State of Washington Department of Ecology

Cruise Ship Memorandum of Understanding, Cruise Operations in Washington State Inspection Report

Northwest Regional Office
3190 160th Ave SE
Bellevue, WA 98008
Phone: (425) 649-7000 Fax: (425) 649-7098

Section A: General Information

Vessel Name:	PACIFIC PRINCESS	Date:	July 9, 2009
Vessel Operator:	Princess Cruises	Entry Time:	9:29 AM
Vessel Type:	Passenger Ship	Exit Time:	11:09 AM
Location:	Terminal 91, Seattle	Notification (name & date):	D. Hutchinson on July 2, 2009
On-board contact(s):	Mike Hennessy, Environmental Officer; Pino Budisa, Senior First Engineer		
Inspector(s):	Amy Jankowiak, Department of Ecology, Water Quality Program		
# passengers/crew:	Actual: ~630 passenger/ ~340 crew		

The PACIFIC PRINCESS arrived on May 14, 2009 at the Port of Seattle to begin the 2009 cruise season for 14 day cruises through mid-September. The vessel uses a Hamworthy biological membrane reactor and ultrafiltration system for treatment of black and gray water. The system includes screening via a screen press, biological treatment via bio-reactors with inter-stage filters and a membrane system, and ultraviolet light disinfection. The vessel is not approved for discharge in MOU waters and has been holding effluent and not discharging in MOU waters since the beginning of the season.

Section B: Areas Evaluated

☒	Black/Gray wastewater system	☒	Residual solids	☒	Records/Reports	☒	Hazardous Waste/Solid Waste	☒	Sampling/ Monitoring
☒	Discharge locations	☒	Operations & Maintenance	☒	Sludge Handling/ Disposal	☒	Oily bilge water	☒	Other

Section C: For vessels discharging ≥ 1nm from berth and ≥ 6 knots only [2.1.3(A)]

☐	Schematics match black/gray wastewater system	Not Applicable
☐	Operations as described in submitted documentation	Not Applicable
☐	Daily 24-hour continuous monitoring for turbidity or equivalent monitoring	Not Applicable
☐	Turbidimeter or equivalent monitoring equipment functioning properly	Not Applicable
☐	Auto shut down or operational controls to insure system shut down if high turbidity occurs	Not Applicable
	Turbidity or equivalent : Last calibration Trigger level for early alarm: Trigger level for shutdown: Recorded turbidity/equivalent levels above triggers:	
☐	Daily 24-hour continuous monitoring for disinfection effectiveness	Not Applicable
☐	Disinfection effectiveness monitoring equipment functioning properly	Not Applicable
	Disinfection Effectiveness Monitoring:	
☐	Auto shut down or operational controls to insure system shut down if disinfection system upset occurs	Not Applicable
☐	Disinfection system operated and maintained properly	Not Applicable
	Disinfection System:	

Section D: For vessels discharging continuously [2.1.3(B)]		
☐	Schematics match black/gray wastewater system	Not Applicable
☐	Operations as described in submitted documentation	Not Applicable
☐	Daily 24-hour continuous turbidity or equivalent monitoring	Not Applicable
☐	Turbidimeter or equivalent monitoring equipment functioning properly	Not Applicable
☐	Auto shut down or operational controls to insure system shut down if a high turbidity occurs	Not Applicable
	Turbidity or equivalent : Last calibration Trigger level for early alarm: Trigger level for shutdown: Recorded turbidity/equivalent levels above triggers:	
☐	Daily 24-hour continuous monitoring for disinfection effectiveness	Not Applicable
☐	Disinfection effectiveness monitoring equipment functioning properly	Not Applicable
	Disinfection Effectiveness Monitoring:	
☐	Auto shut down or operational controls to insure system shut down if disinfection system upset occurs	Not Applicable
☐	Disinfection system operated and maintained properly	Not Applicable
☐	Disinfection immediately prior to discharge	Not Applicable
	Disinfection System:	

Section E: General (Approved to Discharge)		
☐	No discharges within ½ mile from shellfish beds/protocol (President's Point, Apple Tree Cove, Tyee Shoal)	Not Applicable
☐	Discharges immediately stopped when high turbidity occurs	Not Applicable
☐	Discharges immediately stopped when disinfection system upset occurs	Not Applicable
☐	Immediate notifications made to Health for disinfection system upset	Not Applicable
☐	Sampling conducted 2/month, 1/month in Seattle (BOD, TSS, fecal coliform, pH, chlorine residual)	Not Applicable
☐	Whole Effluent Toxicity Testing 1 per 2 years (homeported) or once/40 calls for continuous	Not Applicable

Section F: General		
☒	Discharge records review	Discharge records were reviewed (blackwater/graywater/residual solids) and are maintained properly. No discharges in MOU waters were present from the beginning of the 2008 cruise season to present.
☒	Residual solids managed properly/ disposal protocol per MOU	Residual solids are either incinerated or held to be discharged at greater than 12 nautical miles and outside of MOU waters and the Olympic Coast National Marine Sanctuary.
☒	Hazardous Waste managed properly	All hazardous waste that is collected is being sent off-shore in Victoria, Canada. Records were reviewed for hazardous waste discharges.
☒	WA Haz Waste guidelines followed (appendix vii)	All hazardous waste that is collected is being sent off-shore in Victoria, Canada. Records were reviewed for hazardous waste discharges.
☒	Solid Waste managed properly	Solid waste is being managed properly. The various solid waste streams are collected, sorted, stored, and sent ashore or incinerated as appropriate. Records were reviewed for garbage off-loads.
☒	Oily bilge water managed properly	Oily bilge water is treated and discharged at less than 15 ppm and outside of MOU waters.
Other:		

Health = Washington State Department of Health

Section G: Sample Results

Parameter	Results
Biochemical Oxygen Demand 5-Day (BOD)	Not Applicable
Total Suspended Solids (TSS)	Not Applicable
Fecal Coliform	Not Applicable
Residual Chlorine	Not Applicable
pH	Not Applicable
Ammonia, Nitrogen	Not Applicable

Section H: Summary of Findings/Comments

Introduction

Amy Jankowiak, Washington State Department of Ecology (Ecology) Northwest Regional Office, Water Quality Program (NWRO-WQ) conducted the inspection of the Princess Cruises PACIFIC PRINCESS on July 9, 2009. The main contacts on board the PACIFIC PRINCESS included Mike Hennessy, Environmental Officer, and Pino Budisa, Senior First Engineer. Prior notification of the visit was given on July 2, 2008 for security protocol. The purpose of the inspection was to evaluate compliance with the *Memorandum of Understanding Cruise Operations in Washington State* (MOU), as amended. A copy of the current MOU was on-board. The PACIFIC PRINCESS is not approved to discharge in MOU waters. The vessel has not been discharging and is holding effluent until outside MOU waters.

The PACIFIC PRINCESS was placed into service in 1971 (has changed names/ownership since), and is 168.8 meters long.

Inspection

I arrived and boarded the ship (photo #01) at about 9:29 am and began with introductions and a plan for the day with Mike Hennessy, the Environmental Officer. Mr. Hennessy has been an Environmental Officer for about 18 months and has been on the PACIFIC PRINCES for about three months. We then discussed various waste streams, and the discharge protocols. Pino Budisa, Senior First Engineer is the operator of the black water and gray water Hamworthy system (two years of experience in this position). Mr. Budisa joined us for a more detailed discussion of the Hamworthy system. We then toured the garbage and recycling area and then reviewed records including those for blackwater and graywater discharges and hazardous waste off-loads, as well as garbage and oil sludge. Next, we viewed the Hamworthy system and the oily bilge system. We finished the inspection on the bridge with a review of the electronic navigation and tracking system. The inspection was then finalized with a debriefing and I disembarked the vessel at about 11:09 am.

Discharge Types and Protocols:

If the vessel is in an area where a discharge is allowed, the Bridge notifies the staff in the Engine Control Room (ECR). The Watchkeepers have the authority to then discharge and have "key" access for the overboard ports (photos #11 and #12). For blackwater and graywater, the latitude and longitude coordinates are recorded in the *Sewage and Graywater Discharge Record Book* and in the deck log. The date, time and location of both the start and the stop of the discharges are recorded, along with port location, effluent type, and volumes. All discharge records that were reviewed appeared to be in compliance with the MOU and also did not occur in MOU waters.

Blackwater, which includes toilet waste (and the medical drains) and graywater which includes sink and shower water is treated with a Hamworthy advanced wastewater treatment system and is currently discharged outside of MOU waters. The vessel has the capacity to hold a discharge for about three days. Laundry water and galley water is collected separately and held for discharge outside of MOU waters.

Screenings and grit from the Hamworthy system are collected and incinerated. The solids separated out by the bioreactors is discharged outside of MOU waters, >12 nautical miles from shore, and outside of the Olympic Coast National Marine Sanctuary..

Pool and spa water is discharged outside of 12 nautical miles. Spa water no longer has to be emptied overboard every 24 hours. The water can now be shocked when in a location close to shore.

Food waste is collected in various locations, is sent through a pulper. The water is recirculated and eventually held and discharged outside of MOU waters. The solid food material from the pulpers is discharged outside of 12 nautical miles and outside MOU waters. Cooking oil (photo #04) and grease, is collected and recycled for biodiesel.

Oily bilge water is treated with an oily water separator (photo #09) and discharged at less than 15 ppm after first going through a white box (photo #10) for monitoring.

Potable water is bunkered now and then, while the rest is produced by desalination. The water is chlorinated and pH is adjusted.

The vessel does not offer traditional chemical dry cleaning, only a delicate wet-cleaning detergent. Other hazardous wastes (photo #07) include chemicals, refrigeration oils, printer cartridges, paints, oil filters, batteries, bulbs (no crusher on board), sludge oil, aerosols (punctured), and sharps. Silver is captured from the photo and x-ray waste, and is treated to less than 5 ppm. All hazardous waste is off-loaded in Victoria. Expired medications are logged and sent ashore. Controlled drugs are incinerated with witnesses. Most oily rags are incinerated along with materials such as paper, cardboard, and some plastics (photo #08).

Plastics, garbage, and other materials are collected and sorted (photo #03) on a sorting table. Most materials are then condensed (photos #02 and #05) and recycled on-shore. Glass, aluminum (photo #06), tin, and plastics are all recycled along with other materials.

An electronic navigational tracking system (photo #23) is used on the vessel. The location of every discharge beginning and ending is recorded in the system as well as noted by paper log. This system allows for looking back at where any discharge took place as was done for one such discharge during the inspection. The discharges took place outside of MOU waters.

Black water and Gray water System:
The Hamworthy system consists of two separate membrane bioreactors (MBRs). Both MBRs are typically run at the same time, although one of the MBRs can go off-line for maintenance. Black water, which includes toilet waste and the medical drains is collected by vacuum to one of two collection tanks and then combines with gray water which includes sink and shower water and has been piped to one of five collection tanks. Combined gray and black water flow moves to the screen press (photo #15). The solids are screened into bags (photo #16) and are then sent to the incinerator. The liquid moves to the 1st stage (photo #17) of the membrane bioreactor where aeration occurs. Two types of "good" bacteria are also injected. From the 1st stage, flow moves to the inter-stage filters (photo #18). The inter-stage filtered solids are returned back to the screen press. The liquid moves onto the 2nd stage (photo #19) of the MBR for further aeration. From the 2nd stage MBR, flow is sent to the membrane modules (photo #20) for ultrafiltration. Effluent from the MBR's is approximately 1% solids. Effluent from the membrane modules are sent to a permeate tank (photo #14) where turbidity is monitored. Flow then combines with the other two MBR's for ultraviolet (UV) disinfection (photo #21). Disinfected effluent either goes directly overboard or to a holding tank if not in an approved area for discharge. The held effluent will eventually go back through the entire Hamworthy system before discharge. Currently, effluent is held and discharged outside of MOU waters. There is a sample port for treated effluent after UV disinfection (photo #22).

Turbidity is measured continuously on each of the MBR permeate tanks (photo #13). The meters are alarmed to automatically shutdown at 20 NTU maximum. The UV system consists of 6 bulbs which are alarmed. If the bulbs fail or the power goes out, the discharge automatically stops. At least two sets of spare bulbs are typically available on board. The filters for the interstage filters are replaced about every ten days. The maintenance system provides details of when all maintenance is needed. Representatives from Hamworthy visit the ship about once every six months.

The staff have a small laboratory on board where they sample for such parameters as pH, total and free chlorine, total suspended solids (TSS), e-coli, fecal coliform, and ammonia. Most parameters are tested daily, with the exception of TSS and coliforms which are every other day. The on-board sampling allows for immediate results and a chance for immediate corrections to the system.

If a non-compliance with the MOU occurs, the protocol is for the Environmental Officer to notify their head office, who then directs the local authority contacting. The Environmental Officer would also file an incident report to the head office.

Conclusions and Recommendations

It is recommended that staff continue to work towards high functioning wastewater treatment systems. The staff on board the vessel were very knowledgeable of the systems and protocols.

The laboratory testing on-board is an excellent way to monitor and make needed adjustments to the system. Having a laboratory on-board for the testing is ideal.

Attachments:
Photographs

Copies to:
Andrew Lorenzana, Princess Cruises
Mike Hennessy, Environmental Officer
Amy Jankowiak, Ecology
Karen Burgess, Ecology
Mark Toy, Health
Kevin Fitzpatrick, Ecology
Central Files: Princess Cruises – PACIFIC PRINCESS; WQ 6.1

Section I: Signatures		
Name and Signature of Inspector Amy Jankowiak	Agency/Office/Telephone Department of Ecology/Northwest Regional Office/Water Quality Program/Municipal Compliance Specialist/(425) 649-7195	Date 7/13/09
Name and Signature of Reviewer Karen Burgess	Agency/Office/Telephone Department of Ecology/Northwest Regional Office/Water Quality Section Manager/(425) 649-7207	Date 7/16/09
Name and Signature of Reviewer Kevin C. Fitzpatrick	Agency/Office/Telephone Department of Ecology/Northwest Regional Office/Water Quality Section Manager/(425) 649-7033	Date 7/16/09

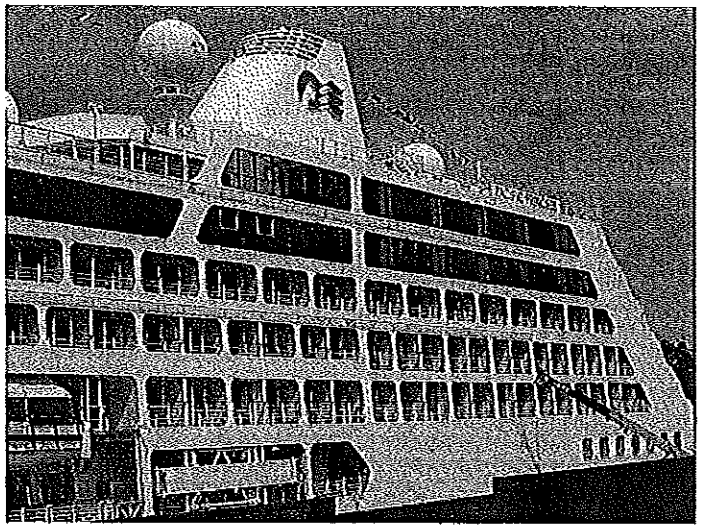

PHOTO #:01 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P7090028
DESCRIPTION: PACIFIC PRINCESS VESSEL, SEATTLE

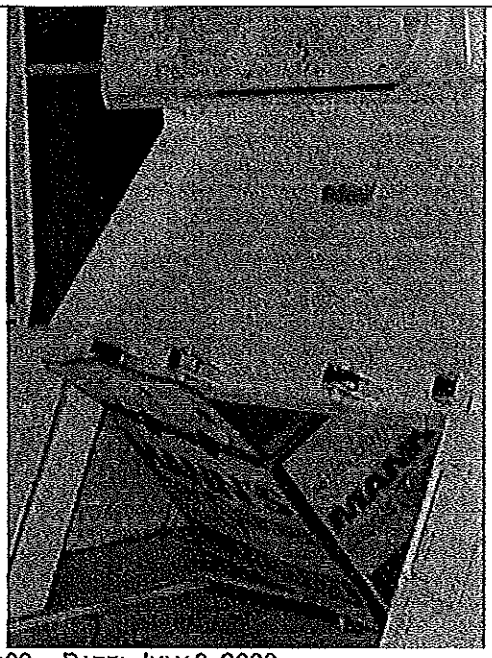

PHOTO #:02 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7090005
DESCRIPTION: GARBAGE/RECYCLING ROOM – CARDBOARD COMPACTOR

PHOTO #:03 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7090006
DESCRIPTION: GARBAGE/RECYCLING ROOM – SORTING AREA

PHOTO #:04 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7090007
DESCRIPTION: GARBAGE/RECYCLING ROOM – USED COOKING OIL

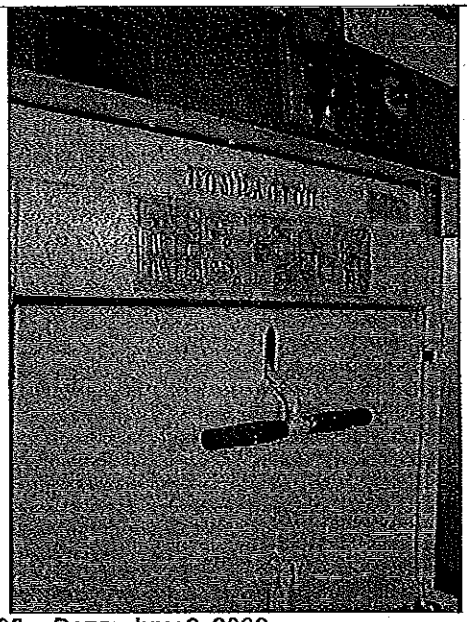

PHOTO #:05 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P7090008
DESCRIPTION: GARBAGE/RECYCLING ROOM – COMPACTOR

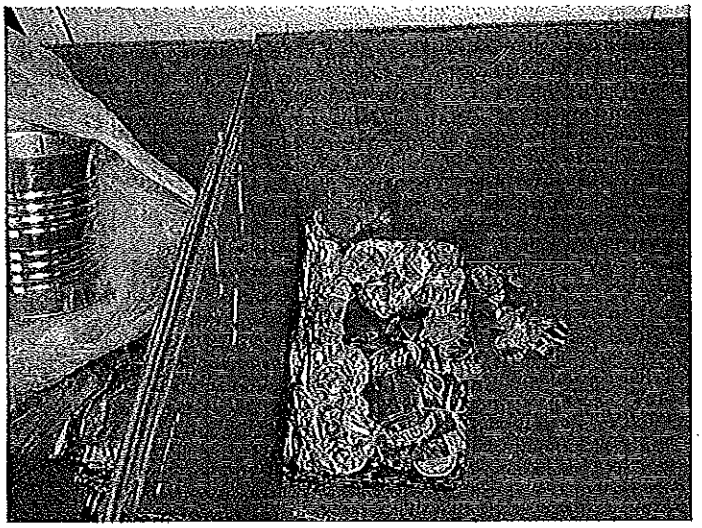

PHOTO #:06 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7090009
DESCRIPTION: GARBAGE/RECYCLING ROOM –ALUMINUM/TIN

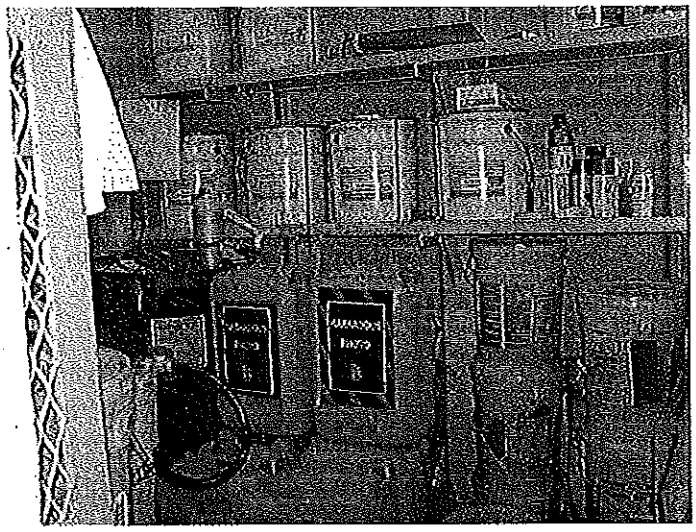

PHOTO #:07 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7090010
DESCRIPTION: HAZARDOUS WASTE STORAGE

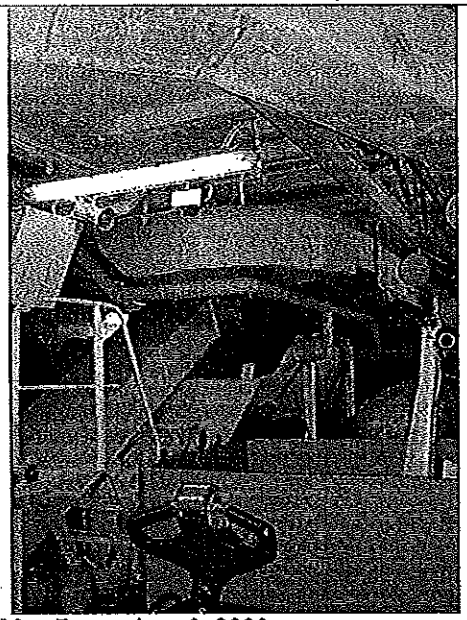

PHOTO #:08 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7090011
DESCRIPTION: GARBAGE/RECYCLING ROOM –MATERIAL TO INCINERATOR

