	LF-ps	Safety	Cuts off power to LERF feed pump if discharge pressure exceeds operating limits.	Functional test every 6 months.
3	RO-hps-1,2	Safety	Receives signals from pressure indicators and cuts off power to RO feed pump if discharge pressure exceeds operating limits.	Functional test every 6 months.
4 5	RO-pi-3, 6, 12	Safety	Monitors RO high-pressure feed pump discharges.	Multipoint calibration against a certified pressure indicator, or, replace with calibrated pressure indicator(s). Frequency: Every 6 months.
6	PH-ls	Process	Sends a signal to the control valve to shut off flow, pH tank liquid level is too high.	Functional test every 3 months.
7	PH-lah	Safety	Energizes a visible alarm light when liquid level in the pH tank is too high.	Functional test with PH-ls every 3 months.
8	VV-hepa	Safety	Removes particulates from vent stream.	DOP test annually.

Table 5B-3. Critical Equipment List.
(sheet 1 of 2)

Equipment number	Unit operation	Item description
TT-tk-1,2	waste transfer	trailer tanks
TT-pr-1,2	waste transfer	rupture disk on trailer tanks
TT-hv-1,2	waste transfer	vent valves on trailer tanks
TT-vr-1,2	waste transfer	vacuum relief devices on trailer tanks
LL-cb	waste load/unload	catch basin at LERF
KU-cb-1	waste unload	inflatable berm at 1706-KE unload station
KU-cb-2	waste unload	catch tank under unload pump at 1706-KE
KU-lde	waste unload	leak detector element for unload pump catch tank at 1706-KE
KU-lds	waste unload	leak detector switch for unload pump catch tank at 1706-KE
KU-lah	waste unload	visible alarm for high level in unload pump catch tank at 1706-KE
KG-aa	several	general audible alarm at 1706-KE
KL-cb	waste load	inflatable berm 1706-KE load station
UV-pr	uv/ox	rupture disk on reactor vessel
UV-fk-1	uv/ox	flow switch on vent line
UV-ps	uv/ox	pressure switch on feed pump discharge
UV-pi-1	uv/ox	pressure indicator on feed pump discharge
UV-TK-1,2	uv/ox	high temperature switches on reactor vessel
UV-ti-2	uv/ox	Indicates temperature of reactor water effluent.
UV-ls-1	uv/ox	limit switch on reactor vessel door

Table 5B-3. Critical Equipment List.
(sheet 2 of 2)

	Equipment number	Unit operation	Item description
1	LF-ps	LERF filtration	high-pressure switch on feed pump discharge
2	RO-hps-1,2,3	reverse osmosis	high-pressure switches on feed pump discharges
3	RO-pi-3, 6, 12	reverse osmosis	pressure indicators on feed pump discharges
4	PH-ls	pH adjustment	limit switch on pH adjustment tank liquid level
5	PH-cv	pH adjustment	control valve on waste water feed line
6	PH-lah	pH adjustment	high-liquid level visible alarm
7	VV-hepa	vessel vent	HEPA filters for the 1706-KE vessel ventilation system
8	VV-dpis	vessel vent	differential pressure indicating switch for 1706-KE HEPA filters
9	VV-dpah	vessel vent	high differential pressure visible alarm for 1706-KE HEPA filters
10	VV-dpal	vessel vent	low differential pressure visible alarm for 1706-KE HEPA filters
11	VV-ps	vessel vent	low pressure switch for vessel vent header
12	VV-pal	vessel vent	low pressure visible alarm for 1706-KE vessel vent header
13			