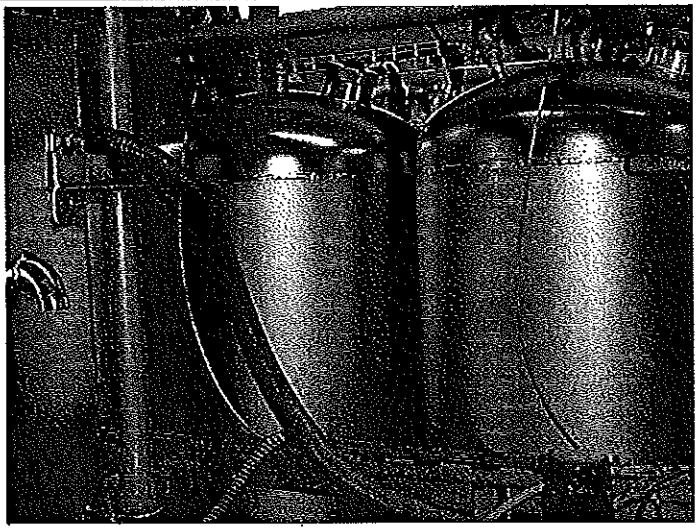

PHOTO #:09 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P7090013
DESCRIPTION: OIL/WATER SEPARATOR

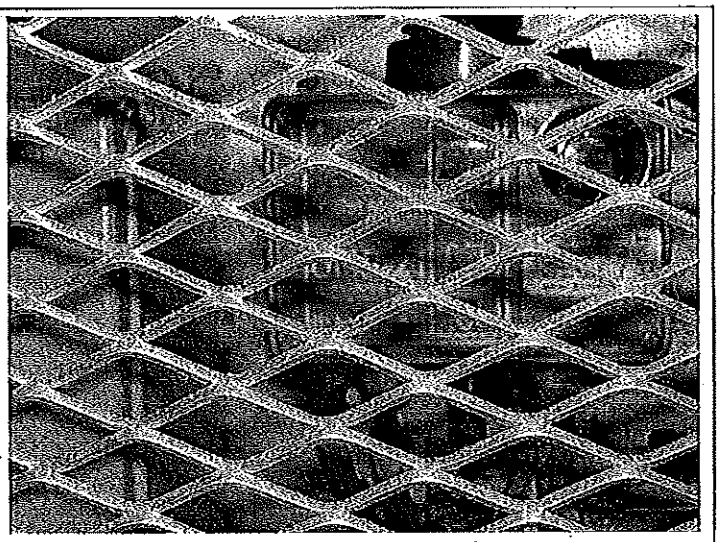

PHOTO #:10 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7090012
DESCRIPTION: OIL/WATER SEPARATOR WHITE BOX

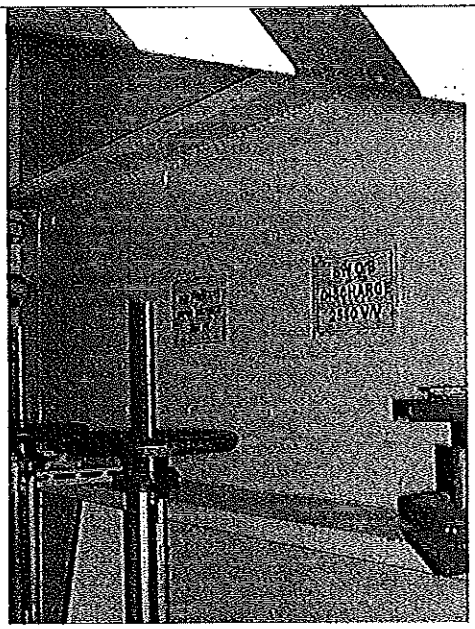

PHOTO #:11 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7090014
DESCRIPTION: BLACKWATER/GRAYWATER OVERBOARD DISCHARGE PORTS

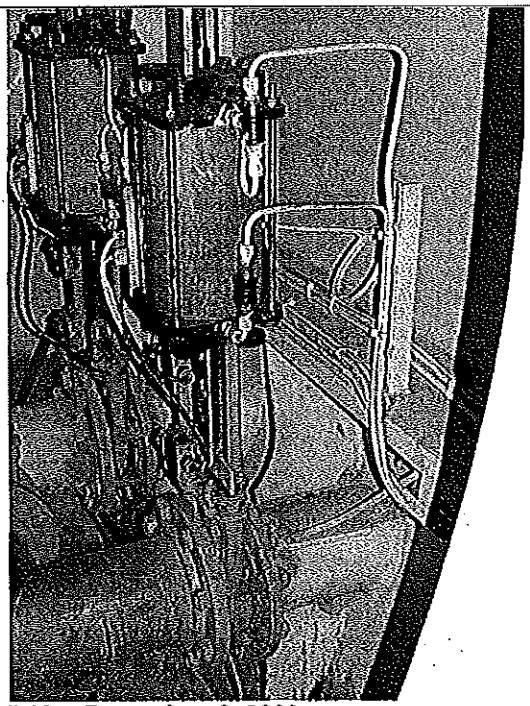

PHOTO #:12 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7090015
DESCRIPTION: BLACKWATER/GRAYWATER OVERBOARD DISCHARGE PORTS

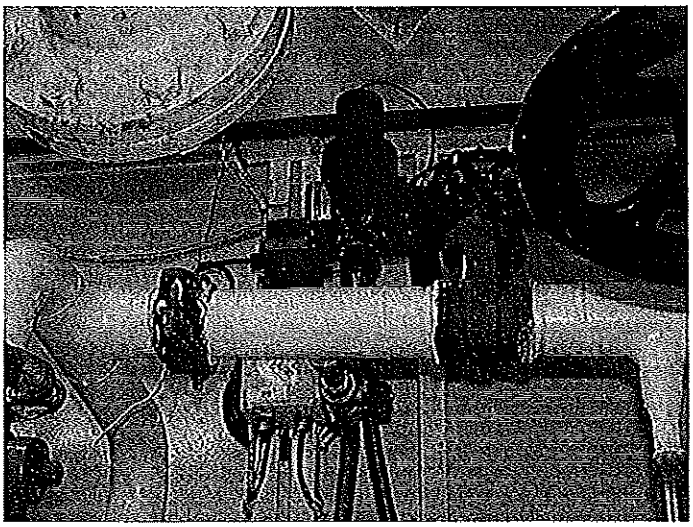

PHOTO #:13 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P7090016
DESCRIPTION: MBR - TURBIDIMETER

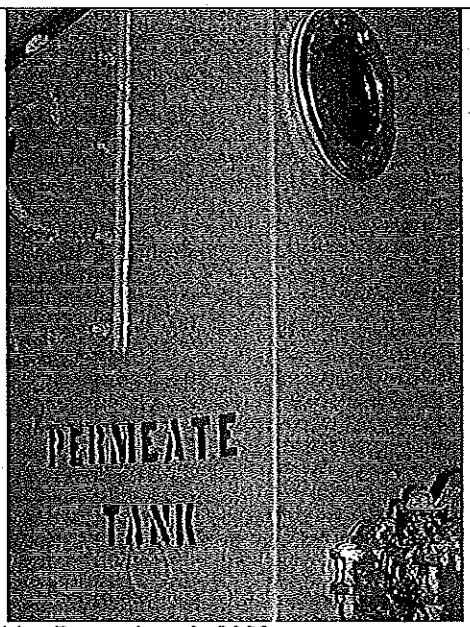

PHOTO #:14 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7090017
DESCRIPTION: MBR - PERMEATE TANK

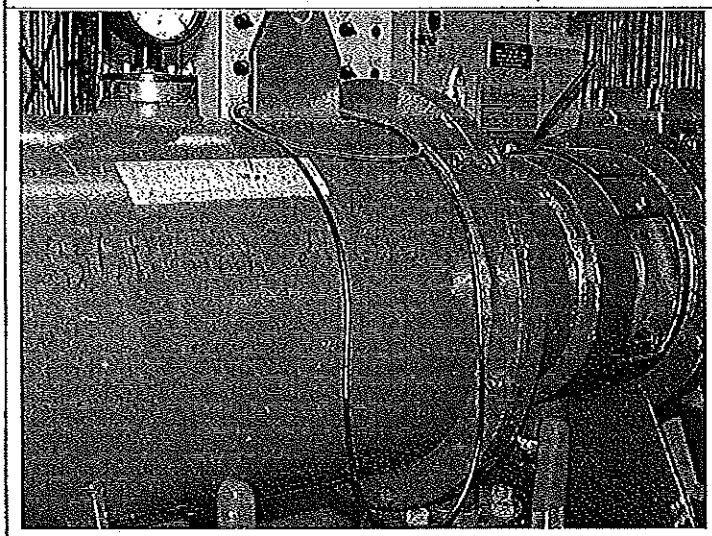

PHOTO #:15 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7090018
DESCRIPTION: MBR - SCREEN PRESS

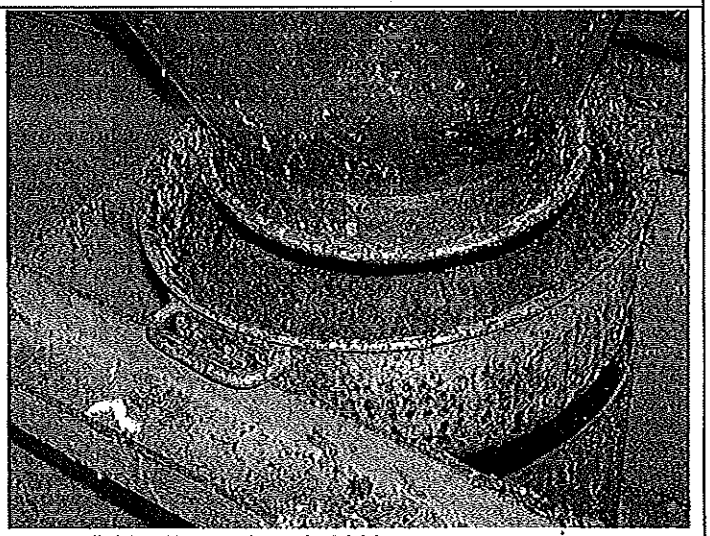

PHOTO #:16 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7090019
DESCRIPTION: MBR- SCREEN PRESS SCREENINGS

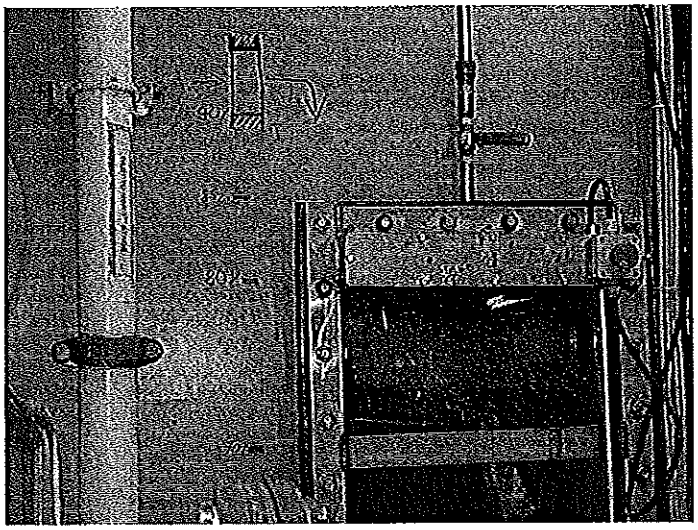

PHOTO #:17 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P7090020
DESCRIPTION: MBR – 1ST STAGE

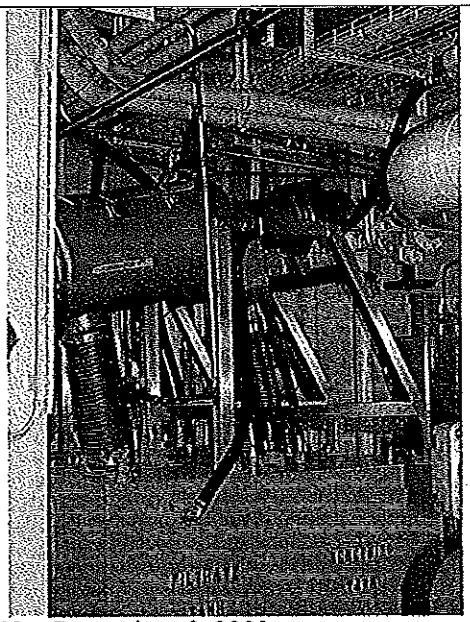

PHOTO #:18 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7090021
DESCRIPTION: MBR – INTERSTAGE FILTERS

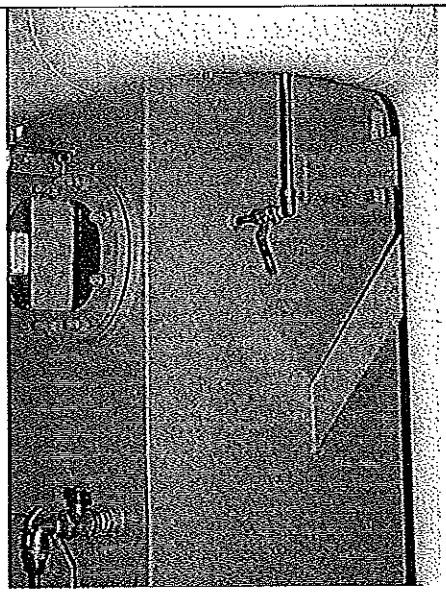

PHOTO #:19 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7090022
DESCRIPTION: MBR – 2ND STAGE

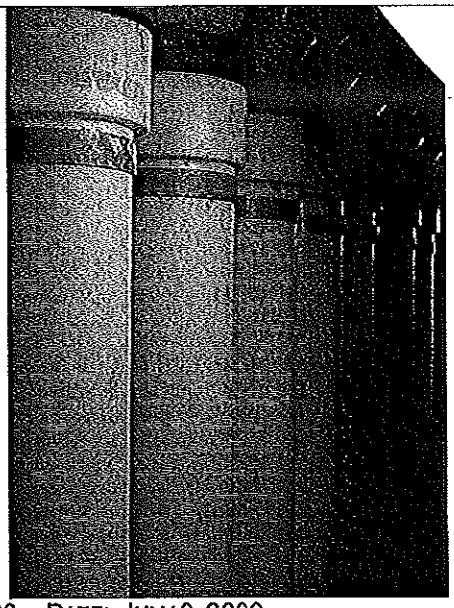

PHOTO #:20 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7090023
DESCRIPTION: MBR - FILTERS

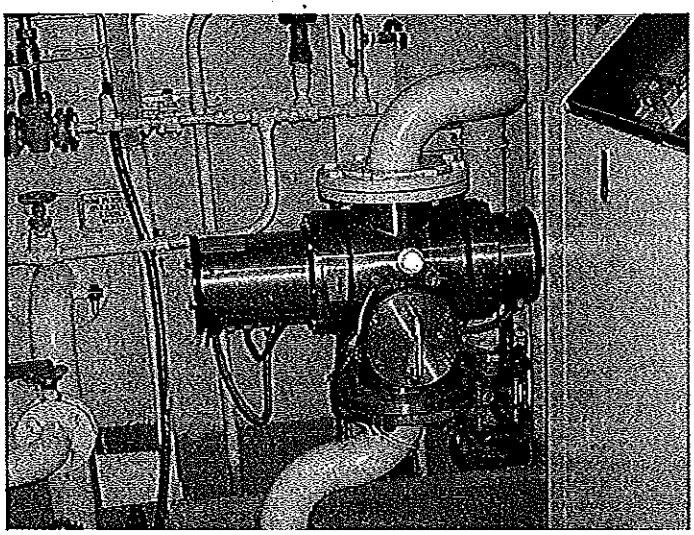

PHOTO #:21 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P7090025
DESCRIPTION: MBR – ULTRAVIOLET LIGHT DISINFECTION SYSTEM

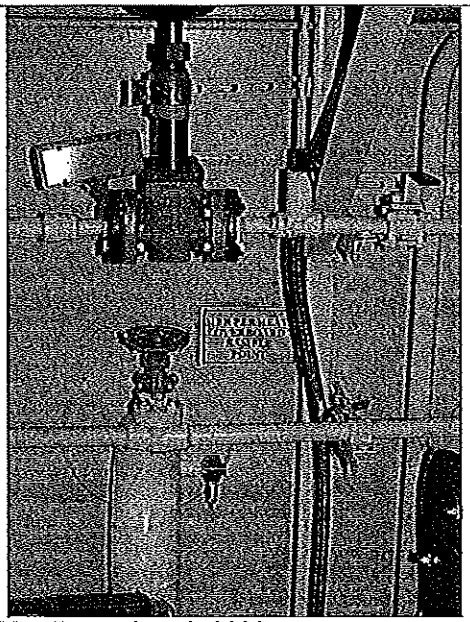

PHOTO #:22 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7090026
DESCRIPTION: MBR – OVERBOARD SAMPLE PORT

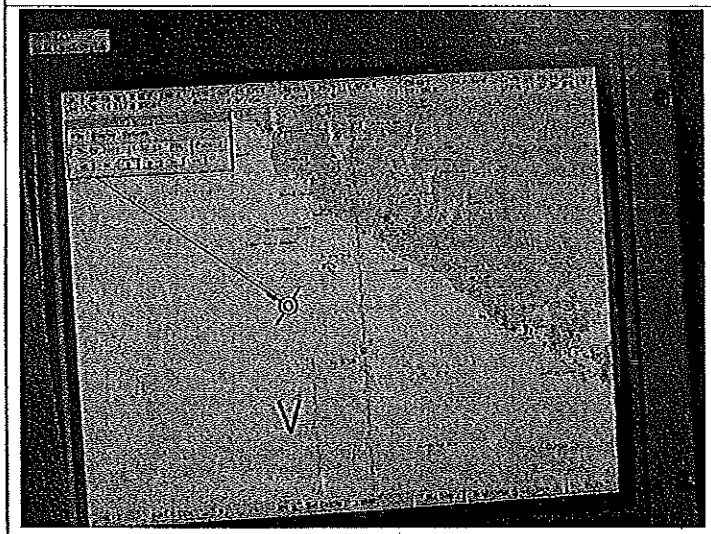

PHOTO #:23 DATE: JULY 9, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7090027
DESCRIPTION: BRIDGE - NAVIGATION/TRACKING SYSTEM

State of Washington Department of Ecology

Cruise Ship Memorandum of Understanding, Cruise Operations in Washington State Inspection Report

Northwest Regional Office
3190 160th Ave SE
Bellevue, WA 98008
Phone: (425) 649-7000 Fax: (425) 649-7098

Section A: General Information

Vessel Name:	NORWEGIAN PEARL	Date:	July 19, 2009
Vessel Operator:	Norwegian Cruise Line	Entry Time:	9:20 AM
Vessel Type:	Passenger Vessel	Exit Time:	11:28 AM
Location:	Pier 66, Seattle	Notification (name & date):	Randy Flebrandt, July 13, 2009
On-board contact(s):	Spyridon (Spiros) Zervopolous, Environmental Officer; Roselo Septin, 3rd Engineer/Environmental Engineer		
Inspector(s):	Amy Jankowiak, Department of Ecology, Water Quality Program		
# passengers/crew:	~3000/~1100		

The NORWEGIAN PEARL arrived on May 10, 2009 at the Port of Seattle to begin the 2009 cruise season. Black/Gray water is treated with the Scanship System, a biological reactor and ultrafiltration system. The system includes prefiltration, biological treatment via a biofilm process, chemical precipitation, clarification through flotation tanks, polishing filtration and UV disinfection. Approval for continuous discharge from Ecology was granted in 2007 and May 5, 2009.

Section B: Areas Evaluated

☒	Black/Gray wastewater system	☒	Residual solids	☒	Records/Reports	☒	Hazardous Waste/Solid Waste	☒	Sampling/ Monitoring
☒	Discharge locations	☒	Operations & Maintenance	☒	Sludge Handling/ Disposal	☒	Oily bilge water	☒	Other

Section C: For vessels discharging ≥ 1nm from berth and ≥ 6 knots only [2.1.3(A)]

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☐	Operations as described in submitted documentation	NOT APPLICABLE
☐	Daily 24-hour continuous monitoring for turbidity or equivalent monitoring	NOT APPLICABLE
☐	Turbidimeter or equivalent monitoring equipment functioning properly	NOT APPLICABLE
☐	Auto shut down or operational controls to insure system shut down if high turbidity occurs	NOT APPLICABLE
	Turbidity or equivalent : Last calibration Trigger level for early alarm: Trigger level for shutdown: Recorded turbidity/equivalent levels above triggers:	
☐	Daily 24-hour continuous monitoring for disinfection effectiveness	NOT APPLICABLE
☐	Disinfection effectiveness monitoring equipment functioning properly	NOT APPLICABLE
	Disinfection Effectiveness Monitoring:	
☐	Auto shut down or operational controls to insure system shut down if disinfection system upset occurs	NOT APPLICABLE
☐	Disinfection system operated and maintained properly	NOT APPLICABLE
	Disinfection System:	

Section D: For vessels discharging continuously [2.1.3(B)]		
☒	Schematics match black/gray wastewater system	Schematics appeared to be consistent with they system on board.
☒	Operations as described in submitted documentation	Operations were as described.
☒	Daily 24-hour continuous turbidity or equivalent monitoring	Has continuous TSS monitoring.
☒	Turbidimeter or equivalent monitoring equipment functioning properly	Appears to be functioning properly. At the time of the inspection the TSS was 2.30 mg/l.
☒	Auto shut down or operational controls to insure system shut down if a high turbidity occurs	A value of 28 mg/l or greater triggers to hold and 30 mg/l for automatic shut down of discharge and recirculation back to mixing tank.
	Turbidity or equivalent : Last calibration: Manufacturer Calibrates, spare meter on board Trigger level for early alarm: 25 mg/l Trigger level for shutdown (recirculation): 28 mg/l switches automatically to hold and 30 mg/l to shut down. Recorded turbidity/equivalent levels above triggers: On occasion	
☒	Daily 24-hour continuous monitoring for disinfection effectiveness	Monitors for alarm intensity.
☒	Disinfection effectiveness monitoring equipment functioning properly	Appears to be functioning properly.
	Disinfection Effectiveness Monitoring:	
☒	Auto shut down or operational controls to insure system shut down if disinfection system upset occurs	Discharge automatically stops discharge and recirculates back to mixing tank when intensity does not meet set points (bulbs out or high turbidity).
☒	Disinfection system operated and maintained properly	Appears to be functioning properly.
☒	Disinfection immediately prior to discharge	Protocol: When discharging, UV occurs immediately prior to discharge.
	Disinfection System: The disinfection system consists of 3 UV units, of which two are typically used with 14 bulbs each. At the time of the inspection, the two operating UV units were at 39 W/m2 and 48 W/m2. The UV sleeves are cleaned by dosing Metal Bright cleaner automatically.	

Section E: General (Approved to Discharge)		
☒	No discharges within ½ mile from shellfish beds/protocol (President's Point, Apple Tree Cove, Tyee Shoal)	Protocol: Stop continuous discharge (recirculate back to mixing tank) when coming into MOU waters, begin discharge while at Port, stop discharge when leaving Port, begin discharge when outside MOU waters.
☒	Discharges immediately stopped when high turbidity occurs	They do have their systems set up to automatically shut down and re-circulate the discharge if high TSS (equivalent to turbidity) occurs.
☒	Discharges immediately stopped when disinfection system upset occurs	They do have their systems set up to automatically shut down and re-circulate the discharge if intensity is low.
☒	Immediate notifications made to Health for disinfection system upset	There are notification numbers posted and a copy of the current MOU was on board.
☒	Sampling conducted 2/month, 1/month in Seattle (BOD, TSS, fecal coliform, pH, chlorine residual)	Sampling is being conducted as required, as of the date of the inspection.
☒	Whole Effluent Toxicity Testing 1 per 2 years (homeported) or once/40 calls for continuous	WET testing was conducted as required last season and is not required this season.

Section F: General		
☒	Discharge records review	Discharge records were reviewed (black water/gray water/residual solids) and are maintained properly.
☒	Residual solids managed properly/ disposal protocol per MOU	Residual solids are collected, dried and incinerated.
☒	Hazardous Waste managed properly	All hazardous waste that is collected is being sent off-shore in Victoria, Canada. Records were reviewed for hazardous waste discharges.
☒	WA Haz Waste guidelines followed (appendix vii)	All hazardous waste is being off-loaded outside of Washington.
☒	Solid Waste managed properly	Solid waste is being managed properly. The various solid waste streams are collected, sorted, stored, and sent ashore or incinerated as appropriate.

☒	Oily bilge water managed properly	Oily bilge water is treated and discharged at less than 15 ppm (usually less than 5 ppm) and outside of MOU waters.

Other:

Health = Washington State Department of Health

Section G: Sample Results

Parameter	Results
Biochemical Oxygen Demand 5-Day (BOD)	<10 mg/l
Total Suspended Solids (TSS)	<1 mg/l
Fecal Coliform	24 CFU/100 ml
Residual Chlorine	<0.1 mg/l
pH	6.76 units
Ammonia, Nitrogen	20.4 mg/l

Section H: Summary of Findings/Comments

Introduction

Amy Jankowiak, Washington State Department of Ecology (Ecology) Northwest Regional Office, Water Quality Program (NWRO-WQ) conducted the inspection of the Norwegian Cruise Line NORWEGIAN PEARL on July 19, 2009. The main contacts on board the NORWEGIAN PEARL included Spyridon (Spiros) Zervopolous, Environmental Officer; and Roselo Septin, 3rd Engineer/Environmental Engineer. Prior notification of the visit was given on July 13, 2009 for security protocol. The purpose of the inspection was to evaluate compliance with the *Memorandum of Understanding Cruise Operations in Washington State* (MOU), as amended. A copy of the current MOU was on-board. The NORWEGIAN PEARL received approval to discharge continuously on May 5, 2009.

The NORWEGIAN PEARL was built in 2005, is 965 feet long with 15 guest decks, with about a 27-foot draft. There are typically about 3000 passengers and 1100 crew this season.

Inspection

I arrived and boarded the ship (photo #01) at about 9:20 am and began with introductions and a plan for the day with Spiros Zervopolous, Environmental Officer in the Engine Control Room (ECR) area and discussed various waste streams, and the discharge protocols. Discharge records were reviewed for black water and gray water discharges, garbage and recycling, and hazardous waste. We then discussed the black water and gray water system in detail. Next, we viewed the black water and gray water system and oily bilge water treatment systems. We then toured the incineration and food waste systems and then the photo silver recovery system and laundry/dry cleaning areas. Samples of the black and gray water effluent were taken before debriefing and finalizing the inspection at about 11:28 am.

Discharge Types and Protocols:

The Bridge staff notifies the ECR staff 30 minutes in advance that they will be entering an area allowable for discharges. The latitude and longitude coordinates are recorded in the *Sewage and Graywater Discharge Record Book* and in the deck log for black water, gray water and untreated wastewater as well as other types of discharges including food waste and oily bilge outside of 12 miles. The date, time and location of both the start and the stop of the discharges are recorded, along with port location, effluent type, and volumes. The protocol for discharges in MOU waters is to stop continuous discharge (recirculate back to mixing tank) when coming into MOU waters, begin discharge while at Port, stop discharge when leaving Port, and begin discharge when outside MOU waters. This procedure prevents discharges in any shellfish areas. All discharge records that were reviewed appeared to be in compliance with the MOU. Only the Environmental Officer and the Captain/Chief Officer have the keys for discharge ports which are padlocked (photo #24).

Black water, which includes toilet waste, galley waste and infirmary drains and gray water which includes sink and shower and laundry water is treated with a Scanship advanced wastewater treatment system and is discharged continuously with the exception of the area near shellfish beds.

Screenings and grit as well as the biomass (sewage sludge) from the Scanship system is collected, dried and incinerated along with food waste. The food waste is collected (photo #25) and pulped (photo #26) twice. The reject water is recycled. Only occasionally is the solid food waste and its reject water held for discharge instead of being incinerated and is discharged outside of 12 nautical miles and outside of MOU waters and the Olympic Coast National Marine Sanctuary.

Cooking oil is collected and recycled as biodiesel.

Oily bilge water is treated with two Marinfloc systems for separating oil (photos #20 and #22). The oily bilge is treated to less than 15 ppm, although the results are typically less than 5 ppm. From the oily water separator, the oil content is again measured in the locked "white box" (photo #21). The treated oily bilge water is then discharged outside of MOU waters and greater than 12 nautical miles.

Potable water that is regularly bunkered. Water is also produced by desalination using a reverse osmosis system and evaporators. The salt that is collected through the production process is sent back to the salt water. A descaler chemical is used on the evaporators and is adjusted for pH before discharge at sea.

Spa water is discharged nightly, although not in MOU waters and not in certain Alaskan waters. Both the spa and pool water use chlorine.

Laundry uses a number of different chemicals (photos #30 and #31) by the SWISHER™ company and all laundry wastewater is sent to graywater for Scanship treatment. Dry cleaning (photo #28) uses PERC (photo #29) which is off-loaded as hazardous waste in Canada. Silver is captured from the photo waste (photo #27), treated to less than 5 ppm and is off-loaded as regulated waste. X-ray/developer waste is off-loaded untreated (can not combine with photo waste) as hazardous waste. Other hazardous wastes include some batteries, paints, mercury filters, some aerosols (punctured), and medical sharps. Fluorescent bulbs are crushed with a system that removes mercury. The filters are changed out about once every three months with each barrel (changed out more frequently than required for safety of staff). The bulbs are then off-loaded as regulated waste. Medical, red bag waste is typically incinerated. Narcotics are incinerated with witnesses and expired medications are off-loaded. All hazardous wastes are off-loaded in Canada. Other materials incinerated 9photo #23) include paper, some cardboard, and oily rags.

Plastics, garbage, and other materials are collected and sorted on a sorting table. Most materials are then condensed and recycled on-shore. Some recycling is off-loaded in Seattle. Crushed glass, aluminum, tin, scrap metal, plastics, cardboard, wood pallets and some paper are all recycled along with other materials. Some other materials such as blankets are donated.

Records were reviewed for black water and gray water discharges, as well as for garbage/incineration/sea discharges and hazardous waste. All records appeared to be in compliance with the MOU.

Black water and Gray water System (Scanship System):
Black water, which includes toilet waste, galley waste and infirmary drains moves by vacuum to a collection tank (photo #19). From the collection tanks, it goes to the drum screens (photos #02 and #03). There are two drum screens which provide pre-screening. Solids from the drum screens go to the sludge tank. Liquid flow from the drum screens then enters the mixing tank where it combines with the gray water. Gray water consists of sink, shower, and laundry water. From the mixing tank, the liquid moves to the biostep (photo #08) for biological treatment (biofilm on rotating plastic pieces – 2 tanks in series, air added). A defoamer can be used to control foam.

After the biostep, liquid moves to a buffer tank (photo #10) where coagulant and a decoagulant are added. Liquid then moves to the flocculation tanks (photo #11). Coagulant is injected and then polymer (photo #15) is injected in the second cylinder of the flocculation tank. Clarification then occurs via flotation tanks (photos #12 and #13). An air and water mixture is added to the bottom of the flotation tanks to keep turbulence at the bottom and to allow the solids to rise to the top, along with the help of the chemical addition. Skimmers on the top skim the solids into a sludge pocket which is then pumped to the sludge tank. Liquid flow then moves to the polishing filters (photo #14) for ultrafiltration (2 rotating mesh drums).

Flow then moves to ultraviolet (UV) light disinfection (photo #16). There are three UV units, of which two are typically used in series with 14 bulbs each. The UV unit not being used goes though a cleaning cycle with Metal Bright cleaner and is then rotated in for use. There is typically about one set (14 bulbs) of spare bulbs on board. The UV system is alarmed for bulb failure and intensity. At the time of the inspection, the two operating UV units were at 39 W/m2 and 48 W/m2. The UV sleeves are cleaned by dosing Metal Bright cleaner automatically. Flow from the UV units is either discharged directly overboard via the discharge port, or is re-circulated to the mixing tank.

Solids from the sludge tank are often combined with food waste decanted (photo #04), dewatered and then the material is dried with a dryer (photos #05 and #06) and incinerated. The reject water is sent to the mixing tank of the Scanship system.

The cruise line uses a system called AMOS for work orders and maintenance. Manufacturer recommendations for maintenance of each piece of equipment is included in the AMOS system which triggers staff when maintenance is required. Scanship also monitors maintenance on the system. Any needed calibrations, cleaning, and other needed maintenance

would be included in AMOS. Total suspended solids (TSS) (equivalent to turbidity) is monitored (photos #17 and #18) continuously at UV disinfection. If TSS exceeds 25 mg/l, the system alarms and staff responds to investigate. At 28 mg/l, the system alarms and switches automatically to hold that discharge. At 30 mg/l, the effluent from the system is shut down and is re-circulated to the mixing tank. PH is also monitored for adjustments. The levels for effluent pH are supposed to be between 6.5 and 8.5. The pH levels also trigger the chemical additions of coagulant and polymer. There are several monitors (photo #07) throughout the system that are used to access controls as well as in the ECR.

Earlier this season, there was a high result for fecal coliform in Juneau. Follow-up included stopping discharges except while out at sea, re-testing, and working with the manufacturer and staff to trouble-shoot any possible problems. Due to higher passenger/crew volumes on board, staff added an additional blower (photo #09) to the biostep process. They again re-tested. Al re-tests for fecal coliform were within allowable ranges. Discharges have resumed.

Samples were taken for Biochemical Oxygen Demand (BOD 5-Day), Total Suspended Solids (TSS), pH, chlorine residual, fecal coliform and ammonia from the combined effluent of the Scanship system after UV disinfection. The sample port was disinfected by heat prior to pulling samples (photo #32). The samples were put on ice immediately and were transported to AmTest laboratory in Kirkland, Washington that morning. Chain of Custody and sampling procedures were followed. All results are in Section F. The results are typical of the results submitted to Ecology thus far for 2009.

Conclusions and Recommendations

The staff on board the vessel were very knowledgeable of the systems and protocols.

It is recommended that staff continue to work towards a high functioning wastewater treatment system.

Attachments:
Photographs
Laboratory Report

Copies to:
Randy Fiebrandt, NCL
Spyridon (Spiros) Zervopolous, NCL
Amy Jankowiak, Ecology
Karen Burgess, Ecology
Mark Toy, Health
Kevin Fitzpatrick, Ecology
Central Files: Norwegian Cruise Line – NORWEGIAN PEARL; WQ 6.1

Section I: Signatures		
Name and Signature of Inspector Amy Jankowiak Amy Jankowiak	Agency/Office/Telephone Department of Ecology/Northwest Regional Office/Water Quality Program/Municipal Compliance Specialist/(425) 649-7195	Date 8/13/09
Name and Signature of Reviewer Kevin C. Fitzpatrick Kevin C. Fitzpatrick	Agency/Office/Telephone Department of Ecology/Northwest Regional Office/Water Quality Section Manager/(425) 649-7033	Date 8/13/09

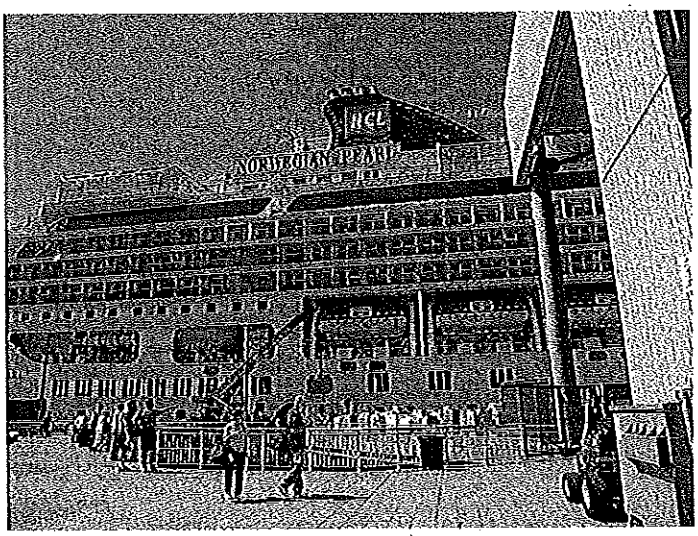


PHOTO #:01 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P7190059
DESCRIPTION: NORWEGIAN PEARL VESSEL, SEATTLE

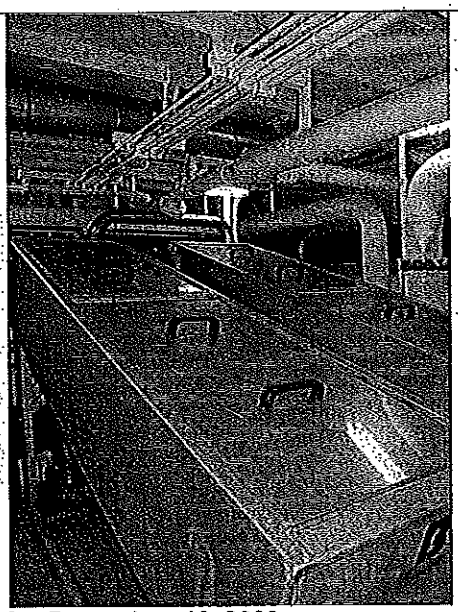


PHOTO #:02 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190017
DESCRIPTION: DRUM SCREENS

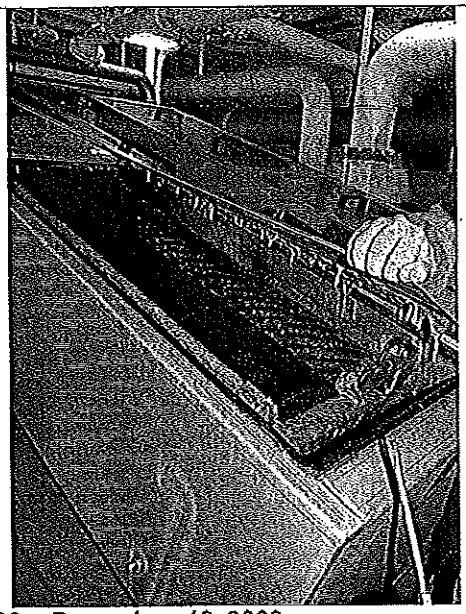


PHOTO #:03 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190018
DESCRIPTION: INSIDE OF DRUM SCREEN

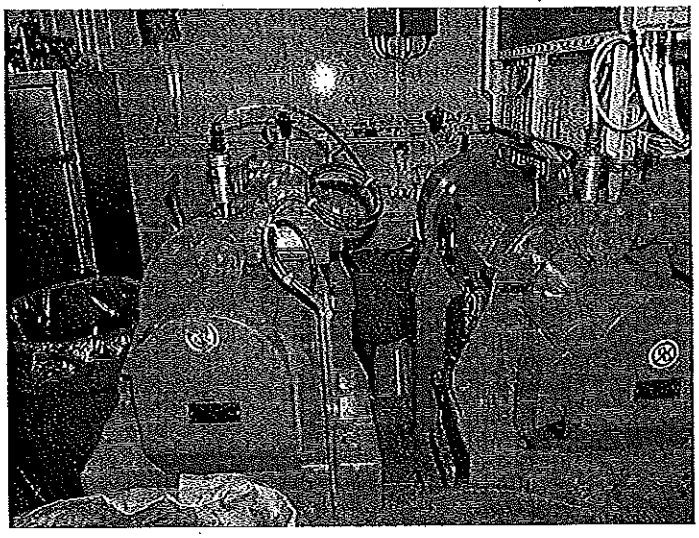


PHOTO #:04 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190020
DESCRIPTION: DECANTERS

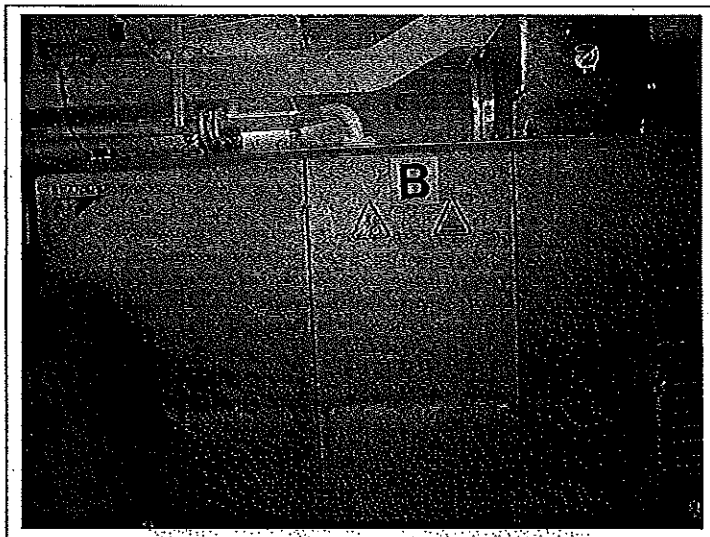


PHOTO #:05 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P7190022
DESCRIPTION: DRYER (1 OF 2)

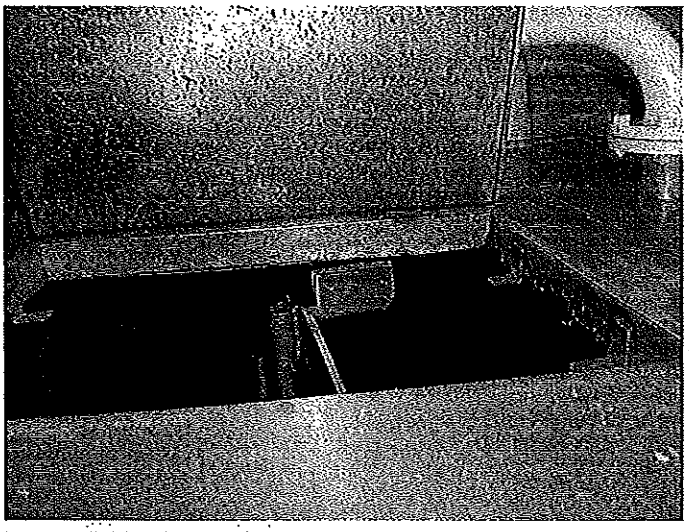


PHOTO #:06 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190021
DESCRIPTION: INSIDE OF DRYER

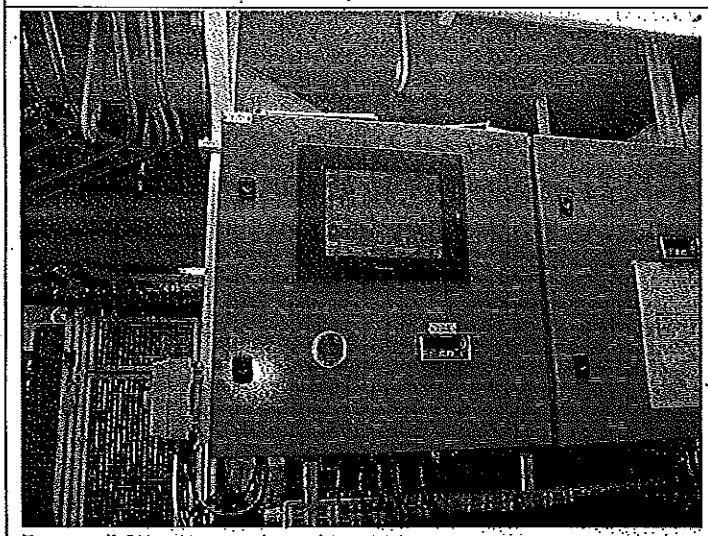


PHOTO #:07 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190019
DESCRIPTION: ONE OF SEVERAL MONITORS ACCESSING SCANSHIP SYSTEMS

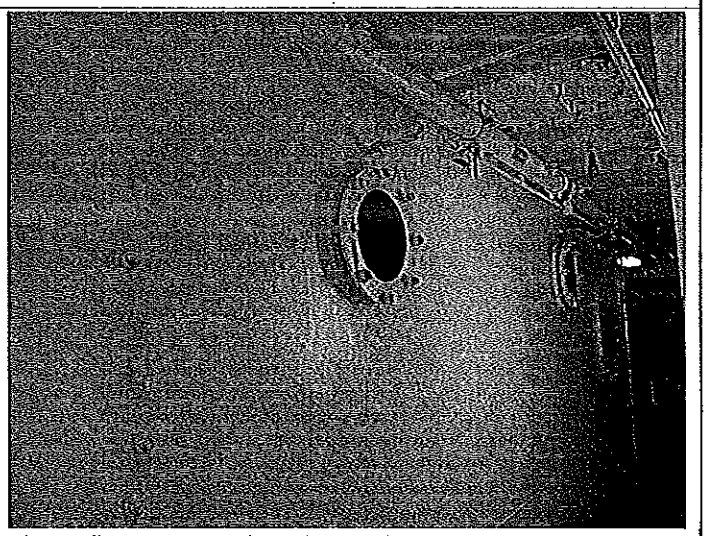


PHOTO #:08 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190024
DESCRIPTION: BIOSTEP 1 (CLOSE SIDE) AND BIOSTEP 2 (FAR SIDE)

PHOTO #:09 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P7190025
DESCRIPTION: BIOSTEP BLOWERS (2 OF 4)

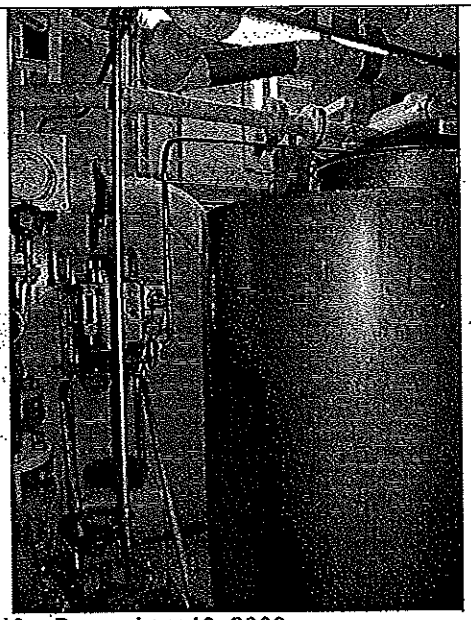


PHOTO #:10 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190026
DESCRIPTION: BUFFER TANK/ COAGULANT ADDITION

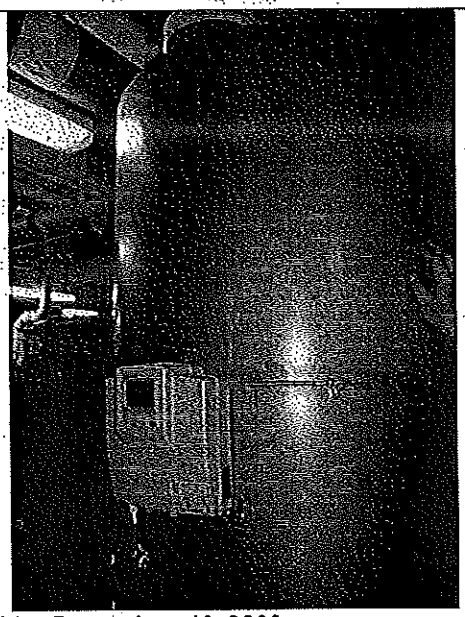


PHOTO #:11 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190027
DESCRIPTION: COAGULANT/POLYMER ADDED AND pH MONITOR

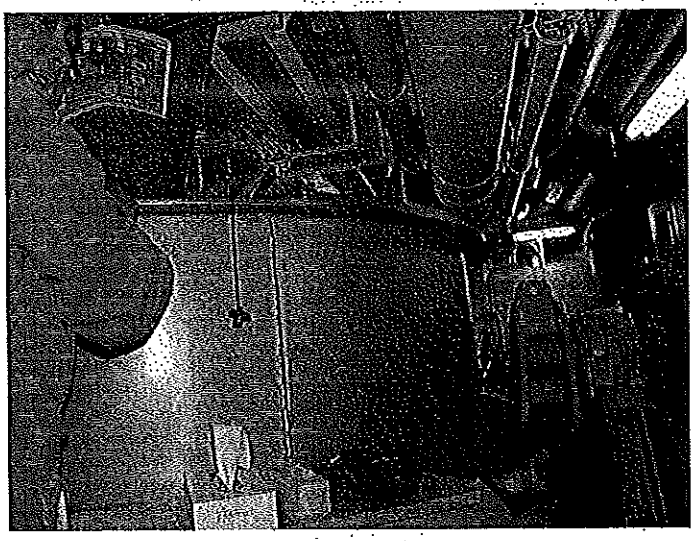


PHOTO #:12 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190028
DESCRIPTION: FLOTATION TANK (1 OF 2)

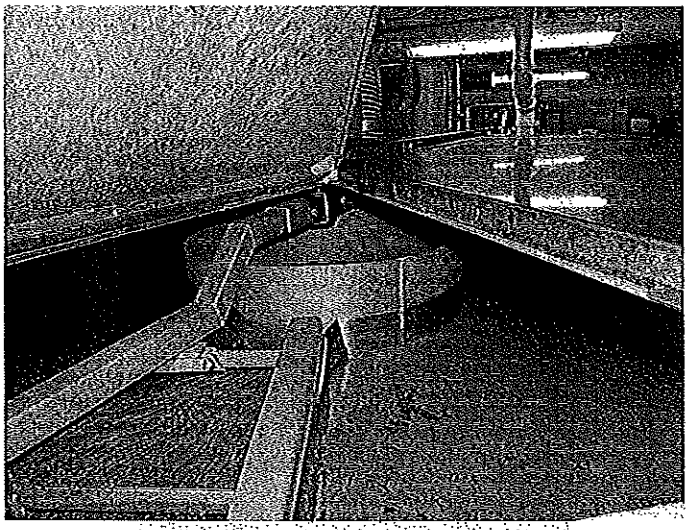


PHOTO #:13 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P7190029
DESCRIPTION: INSIDE OF FLOTATION TANK

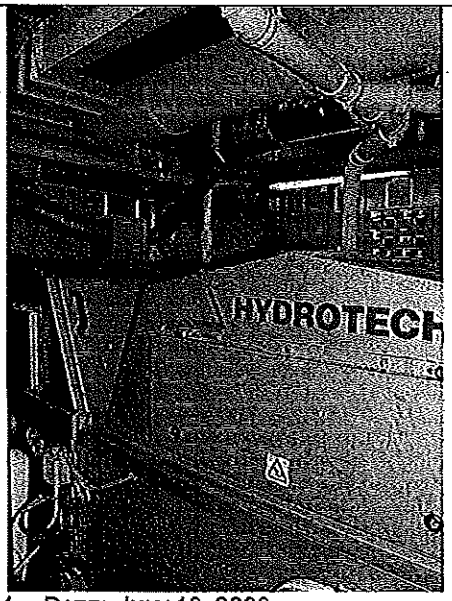


PHOTO #:14 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190030
DESCRIPTION: POLISHING FILTERS

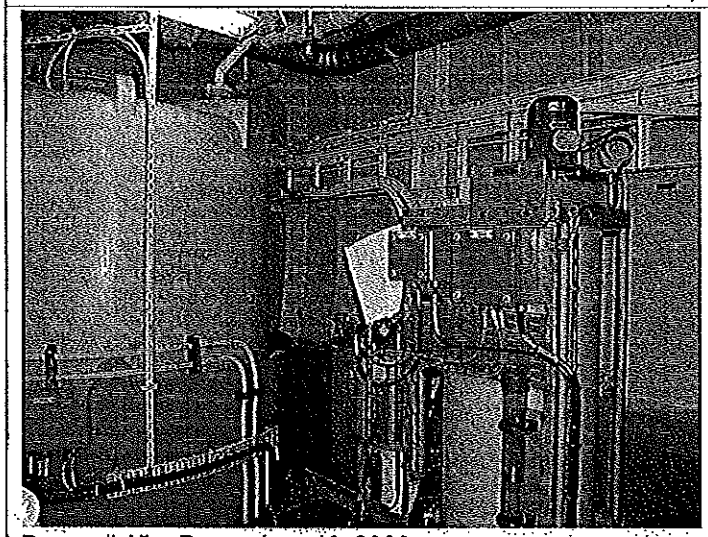


PHOTO #:15 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190031
DESCRIPTION: COAGULANT AND POLYMER TANKS

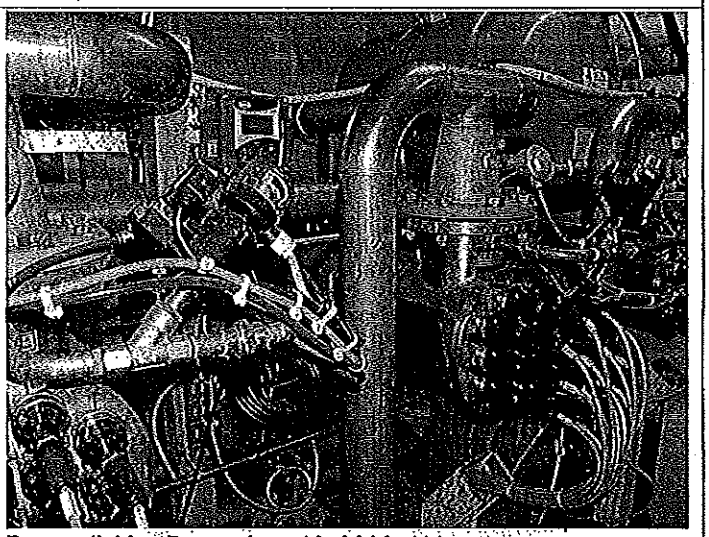


PHOTO #:16 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190034
DESCRIPTION: ULTRAVIOLET DISINFECTION (3 UNITS)

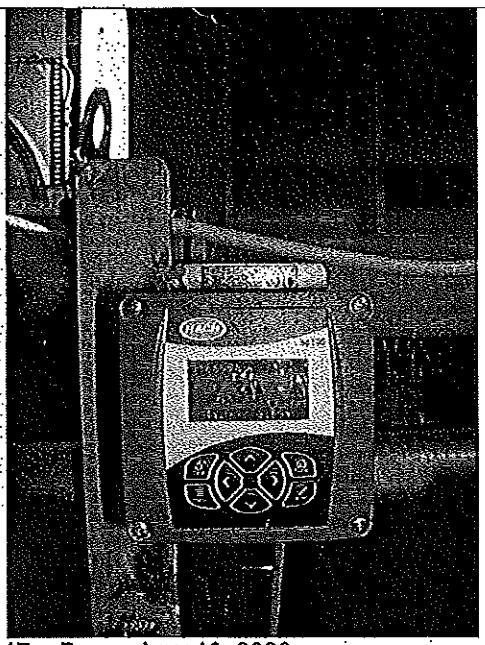


PHOTO #:17 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P7190035
DESCRIPTION: TSS METER READ OUT (2.30 MG/L)

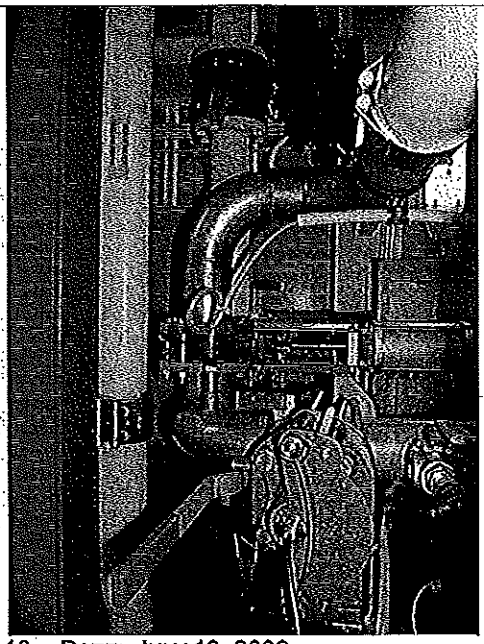


PHOTO #:18 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190037
DESCRIPTION: TSS METER AND 2 PIPES (ONE TO CONTINUOUS DISCHARGE, ONE TO RECIRCULATE TO MIXING TANK)

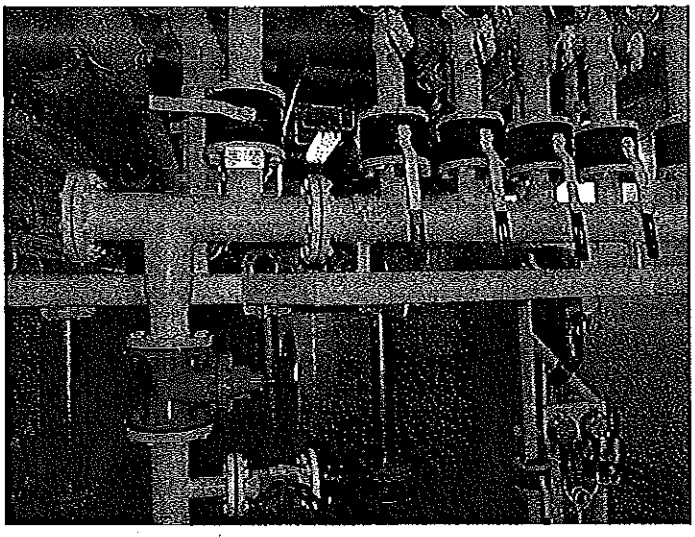


PHOTO #:19 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190038
DESCRIPTION: GRAVITY LINES TO BLACKWATER TANK

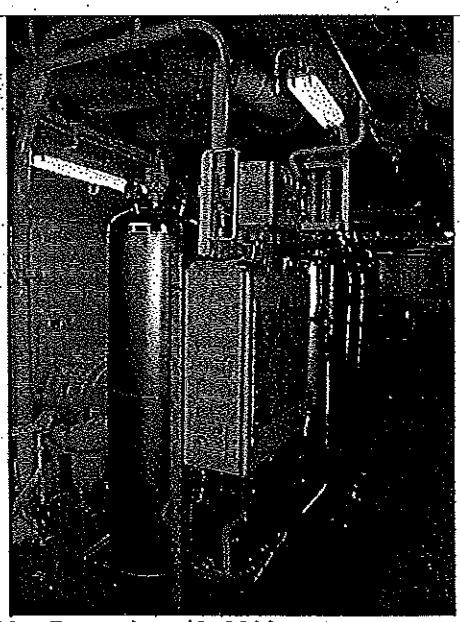


PHOTO #:20 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190039
DESCRIPTION: BILGE - OILY WATER SEPARATOR (OWS) SYSTEM (1 OF 2)

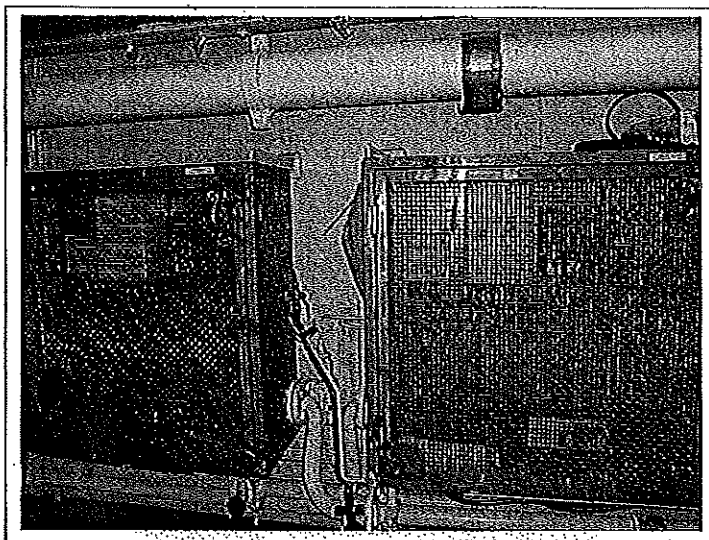


PHOTO #:21 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P7190040
DESCRIPTION: OWS WHITE BOXES

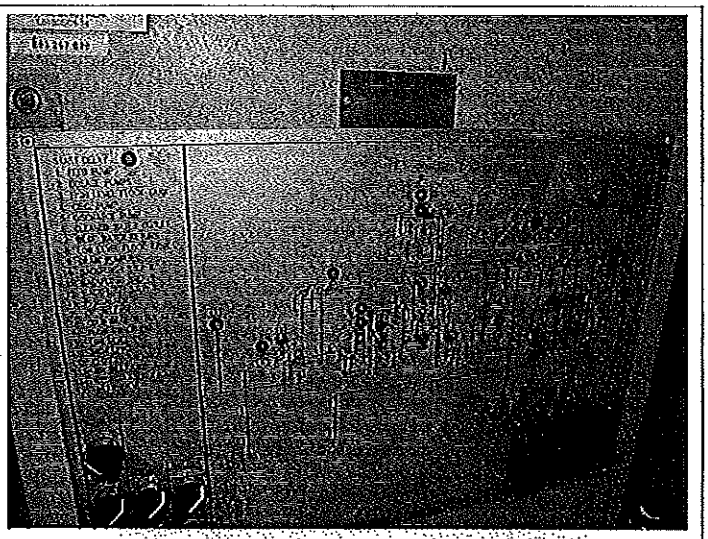


PHOTO #:22 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190042
DESCRIPTION: OWS DISPLAY

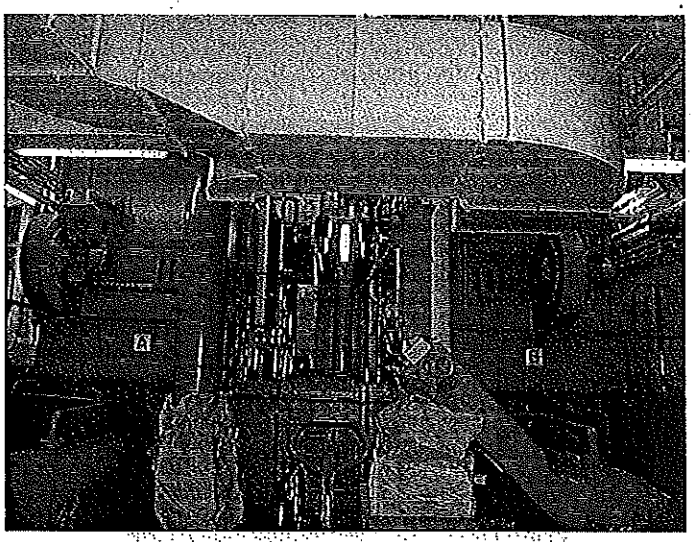


PHOTO #:23 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190044
DESCRIPTION: INCINERATORS

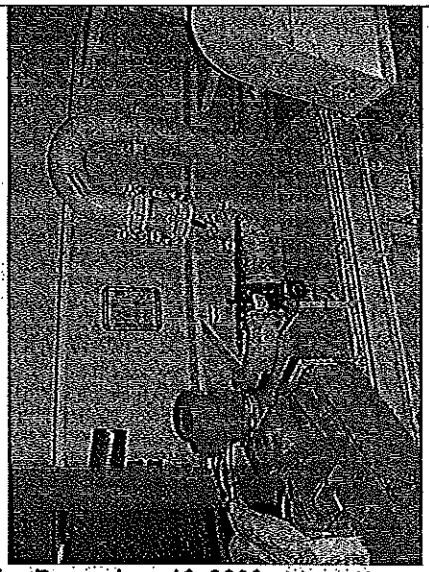


PHOTO #:24 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P71900
DESCRIPTION: BLACK/GRAY WATER DISCHARGE PORT (PADLOCKED)

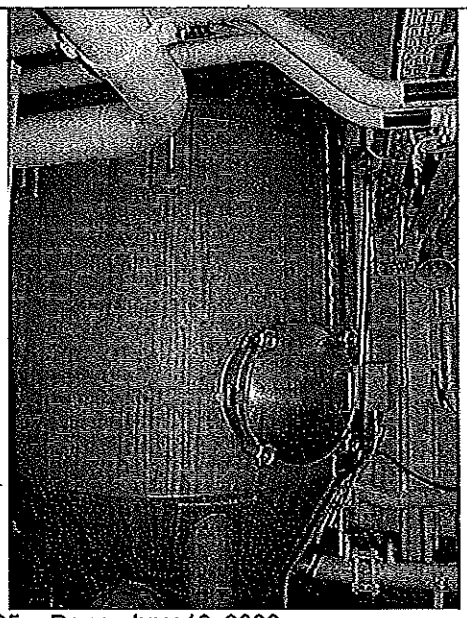


PHOTO #:25 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P7190047
DESCRIPTION: FOOD WASTE TANK

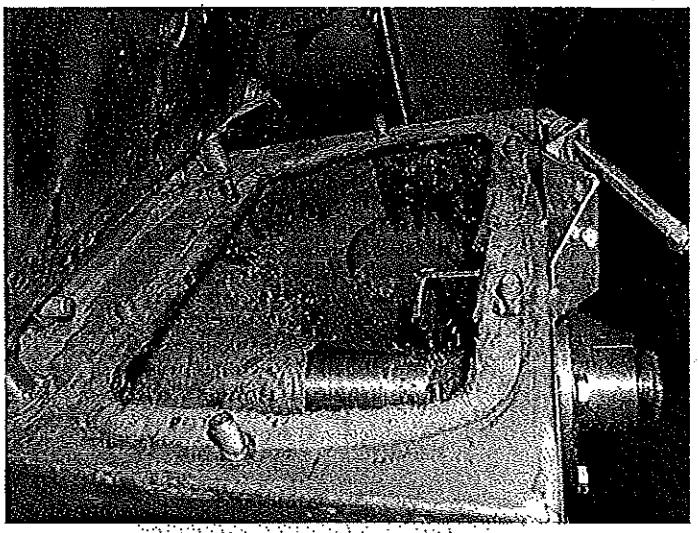


PHOTO #:26 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190048
DESCRIPTION: INSIDE OF FOOD WASTE PULPER

PHOTO #:27 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190050
DESCRIPTION: PHOTO SILVER RECOVERY SYSTEM

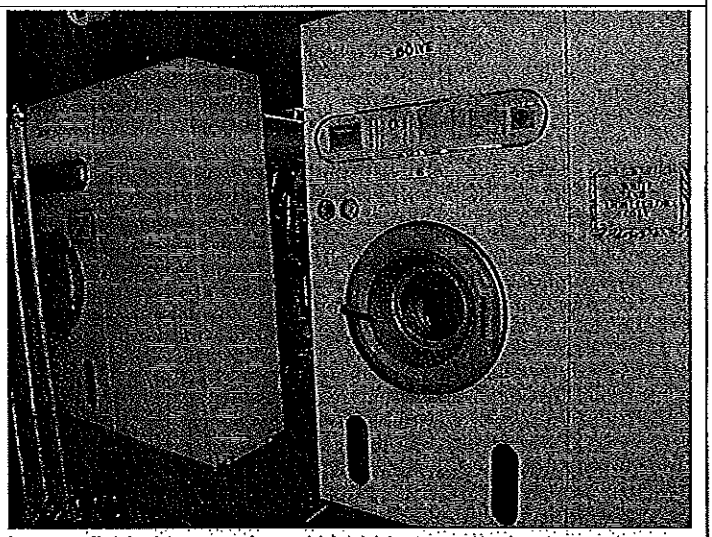


PHOTO #:28 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190051
DESCRIPTION: DRY CLEANING SYSTEMS (PERC BASED)

PHOTO #:29 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P7190053
DESCRIPTION: DRY CLEANING PERC WASTE COLLECTION

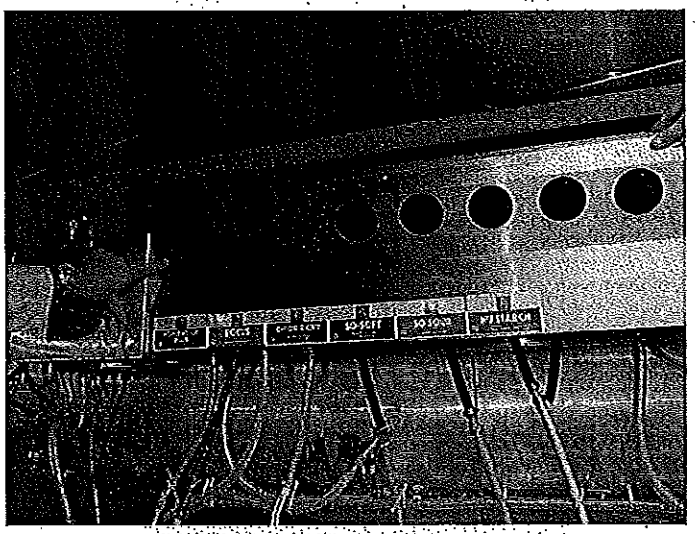


PHOTO #:30 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190057
DESCRIPTION: LAUNDRY CHEMICALS

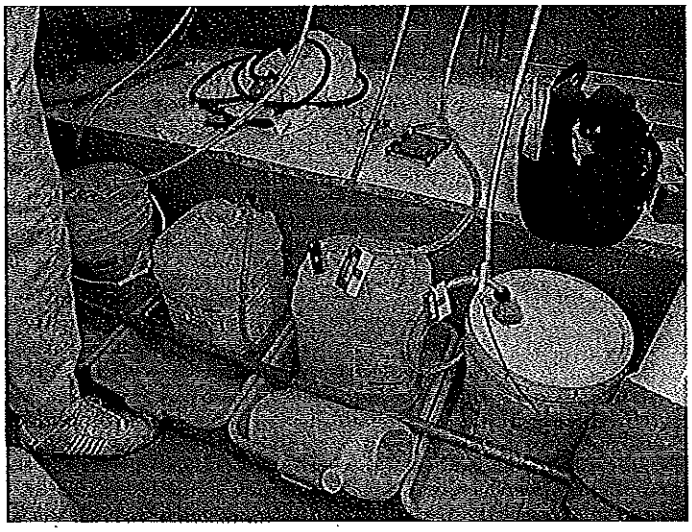


PHOTO #:31 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190056
DESCRIPTION: LAUNDRY CHEMICALS

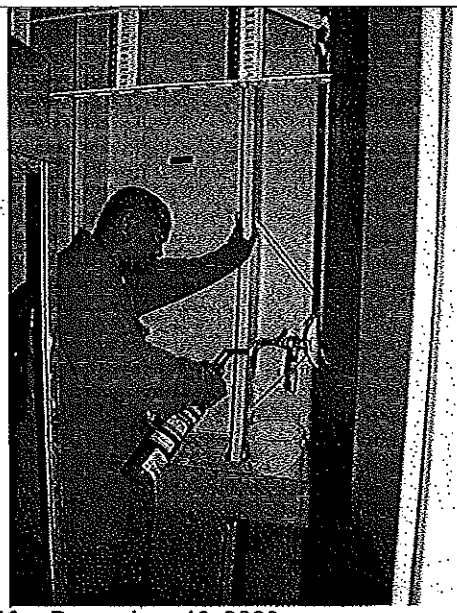


PHOTO #:32 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P7190058
DESCRIPTION: BLACK/GRAY WATER SAMPLING PORT DISINFECTION FOR SAMPLING

Am Test Inc.
13600 NE 126TH PL
Suite C
Kirkland, WA 98034
(425) 885-1664
www.amtestlab.com

AMTEST LABORATORIES

Professional Analytical Services

ANALYSIS REPORT

Department of Ecology
3190 160th Ave SE
Bellevue, WA 98008
Attention: Amy Jankowiak
Project Name: Norwegian Pearl
All results reported on an as received basis.

Date Received: 07/20/09
Date Reported: 8/11/09

AMTEST Identification Number 09-A011402
Client Identification Norpearl-Eff
Sampling Date 07/19/09, 11:02

Microbiological

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Fecal Coliforms	24.	CFU/100 ml		1.	SM 9222D	KF	07/19/09

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
pH	6.76	unit			EPA 150.1	KF	07/19/09
Chlorine Residual	< 0.1	mg/l		0.10	EPA 330.5	KF	07/19/09
Total Suspended Solids	< 1	mg/l		1.0	SM 2540D	SL	07/27/09

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
BOD	< 10	mg/l		10.	SM 5210B	KF	07/19/09

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	20.4	mg/l		0.005	EPA 350.1	TS	08/07/09

Kathy Fuglel
President

State of Washington Department of Ecology

Cruise Ship Memorandum of Understanding, Cruise Operations in Washington State Inspection Report

Northwest Regional Office
3190 160th Ave SE
Bellevue, WA 98008
Phone: (425) 649-7000 Fax: (425) 649-7098

Section A: General Information

Vessel Name:	WESTERDAM	Date:	July 26, 2009
Vessel Operator:	Holland America Line	Entry Time:	9:35 AM
Vessel Type:	Passenger Ship	Exit Time:	12:10 PM
Location:	Terminal 91, Seattle	Notification (name & date):	Jon Turvey, July 21, 2009
On-board contact(s):	Kieron Connelly, Environmental Officer; Scotty Andrews, 4th Engineer		
Inspector(s):	Amy Jankowiak, Department of Ecology, Water Quality Program; Mark Henderson, Department of Ecology, Water Quality Program		
# passengers/crew:	Actual ~2300/~798		

The WESTERDAM arrived on May 10th, 2009 at the Port of Seattle to begin the 2009 cruise season. The Rochem graywater system was not functioning at the time of the inspection. The graywater is held and then discharged outside of MOU waters. The vessel uses a Rochem membrane bioreactor with ultrafiltration for the treatment of blackwater. All discharges are being held and then discharged outside of MOU waters.

Section B: Areas Evaluated

☒	Black/Gray wastewater system	☒	Residual solids	☒	Records/Reports	☒	Hazardous Waste/Solid Waste	☐	Sampling/ Monitoring
☒	Discharge locations	☒	Operations & Maintenance	☒	Sludge Handling/ Disposal	☒	Oily bilge water	☒	Other

Section C: For vessels discharging ≥ 1nm from berth and ≥ 6 knots only [2.1.3(A)]

☐	Schematics match black/gray wastewater system	Not Applicable
☐	Operations as described in submitted documentation	Not Applicable
☐	Daily 24-hour continuous monitoring for turbidity or equivalent monitoring	Not Applicable
☐	Turbidimeter or equivalent monitoring equipment functioning properly	Not Applicable
☐	Auto shut down or operational controls to insure system shut down if high turbidity occurs	Not Applicable
	Turbidity or equivalent : Last calibration Trigger level for early alarm: Trigger level for shutdown: Recorded turbidity/equivalent levels above triggers:	
☐	Daily 24-hour continuous monitoring for disinfection effectiveness	Not Applicable
☐	Disinfection effectiveness monitoring equipment functioning properly	Not Applicable
	Disinfection Effectiveness Monitoring:	
☐	Auto shut down or operational controls to insure system shut down if disinfection system upset occurs	Not Applicable
☐	Disinfection system operated and maintained properly	Not Applicable
	Disinfection System:	

Section D: For vessels discharging continuously [2.1.3(B)]		
☐	Schematics match black/gray wastewater system	Not Applicable
☐	Operations as described in submitted documentation	Not Applicable
☐	Daily 24-hour continuous turbidity or equivalent monitoring	Not Applicable
☐	Turbidimeter or equivalent monitoring equipment functioning properly	Not Applicable
☐	Auto shut down or operational controls to insure system shut down if a high turbidity occurs	Not Applicable
	Turbidity or equivalent : Last calibration Trigger level for early alarm: Trigger level for shutdown: Recorded turbidity/equivalent levels above triggers:	
☐	Daily 24-hour continuous monitoring for disinfection effectiveness	Not Applicable
☐	Disinfection effectiveness monitoring equipment functioning properly	Not Applicable
	Disinfection Effectiveness Monitoring:	
☐	Auto shut down or operational controls to insure system shut down if disinfection system upset occurs	Not Applicable
☐	Disinfection system operated and maintained properly	Not Applicable
☐	Disinfection immediately prior to discharge	Not Applicable
	Disinfection System:	

Section E: General (Approved to Discharge)		
☐	No discharges within ½ mile from shellfish beds/protocol (President's Point, Apple Tree Cove, Tyee Shoal)	Not Applicable
☐	Discharges immediately stopped when high turbidity occurs	Not Applicable
☐	Discharges immediately stopped when disinfection system upset occurs	Not Applicable
☐	Immediate notifications made to Health for disinfection system upset	Not Applicable
☐	Sampling conducted 2/month, 1/month in Seattle (BOD, TSS, fecal coliform, pH, chlorine residual)	Not Applicable
☐	Whole Effluent Toxicity Testing 1 per 2 years (homeported) or once/40 calls for continuous	Not Applicable

Section F: General		
☒	Black Water/Gray Water Discharge records review	Discharge records were reviewed (blackwater/graywater/residual solids) and are maintained properly. No discharges in MOU waters were present from the beginning of the 2009 cruise season to present.
☒	Residual solids managed properly/ disposal protocol per MOU.	Residual solids are either incinerated or held to be discharged at greater than 12 nautical miles and outside of MOU waters and the Olympic Coast National Marine Sanctuary.
☒	Hazardous Waste managed properly	All hazardous waste that is collected is being sent off-shore in Victoria, Canada. Records were reviewed for hazardous waste off-loads.
☒	WA Haz Waste guidelines followed (appendix vii)	All hazardous waste that is collected is being sent off-shore in Victoria, Canada. Records were reviewed for hazardous waste off-loads.
☒	Solid Waste managed properly	Solid waste is being managed properly. The various solid waste streams are collected, sorted, stored, and sent ashore or incinerated as appropriate.
☒	Oily bilge water managed properly	Oily bilge water is treated and discharged at less than 15 ppm and outside of MOU waters.
Other:		

Health = Washington State Department of Health

Section G: Sample Results

Parameter	Results
Biochemical Oxygen Demand 5-Day (BOD)	Not Applicable
Total Suspended Solids (TSS)	Not Applicable
Fecal Coliform	Not Applicable
Residual Chlorine	Not Applicable
pH	Not Applicable
Ammonia, Nitrogen	Not Applicable

Section H: Summary of Findings/Comments

Introduction

Amy Jankowiak, Washington State Department of Ecology (Ecology) Northwest Regional Office, Water Quality Program, and Mark Henderson, Ecology Bellingham Field Office conducted the inspection of the Holland America Line WESTERDAM on July 26, 2009. The main contacts on board the WESTERDAM included Kieron Connelly, Environmental Officer, Scotty Andrews, 4th Engineer and AWWPS Operator, and Jon Turvey, Senior Manager, Auditing, Training and ISO 14001 Coordination HAL. Prior notification of the visit was given on July 26, 2009 for security protocol. The purpose of the inspection was to evaluate compliance with the *Memorandum of Understanding Cruise Operations in Washington State* (MOU), as amended. The WESTERDAM is currently not approved for and is not discharging black or graywater into MOU waters.

The HOLLAND WESTERDAM was dedicated in 2004, and is 936 feet long with a width of 105.8 feet. The actual passenger volume is about 2300 and the crew capacity is about 800. The vessel is powered with on-shore power during port calls in Seattle.

Inspection

We arrived and boarded the ship at about 9:35 am and began with introductions and a plan for the day with Kieron Connelly, the Environmental Officer and Jon Turvey with Holland America Line. We then discussed various waste streams, and the discharge protocols. Discharge records were reviewed for blackwater and graywater discharges, hazardous waste off-loads, and garbage. We then went to the Bridge to view and discuss the Valve Monitoring System and schedule for discharges. We viewed and discussed the black water treatment system and the oily bilge water oily water separators. Next, we took a look at the graywater system and toured the garbage and recycling sorting area as well as food waste. The inspection was then finalized and we disembarked the vessel at about 12:10 pm.

Discharge Types and Protocols:

All discharges to water occur at greater than 12 nautical miles and outside of MOU waters. No discharges occur in the Olympic Coast National Marine Sanctuary. Only upon verification of location between the Bridge and the Engine Control Room (ECR), will a discharge occur at greater than 12 nautical miles and outside of MOU waters. If a discharge is allowed, the Bridge authorizes any discharge. For wastewater discharges, the latitude and longitude coordinates are recorded in the *Sewage and Graywater Discharge Record Book* and in the deck log. There is an overboard valve monitoring system (photo #01) on the bridge. The system has four lights:

- >12 nm
- > 4, <12 nm
- <4 nm
- Special Areas

The "special areas light" means no discharges. Currently, MOU waters are considered "special areas". The computer system "Overboard Valve Monitoring" system details where certain discharges can and cannot take place and includes alarms. The Environmental Officer reviews the event alarm settings periodically. When any overboard valve is open, the location (lat and long) is automatically recorded. The date, time and location of both the start and the stop of the discharges are recorded, along with port location, effluent type, volumes, and speed. Discharges are tentatively scheduled ahead of time by matrix, but locations are always verified prior to discharges. Discharge ports have a micro-switch which is connected to the valve monitoring system. This system does not allow for discharges unless the valve monitoring system allows for a discharge. All discharge records that were reviewed appeared to be in compliance with the MOU.

Blackwater, which includes toilet waste, Galley waste, infirmary drains, crew waste, and a small amount of graywater, is treated with a Rochem membrane bioreactor and ultrafiltration system and is then discharged outside of MOU waters. The

majority of the graywater typically goes to the graywater system, Rochem low pressure reverse osmosis system, but is currently not operational and therefore graywater is collected, held and discharged outside of MOU waters. The vessel has about five days of capacity on board. Laundry water goes to the graywater tanks. Pool and spa water also goes to the Rochem system.

Screenings and grit from the blackwater system are collected and incinerated. The solids separated out from the blackwater system at the SWECO filter and from the bioreactors, known by the cruise lines as "biomass", is collected into a tank and discharged outside of MOU waters, >12 nautical miles from shore, and outside of the Olympic Coast National Marine Sanctuary.

Food waste is collected in various locations including the galley and the garbage sorting area. The food is shredded and discharged. The liquid from the food waste is extracted and recycled, and then cleaned out about once every 6 months and discharged outside of MOU waters, >12 nautical miles from shore, and outside of the Olympic Coast National Marine Sanctuary. Food waste is hand checked for plastics and other materials approximately four times per day by the foreman and is sorted prior to shredding (maceration). Grease is collected separately and either off-loaded to shore, or filtered and re-used on board.

Oily bilge water is sent to the 50 ppm oily water separator (FACET) (photos #09 and #11), then to the intermediate tank and then to the 15 ppm oily water separator (SERAP) (photo #10). If the effluent does not meet 15ppm, it is automatically sent back for further treatment. The effluent that meets 15 ppm is either discharged at greater than 12 nautical miles and outside of MOU waters or is sent to a clean tank and later discharged. All effluent first goes through the "white box" for monitoring prior to discharge.

Potable water is bunkered now and then, while the rest is produced by desalination. Steam from the boilers heat up the sea water with low pressure evaporation. The condensate is then chlorinated and adjusted for pH prior to distribution. Salt collected from the evaporators is sent back to the sea. Scaling is treated with acid and is then neutralized prior to discharge at sea.

Dry cleaning currently uses Perchloroethylene (PERC) which is collected and off-loaded as hazardous waste in Victoria (dry and liquid).

Silver is captured from the photo waste, collected and off-loaded as non-hazardous waste in Victoria. All hazardous wastes to shore are off-loaded in Victoria. X-ray's are done digitally, and therefore there is no x-ray waste.

Medical waste that is not hazardous is collected in white bags and incinerated. Red bags are used for material containing bodily fluids, and along with sharps are collected and sent to shore with hazardous waste.

Batteries, oily rags, electronics, and oil sludge are also off-loaded with hazardous waste in Victoria. Records were reviewed for hazardous waste off-loads and showed that all off-loads this season have been to Victoria.

Plastics, garbage, and other materials are collected and sorted into various color-coded cans and sorted on a sorting table. The materials are then condensed and recycled on-shore. The non-hazardous garbage, paper, some plastics, and food-contaminated cardboard are incinerated. The incinerator is not used while in Port. Cardboard is collected and off-loaded for recycling. Crushed glass (photo #13), aluminum, metals, mixed paper, and plastics (photo #14) are all recycled along with other materials. The amount of materials collected and recycled is maximized in order to minimize the amount of materials incinerated or land filled. Various materials are also donated in a ship to shelter program. Fluorescent light bulbs are collected, crushed in a system that collects the mercury vapors. The material is then off-loaded with hazardous waste.

Solid waste is being managed properly. The various solid waste streams are collected, sorted, stored, and sent ashore or incinerated as appropriate. Garbage records were reviewed and were in good order.

Holland America Line is ISO 14001 Certified. The WESTERDAM is equipped for shore power in Seattle and was connected during the inspection.

Graywater System:
The graywater system, Rochem low pressure reverse osmosis (LP-RO) (photo #12), was not operational during the inspection. Graywater is being collected, strained and then held and discharged outside of MOU waters. The graywater system, when operational, collects graywater to collection tanks. The graywater is then sent to a buffer tank and then to the SWECO prefiltration system. Graywater then moves to the LP-RO for treatment. Effluent from the LP-RO moves to permeate tanks prior to disinfection treatment via ultraviolet disinfection. Effluent is then held or discharged outside of MOU waters.

Blackwater System:
Scotty Andrews, 4th Engineer and AWWPS operator, joined us to describe the blackwater system, Rochem UF; ultrafiltration, and tour the system. Mr. Andrews was trained by Rochem staff on the vessel, had computer-based training and a short handover period with the previous operator. Toilet waste, Galley waste, infirmary drains, and crew waste goes by vacuum to collection tanks and then to a buffer tank. Screenings collected by a filter are sent to incineration.

From the buffer tank, flow is sent to prefiltration through the SWECO system (photo #02). Screenings are filtered out and sent to incineration. The SWECO system vibrates out the solids to the solids tank (photos #03 and #04) where it combines with solids from the bioreactors and is sent to another solids tank for holding and discharge outside of MOU waters. Filtrate from the SWECO is collected and sent to a tank, and then sent to the bioreactors (photo #05). PH is adjusted and conductivity monitored prior to going to the bioreactors.

There are three bioreactor lines. Lines 1 and 2 have four MBR units each, and Line 3 has two MBR units for a total of ten. The biological activity takes place in the bioreactors. Solids in the bioreactors are returned back to the beginning of the bioreactors to enhance activity. A minimal amount of solids are periodically wasted to the solids tanks. Total Suspended Solids (TSS) are monitored continuously at the bioreactors.

From the bioreactors, flow goes through the membranes for ultrafiltration (UF) (photo #06). The membranes are cleaned by flushing with air and reverse direction flow. Turbidity is also monitored continuously after the permeate. Effluent or permeate from the UF's are sent to the permeate tanks. All three lines then combine at one ultraviolet light disinfection system (photo #07). The UV system consists of 8 lights and a control board (photo #08) has a lighted alarm if any of the bulbs are out. Neither intensity nor wattage is monitored with this system. From the UV, the flow can either go straight overboard, be combined with the graywater system effluent, or can go to storage tanks. The blackwater system is currently not discharging in MOU waters.

A high alarm is set for turbidity, and a high-high alarm is set which automatically shuts down any discharge.

A maintenance program, AMOS, triggers maintenance required such as oiling and greasing motors. Spare blowers, motors, membranes, screens, and UV bulbs are kept on board the vessel.

Sampling is not required per the MOU when not approved and not discharging. No samples were taken by Ecology.

Conclusions and Recommendations
The staff on board the vessel were very knowledgeable of the systems and protocols. The discharge protocols and notification procedures were very clear.

The efforts made towards waste minimization and energy conservation are impressive.

It is recommended that staff continue to work towards high functioning wastewater treatment systems.

Attachments:
Photographs

Copies to:
John Turvey, HAL
William Morani, Jr., HAL
Bob Diaz, HAL
Tina Stoltz, HAL
Kieron Connelly, Environmental Officer
Amy Jankowiak, Ecology
Mark Henderson, Ecology
Mark Toy, Health
Kevin Fitzpatrick, Ecology
Central Files: Holland America Line – HOLLAND WESTERDAM; WQ 6.1

Section I: Signatures

Name and Signature of Inspector	Agency/Office/Telephone	Date
Amy Jankowiak Amy Jankowiak	Department of Ecology/Northwest Regional Office/Water Quality Program/Municipal Compliance Specialist/(425) 649-7195	8/13/09
Name and Signature of Reviewer	**Agency/Office/Telephone**	**Date**
Kevin C. Fitzpatrick Kevin C. Fitzpatrick	Department of Ecology/Northwest Regional Office/Water Quality Section Manager/(425) 649-7033	8/13/09

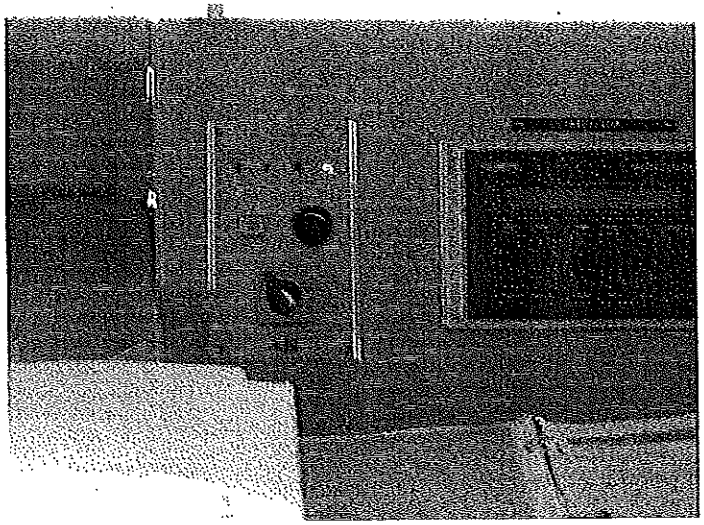


PHOTO #:01 DATE: JULY 26, 2009
TAKEN BY: MARK HENDERSON FILE NO.:IMG_1104
DESCRIPTION: VALVE MONITORING SYSTEM

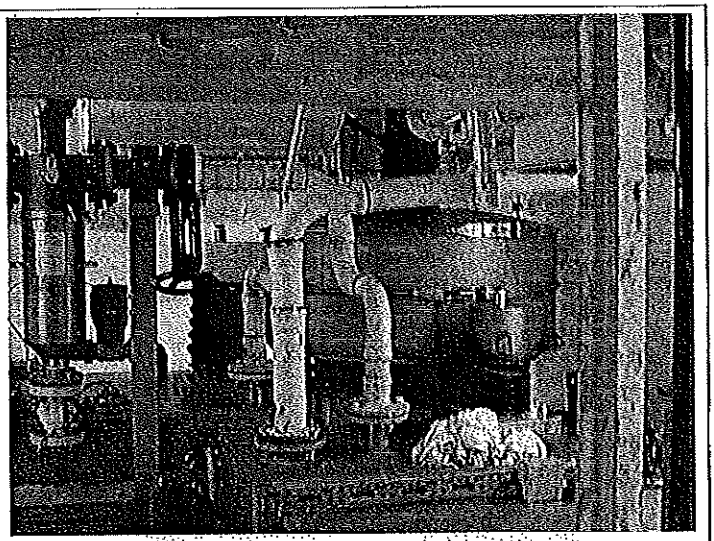


PHOTO #:02 DATE: JULY 26, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_1116
DESCRIPTION: PRE-FILTRATION – SWECO SYSTEM

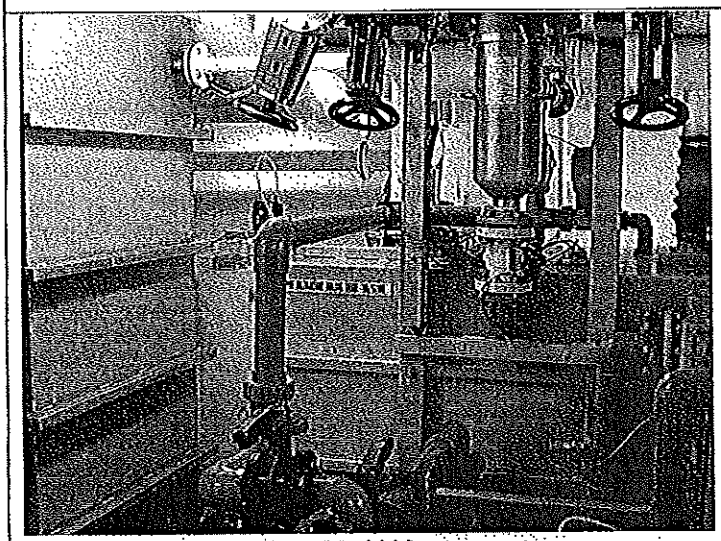


PHOTO #:03 DATE: JULY 26, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_1117
DESCRIPTION: PRE-FILTRATION SOLIDS TANK

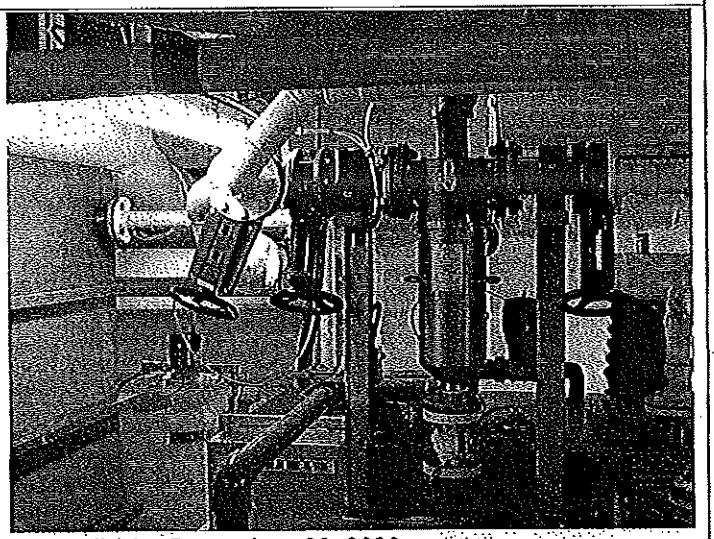


PHOTO #:04 DATE: JULY 26, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_1120
DESCRIPTION: CAUSTIC SODA STORAGE (BEHIND SOLIDS TANK)

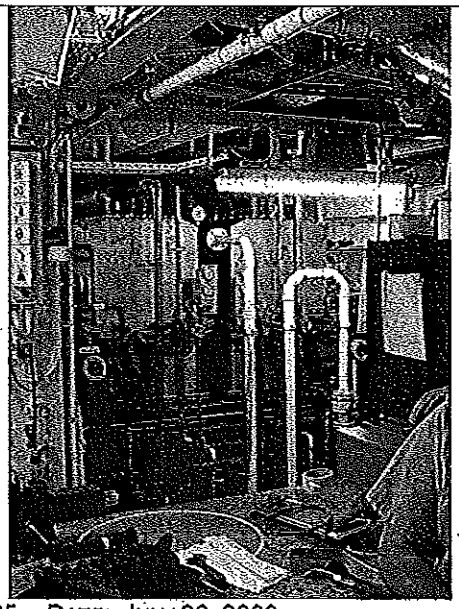


PHOTO #:05 DATE: JULY 26, 2009
TAKEN BY: MARK HENDERSON FILE NO.:IMG_1118
DESCRIPTION: MEMBRANE BIOREACTORS

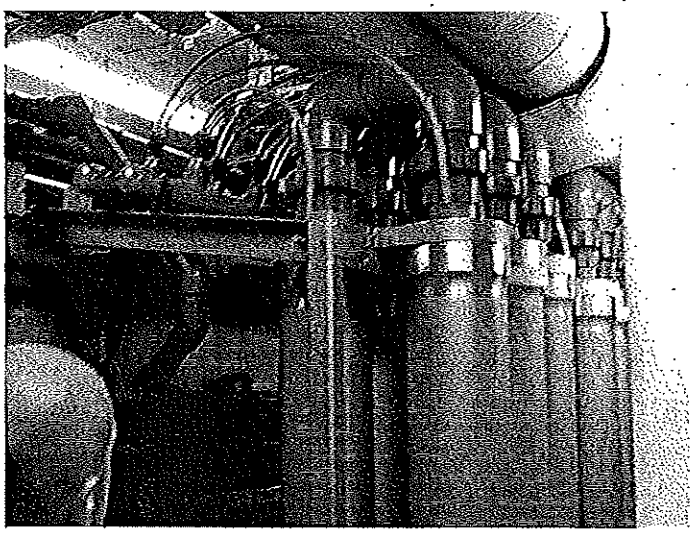


PHOTO #:06 DATE: JULY 26, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_1111
DESCRIPTION: MEMBRANE FILTERS

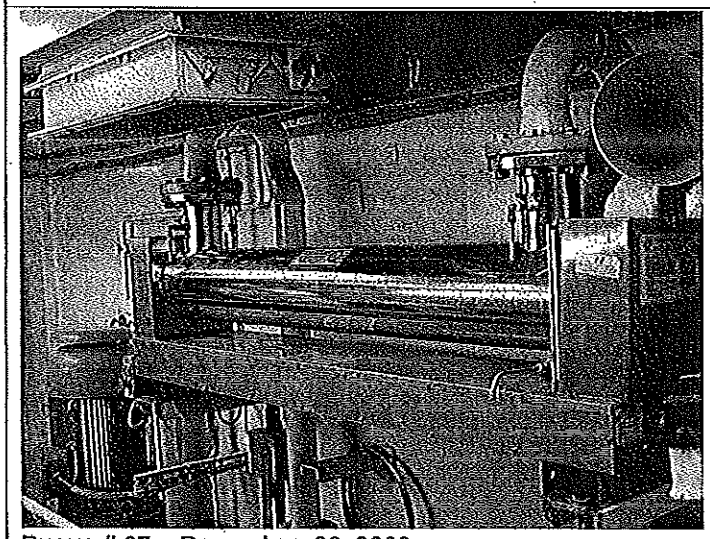


PHOTO #:07 DATE: JULY 26, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_1114
DESCRIPTION: ULTRAVIOLET (UV) DISINFECTION SYSTEM

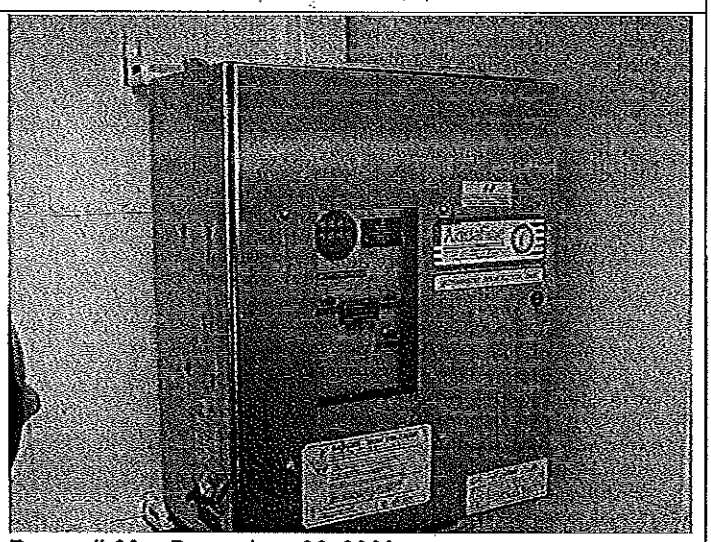


PHOTO #:08 DATE: JULY 26, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_1115
DESCRIPTION: UV DISINFECTION SYSTEM CONTROL BOX

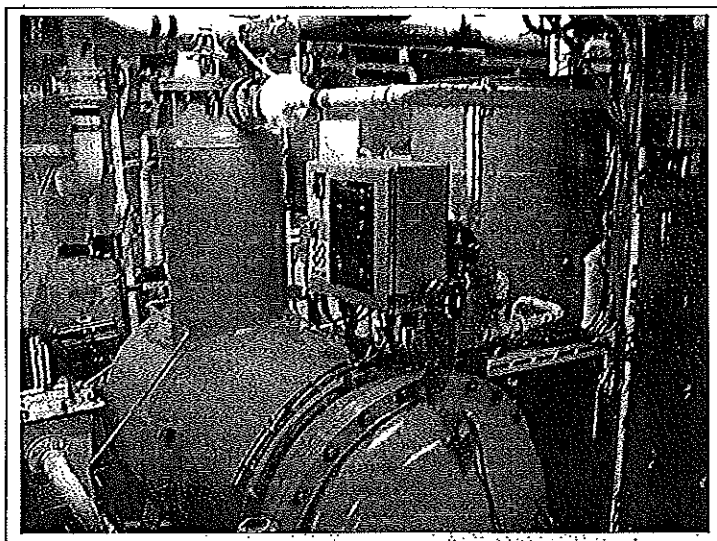


PHOTO #:09 DATE: JULY 26, 2009
TAKEN BY: MARK HENDERSON FILE NO.:IMG_1121
DESCRIPTION: OILY BILGE OILY WATER SEPARATOR – FACET SYSTEM

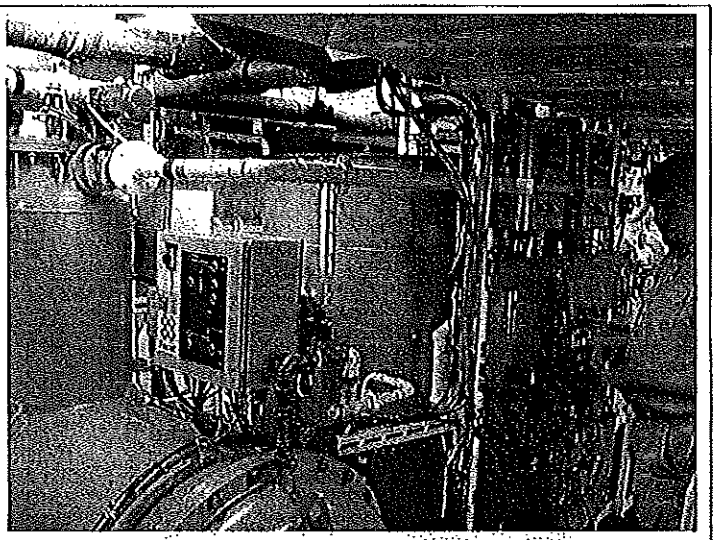


PHOTO #:10 DATE: JULY 26, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_1122
DESCRIPTION: OILY BILGE OILY WATER SEPARATOR – SERAP SYSTEM

PHOTO #:11 DATE: JULY 26, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_1123
DESCRIPTION: OWS FACET SPARE FILTER

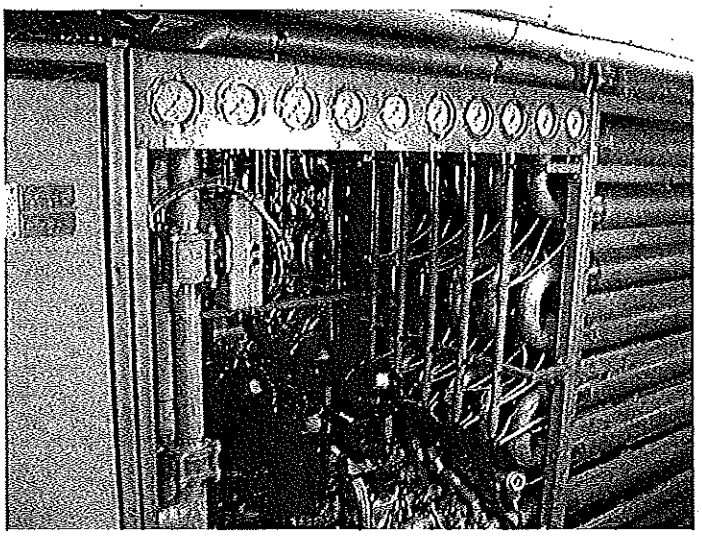


PHOTO #:12 DATE: JULY 26, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_1125
DESCRIPTION: GRAY WATER REVERSE OSMOSIS SYSTEM

PHOTO #:13 DATE: JULY 26, 2009
TAKEN BY: MARK HENDERSON FILE NO.:IMG_1128
DESCRIPTION: GLASS SHREDDER

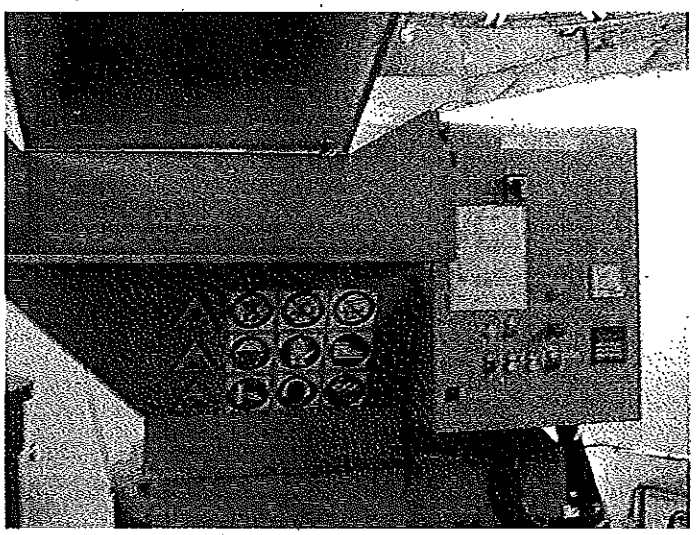


PHOTO #:14 DATE: JULY 26, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_1129
DESCRIPTION: PLASTIC SHREDDER

State of Washington Department of Ecology

Cruise Ship Memorandum of Understanding, Cruise Operations in Washington State Inspection Report

Northwest Regional Office
3190 160th Ave SE
Bellevue, WA 98008
Phone: (425) 649-7000 Fax: (425) 649-7098

Section A: General Information

Vessel Name:	NORWEGIAN STAR	Date:	August 8, 2009
Vessel Operator:	Norwegian Cruise Line	Entry Time:	9:40 AM
Vessel Type:	Passenger Vessel	Exit Time:	11:40 AM
Location:	Pier 66, Seattle	Notification (name & date):	Randy Fiebrandt; August 3, 2009
On-board contact(s):	Davor Baletin, Environmental Officer		
Inspector(s):	Amy Jankowiak, Department of Ecology, Water Quality Program		
# passengers/crew:	~2700/~1100		

The NORWEGIAN STAR arrived on May 9, 2009 at the Port of Seattle to begin the 2009 cruise season. Black/Gray water is treated with the Scanship System, a biological reactor and ultrafiltration system. The system includes prefiltration, biological treatment via a biofilm process, chemical precipitation, clarification through flotation tanks, polishing filtration and UV disinfection. Approval for continuous discharge from Ecology was granted in 2004 through 2008 and May 5, 2009.

Section B: Areas Evaluated

☒	Black/Gray wastewater system	☒	Residual solids	☒	Records/Reports	☒	Hazardous Waste/Solid Waste	☒	Sampling/ Monitoring
☒	Discharge locations	☒	Operations & Maintenance	☒	Sludge Handling/ Disposal	☒	Oily bilge water	☒	Other

Section C: For vessels discharging ≥ 1nm from berth and ≥ 6 knots only [2.1.3(A)]

☐	Schematics match black/gray wastewater system	Not Applicable
☐	Operations as described in submitted documentation	Not Applicable
☐	Daily 24-hour continuous monitoring for turbidity or equivalent monitoring	Not Applicable
☐	Turbidimeter or equivalent monitoring equipment functioning properly	Not Applicable
☐	Auto shut down or operational controls to insure system shut down if high turbidity occurs	Not Applicable
	Turbidity or equivalent : Last calibration Trigger level for early alarm: Trigger level for shutdown: Recorded turbidity/equivalent levels above triggers:	
☐	Daily 24-hour continuous monitoring for disinfection effectiveness	Not Applicable
☐	Disinfection effectiveness monitoring equipment functioning properly	Not Applicable
	Disinfection Effectiveness Monitoring:	
☐	Auto shut down or operational controls to insure system shut down if disinfection system upset occurs	Not Applicable
☐	Disinfection system operated and maintained properly	Not Applicable
	Disinfection System:	

Section D: For vessels discharging continuously [2.1.3(B)]		
☒	Schematics match black/gray wastewater system	Schematics appeared to be consistent with they system on board.
☒	Operations as described in submitted documentation	Operations were as described.
☒	Daily 24-hour continuous turbidity or equivalent monitoring	Has continuous TSS monitoring.
☒	Turbidimeter or equivalent monitoring equipment functioning properly	Appears to be functioning properly.
☒	Auto shut down or operational controls to insure system shut down if a high turbidity occurs	A value of 28 mg/l or greater triggers automatic shut down of that MBR.
	Turbidity or equivalent : Last calibration: in AMOS Trigger level for early alarm: 20 mg/l Trigger level for shutdown: 28 mg/l Recorded turbidity/equivalent levels above triggers:	
☒	Daily 24-hour continuous monitoring for disinfection effectiveness	Has disinfection effectiveness monitoring.
☒	Disinfection effectiveness monitoring equipment functioning properly	Appears to be functioning properly.
	Disinfection Effectiveness Monitoring: The bulbs are alarmed for bulb failure and intensity at 10 watts per meter squared (W/m^2).	
☒	Auto shut down or operational controls to insure system shut down if disinfection system upset occurs	Low intensity will shut down the effluent.
☒	Disinfection system operated and maintained properly	The UV system appeared to be operational and maintained well.
☒	Disinfection immediately prior to discharge	Protocol: When discharging, UV occurs immediately prior to discharge.
	Disinfection System:	

Section E: General (Approved to Discharge)		
☒	No discharges within ½ mile from shellfish beds/protocol (President's Point, Apple Tree Cove, Tyee Shoal)	There is a clear protocol in place to stop discharges for about one hour while in the shellfish beds area. During that hour, the effluent is sent to holding tanks and recirculated through the system. This protocol keeps discharges completely out of the area of ½ mile from shellfish beds.
☒	Discharges immediately stopped when high turbidity occurs	They do have their systems set up to automatically shut down the discharge if high TSS (equivalent to turbidity) occurs.
☒	Discharges immediately stopped when disinfection system upset occurs	They do have their systems set up to automatically shut down the discharge if the UV intensity is less than 10 w/m^2 (recirculates).
☒	Immediate notifications made to Health for disinfection system upset	A copy of the current MOU was on board. A notification list including Ecology and DOH numbers is also posted.
☒	Sampling conducted 2/month, 1/month in Seattle (BOD, TSS, fecal coliform, pH, chlorine residual)	Sampling is being conducted as required, as of the date of the inspection.
☒	Whole Effluent Toxicity Testing 1 per 2 years (homeported) or once/40 calls for continuous	Wet testing was completed last season and is not required this season.

Section F: General		
☒	Wastewater Discharge records review	Discharge records were reviewed (blackwater/graywater/residual solids) and are maintained properly. Untreated sewage/gray water (USG), held discharges, and biomass were all outside of MOU waters.
☒	Residual solids managed properly/ disposal protocol per MOU	Residual solids are held to be discharged at greater than 12 nautical miles and outside of MOU waters and the Olympic Coast National Marine Sanctuary.
☒	Hazardous Waste managed properly	All hazardous waste that is collected is being sent off-shore in Canada. Records were reviewed for hazardous waste discharges.
☒	WA Haz Waste guidelines followed (appendix vii)	All hazardous waste that is collected is being sent off-shore in Canada. Records were reviewed for hazardous waste discharges.
☒	Solid Waste managed properly	Solid waste is being managed properly. The various solid waste streams are collected, sorted, stored, and sent ashore or incinerated as appropriate. Records showed only food waste being discharged and

		only outside of MOU waters.
☒	Oily bilge water managed properly	Oily bilge water is treated and discharged at less than 15 ppm and outside of MOU waters.
Other:		

Health = Washington State Department of Health

Section G: Sample Results

Parameter	Results
Biochemical Oxygen Demand 5-Day (BOD)	<10 mg/l
Total Suspended Solids (TSS)	6.0 mg/l
Fecal Coliform	2 CFU/100 ml
Residual Chlorine	0.75 mg/l
pH	7.32
Ammonia, Nitrogen	39.3 mg/l

Section H: Summary of Findings/Comments

Introduction

Amy Jankowiak, Washington State Department of Ecology (Ecology) Northwest Regional Office, Water Quality Program conducted the inspection of the Norwegian Cruise Line NORWEGIAN STAR on August 8, 2009. The main contact on board the NORWEGIAN STAR included Davor Baletin, Environmental Officer. Prior notification of the visit was given on August 3, 2009 for security protocol. The purpose of the inspection was to evaluate compliance with the *Memorandum of Understanding Cruise Operations in Washington State* (MOU), as amended. A copy of the current MOU was on-board. The NORWEGIAN STAR received approval to discharge continuously on May 5, 2009.

The NORWEGIAN STAR was built in 2001, is 965 feet long with 15 guest decks, with about a 28-foot draft. It is my understanding that the ship's wastewater system, Scanship, was installed in 2004.

Inspection

We arrived and boarded the ship at about 9:40 pm and began with introductions and a plan for the day with Davor Baletin, Environmental Officer in the Engine Control Room (ECR) area and discussed various waste streams, and the discharge protocols. Discharge records were reviewed for blackwater and graywater discharges, solid waste, and hazardous waste off-loads. We then discussed the blackwater and graywater system in detail. Next, we viewed the Hamworthy system and the oily water separator system. We then viewed the garbage and recycling area, the food waste pulper, and the garbage storage area. We then took samples of the Scanship effluent, finalized the inspection and disembarked the vessel at about 11:40 am.

Discharge Types and Protocols:

If a discharge is allowed, the Bridge authorizes any discharge. The bridge contacts the Environmental Officer as the vessel enters area of allowed discharges. The Environmental Officer has the key to unlock the discharge ports, as well as the Chief Engineer. For wastewater discharges, the latitude and longitude coordinates are recorded in the *Sewage and Graywater Discharge Record Book* and in the deck log. The date, time and location of both the start and the stop of the discharges are recorded, along with port location, effluent type, and volumes. There is an interlock for the discharge ports that records the activity of the locks electronically and is kept for about one year. All discharge records that were reviewed appeared to be in compliance with the MOU.

Blackwater, which includes toilet waste and infirmary drains and graywater which includes sink and shower and laundry water is treated with a Scanship advanced wastewater treatment system and is discharged continuously with the exception of the area near shellfish beds. There is a clear protocol in place to stop discharges for about one hour while in the shellfish beds area. During that hour, the effluent is sent to holding tanks and recirculated through the system. This protocol keeps discharges completely out of the area of ½ mile from shellfish beds. Beginning in the 2009 season, no discharges of any kind are occurring in the entire Olympic Coast National Marine Sanctuary.

Screenings and grit from drum screen and well as biomass (sewage sludge) from the Scanship system is held and then discharged outside of MOU waters, >12 nautical miles from shore, and outside of the Olympic Coast National Marine

Sanctuary.

Pool water is discharged outside of 12 nautical miles. Spa water is neutralized and discharged.

Food waste is collected in various locations, is sent through a pulper to less than 25 mm. The water is recirculated and eventually sent to galley gray water (about every three weeks). Pulped solid waste is also discharged outside of MOU waters. Bones from the galley are crushed and incinerated. Grease, or cooking oil is collected (photo #07) sent to the oil sludge tank for off-loading.

Oily bilge water is sent to a dirty bilge tank and then onto the Marinfloc for separating oil. Liquid from the Marinfloc goes to the Clean bilge tank and onto the oily water separator. From the oily water separator, the oil content is again measured in the locked "white box". If the parts per million (ppm) exceed 15, there the discharge valve closes and sends the waste either to the clean bilge tank where it then again goes through the oily water separator or it can be sent all the way back to the dirty bilge tank. Typical concentrations are about 2-3 ppm. Effluent from the clean bilge tank is discharged outside of MOU waters. Residue and oily sludge is off-loaded in Prince Rupert.

Dry cleaning uses PERC which is off-loaded as hazardous waste in Prince Rupert. Silver is captured from the photo waste, treated to less than 5 ppm and is off-loaded as non-hazardous waste. Some of the X-ray waste is hazardous and off-loaded as such, while some is non-hazardous and off-loaded as such. Other hazardous wastes include batteries, paints, oil filters, aerosols (punctured), and sharps. Fluorescent bulbs are crushed with a system that removes mercury by filter which is sent off as hazardous waste. Medical, red bag waste is typically incinerated about 2-3 times per week. All hazardous waste is off-loaded in Prince Rupert about once or twice a month. Narcotics and expired medications are logged and incinerated. Other materials incinerated include paper, food–contaminated cardboard, oily rags and low-density plastics.

Plastics, garbage, and other materials are collected and sorted on a sorting table. Crew do their own sorting of their own wastes. Most materials are then condensed and recycled on-shore. Glass, aluminum, tin, scrap metal and plastics, and some cardboard are all recycled along with other materials. Some of the recycled materials are off-loaded in Seattle.

Black water and Gray water System:
Blackwater, which includes toilet waste and infirmary drains goes to one of 4 collection tanks and graywater which includes sink and shower, galley and laundry water combines in tanks before combining and entering the drum screens. There are two drum screens which provide pre-screening and are cleaned about once every 2 days. Solids from the drum screens go to the sludge tank. Liquid flow from the drum screens then enters the biostep tanks for biological treatment (biofilm on rotating plastic pieces – 2 tanks in series, air added). The plastic pieces in the biostep were recently replaced for better function. After biostep, flocculants and polymers are added. Clarification then occurs via flotation tanks. Solids from the flotation tanks are sent to the sludge tank along with the screenings to be held for later discharge. Liquid flow then moves to the polishing filters for ultrafiltration (2 rotating mesh drums), and then to ultraviolet (UV) disinfection. There are three UV units, of which two are typically used with 14 bulbs each. There are typically about 20 spare bulbs on board. The bulbs are alarmed for bulb failure and intensity at 10 watts per meter squared (W/m^2). At the time of the inspection, the two operating UV units were at 35 W/m^2 and 56 W/m^2. The Environmental Officer was only aware of one time when the UV system alarmed and that was due to a washing issue and the end of July. The UV sleeves are cleaned by dosing Metal Bright cleaner automatically. Flow from the UV units is either discharged directly overboard via the discharge port or is held and re-circulated.

The vessel is currently under-going a year-long process of replacing the metal plumbing throughout with plastic to minimize metal concentrations in the effluent.

The cruise line uses a system called AMOS for work orders and maintenance. Manufacturer recommendations for maintenance of each piece of equipment is included in the AMOS system which triggers staff when maintenance is required. Scanship also monitors maintenance on the system. Any needed calibrations, cleaning, and other needed maintenance would be included in AMOS. Total suspended solids (TSS) (equivalent to turbidity) is monitored continuously at UV disinfection. If TSS exceed 20 mg/l, the system alarms and staff responds to investigate. At 28 mg/l, the system alarms and switches automatically to hold and re-circulate that discharge. At 30 mg/l, the effluent from the system is shut down. PH is also monitored for adjustments.

Samples were taken for Biochemical Oxygen Demand (BOD 5-Day), Total Suspended Solids (TSS), pH, chlorine residual, fecal coliform and ammonia from the combined effluent of the Scanship system after UV disinfection. The sample port was disinfected by heat prior to pulling samples. The samples were put on ice immediately and were transported to AmTest laboratory in Redmond, Washington that morning. Chain of Custody and sampling procedures were followed. All results are in Section F. The results are typical of the results submitted to Ecology thus far for 2009 with the exception of chlorine residual. The chlorine residual was higher with Ecology's testing than they have been for the other results submitted to date.

Conclusions and Recommendations

The protocols for discharging away from the shellfish beds was very clear.

It is recommended that staff continue to work towards a high functioning wastewater treatment system.

Attachments:
Photographs
Laboratory Report

Copies to:
Randy Fiebrandt, NCL
Davor Baletin, NCL
Amy Jankowiak, Ecology
Karen Burgess, Ecology
Mark Toy, Health
Kevin Fitzpatrick, Ecology
Central Files: Norwegian Cruise Line – NORWEGIAN STAR; WQ 6.1

Section I: Signatures		
Name and Signature of Inspector Amy Jankowiak Amy Jankowiak	Agency/Office/Telephone Department of Ecology/Northwest Regional Office/Water Quality Program/Municipal Compliance Specialist/(425) 649-7195	Date 9/3/09
Name and Signature of Reviewer Kevin C. Fitzpatrick Kevin C. Fitzpatrick	Agency/Office/Telephone Department of Ecology/Northwest Regional Office/Water Quality Section Manager/(425) 649-7033	Date 9/3/09

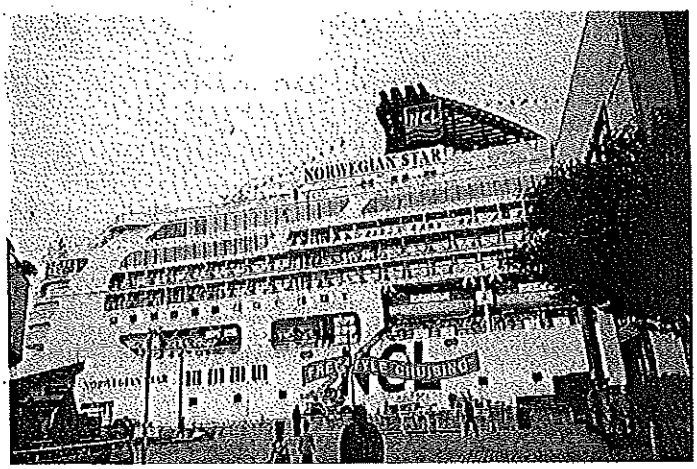


PHOTO #:01 DATE: AUGUST 08, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P8080001
DESCRIPTION: NORWEGIAN STAR VESSEL, PIER 66, SEATTLE

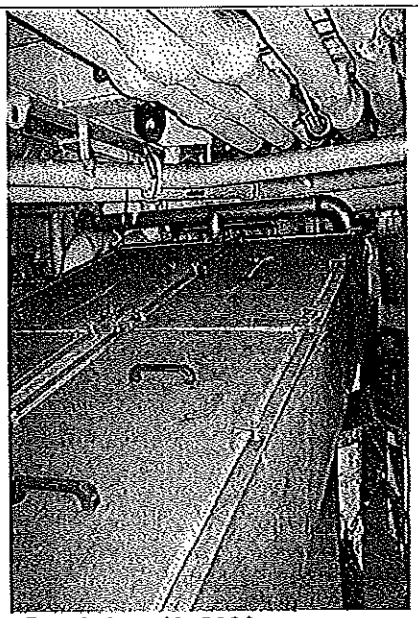


PHOTO #:02 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P8080002
DESCRIPTION: SCANSHIP- DRUM SCREENS

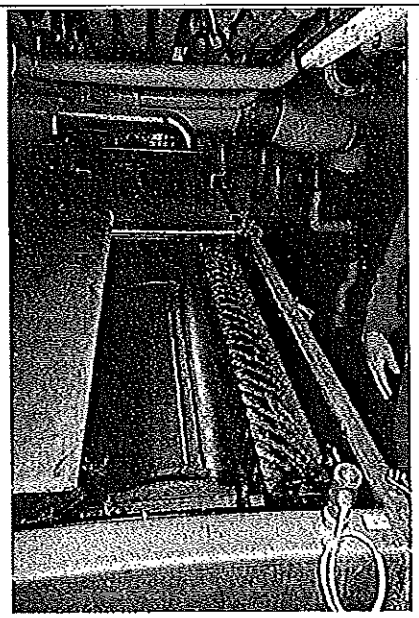


PHOTO #:03 DATE: AUGUST 8, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P8080003
DESCRIPTION: SCANSHIP - INSIDE OF DRUM SCREEN

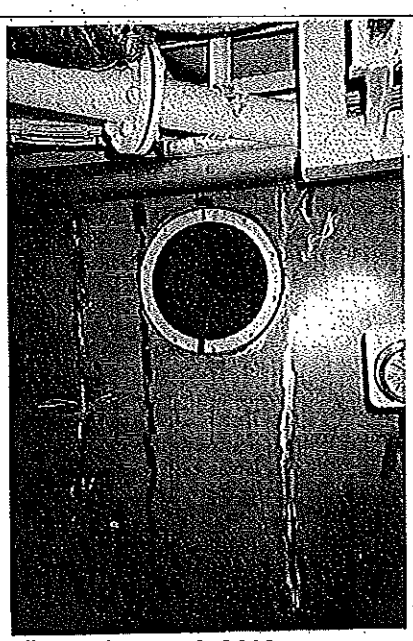


PHOTO #:04 DATE: AUGUST 8, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P8080004
DESCRIPTION: SCANSHIP - BIOSTEP

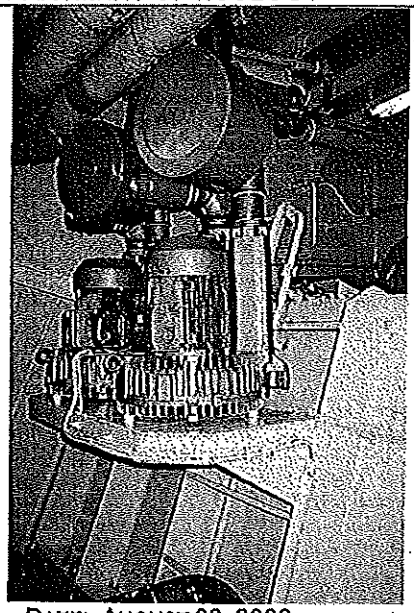


PHOTO #:05 DATE: AUGUST 08, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P8080005
DESCRIPTION: SCANSHIP - BLOWERS

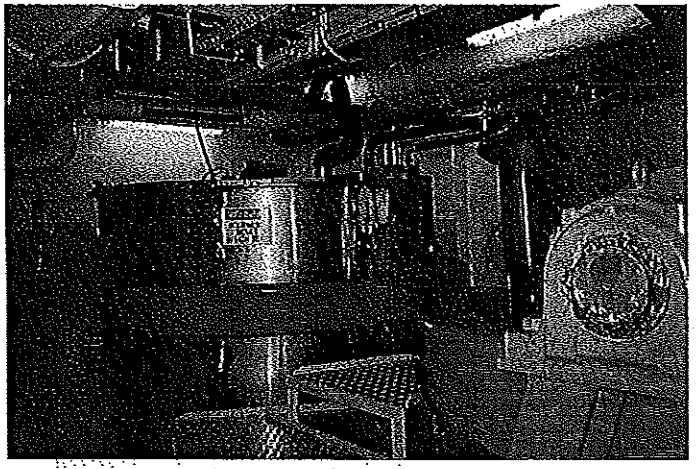


PHOTO #:06 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P8080008
DESCRIPTION: SCANSHIP FLOTATION TANKS

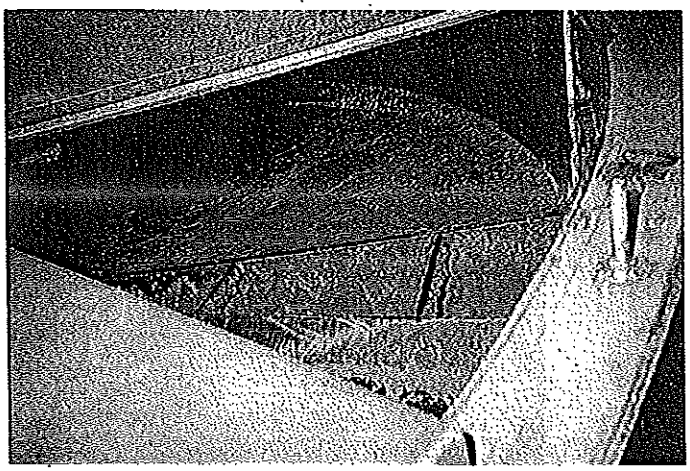


PHOTO #:07 DATE: AUGUST 8, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P8080009
DESCRIPTION: SCANSHIP – INSIDE OF FLOTATION TANK

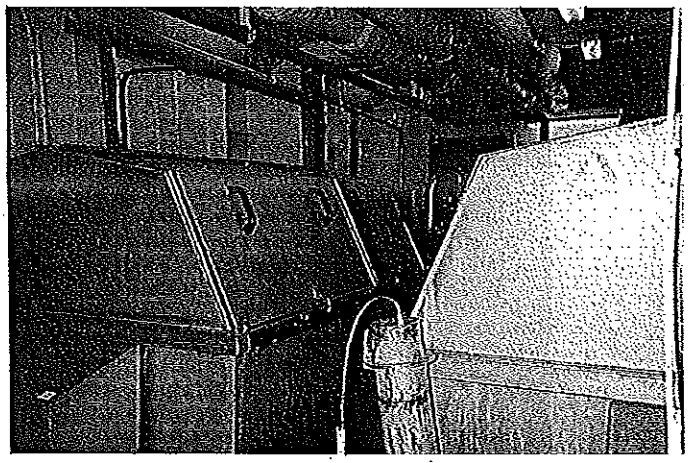
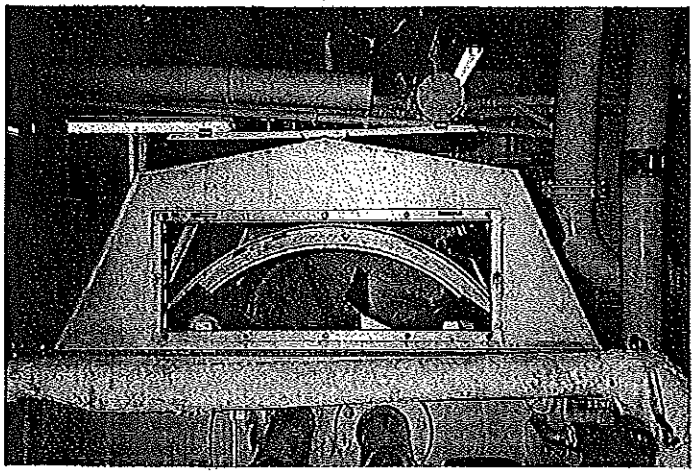


PHOTO #:08 DATE: AUGUST 8, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P8080010
DESCRIPTION: SCANSHIP – POLISHING FILTERS



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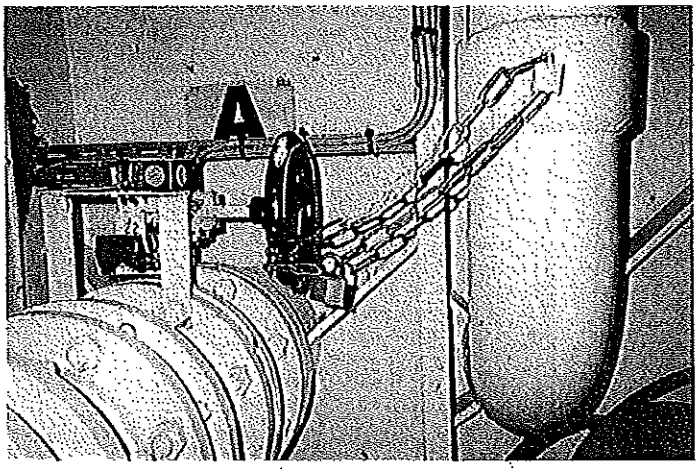

PHOTO #:10 DATE: JULY 19, 2009
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DESCRIPTION: DISCHARGE PORT - PADLOCKED

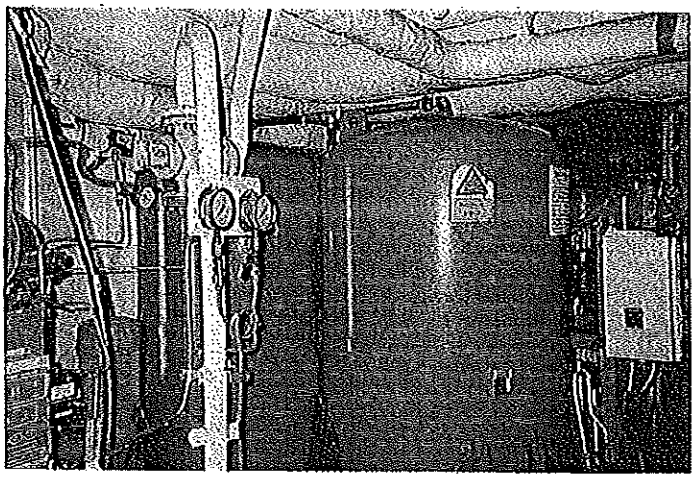

PHOTO #:11 DATE: AUGUST 8, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P8080006
DESCRIPTION: OILY WATER SEPARATOR SYSTEM

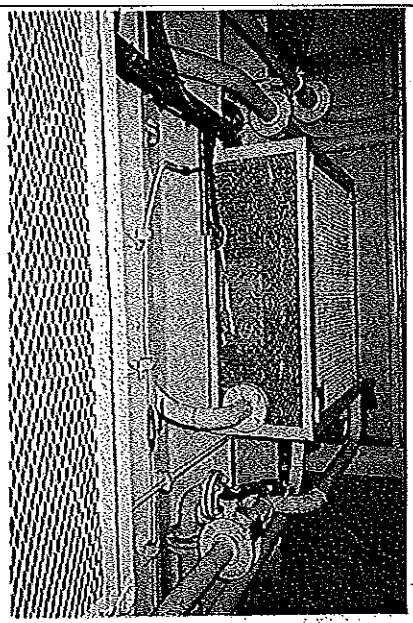

PHOTO #:12 DATE: AUGUST 8, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P8080007
DESCRIPTION: OILY WATER SEPARATOR WHITE BOXES

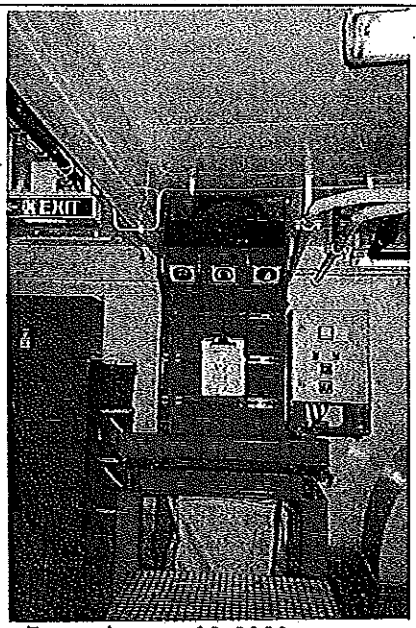

PHOTO #:13 DATE: AUGUST 08, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P8080013
DESCRIPTION: GLASS CRUSHER

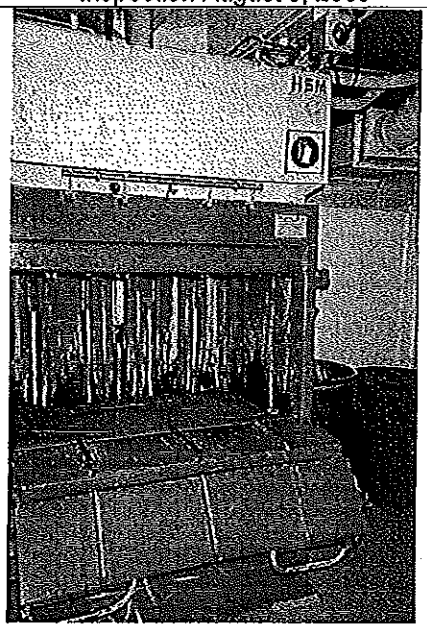

PHOTO #:14 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P8080014
DESCRIPTION: CARDBOARD CRUSHER

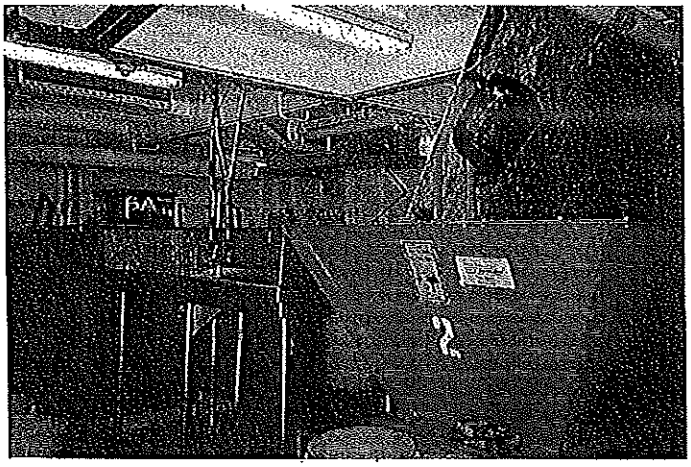

PHOTO #:15 DATE: AUGUST 8, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P8080015
DESCRIPTION: GARBAGE/RECYCLING SORTING AREA/TOP OF INCINERATOR

PHOTO #:16 DATE: AUGUST 8, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P8080017
DESCRIPTION: COOKING OIL/GREASE

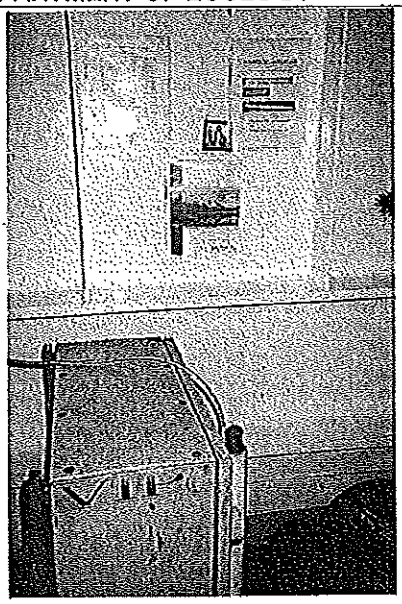

PHOTO #:17 DATE: AUGUST 08, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P8080016
DESCRIPTION: FLUORESCENT BULB CRUSHER (TOP)

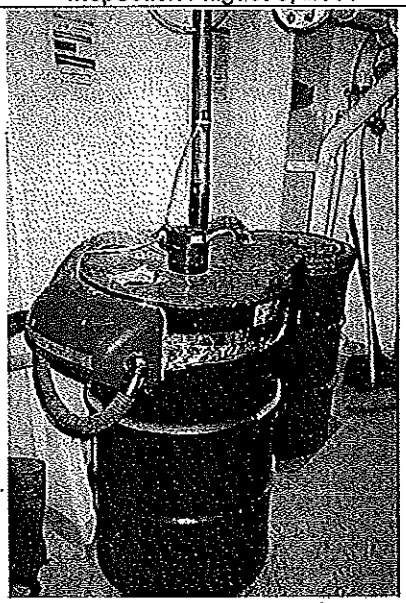

PHOTO #:18 DATE: JULY 19, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P8080018
DESCRIPTION: FLUORESCENT BULB CRUSHER (BOTTOM) – MERCURY REMOVAL SYSTEM

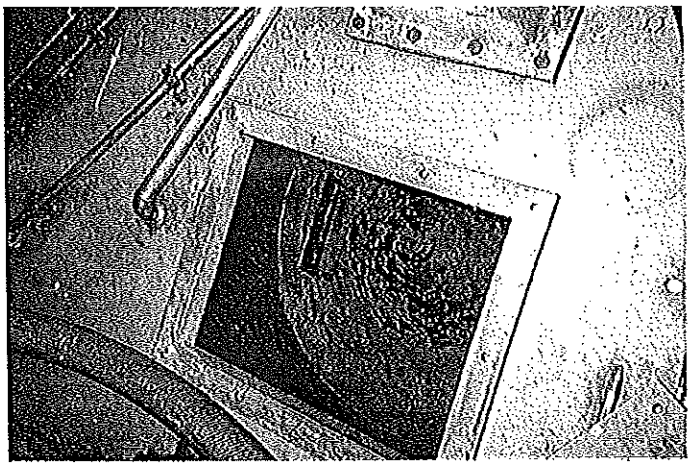

PHOTO #:19 DATE: AUGUST 8, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P8080019
DESCRIPTION: FOOD WASTE

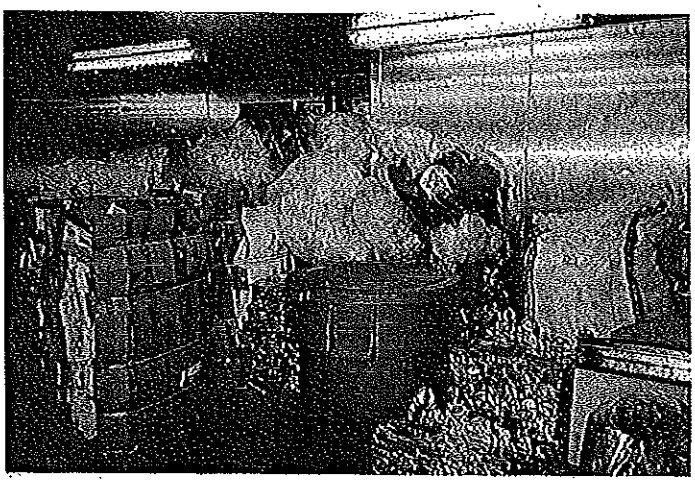

PHOTO #:20 DATE: AUGUST 8, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P8080020
DESCRIPTION: COLD STORAGE – GARBAGE AND RECYLABLES

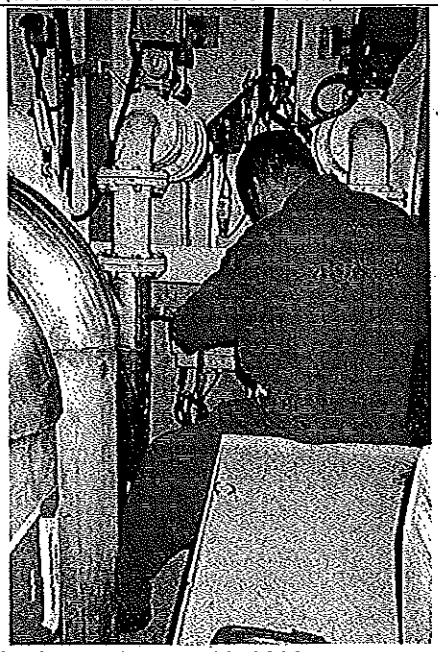

PHOTO #:21 DATE: AUGUST 08, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P8080021
DESCRIPTION: SCANSHIP SAMPLING

AMTEST LABORATORIES

Professional Analytical Services

Am Test Inc.
13600 NE 126TH PL
Suite C
Kirkland, WA 98034
(425) 885-1664

Aug 28 2009
Department of Ecology
3190 160th Ave SE
Bellevue, WA 98008
Attention: Amy Jankowiak

Dear Amy Jankowiak:

Enclosed please find the analytical data for your Norweglan Star project.

The following is a cross correlation of client and laboratory identifications for your convenience.

CLIENT ID	MATRIX	AMTEST ID	TEST
Norstar-Eff	Water	09-A012937	Micro, CONV, DEM, NUT

Your sample was received on Saturday, August 8, 2009. At the time of receipt, the sample was logged in and properly maintained prior to the subsequent analysis.

The analytical procedures used at AmTest are well documented and are typically derived from the protocols of the EPA, USDA, FDA or the Army Corps of Engineers.

Following the analytical data you will find the Quality Control (QC) results.

Please note that the detection limits that are listed in the body of the report refer to the Method Detection Limits (MDL's), as opposed to Practical Quantitation Limits (PQL's).

If you should have any questions pertaining to the data package, please feel free to contact me.

Sincerely,

Kathy Fugiel
President

BACT = Bacteriological
CONV.= Conventionals
TC=Total Coliforms

MET = Metals
ORG = Organics

NUT=Nutrients
DEM=Demand

MIN=Minerals
APC=Aerobic Plate Count

Am Test Inc.
13600 NE 126TH PL
Suite C
Kirkland, WA 98034
(425) 885-1664
www.amtestlab.com

AMTEST LABORATORIES

Professional Analytical Services

ANALYSIS REPORT

Department of Ecology
3190 160th Ave SE
Bellevue, WA 98008
Attention: Amy Jankowiak
Project Name: Norwegian Star
All results reported on an as received basis.

Date Received: 08/08/09
Date Reported: 8/28/09

AMTEST Identification Number 09-A012937
Client Identification Norstar-Eff
Sampling Date 08/08/09, 11:24

Microbiological

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Fecal Coliforms	2.	CFU/100 ml		1.	SM 9222D	KF	08/08/09 12:30

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
pH	7.32	unit	*		EPA 150.1	SS	08/08/09
Chlorine Residual	0.75	mg/l		0.10	EPA 330.5	KF	08/08/09
Total Suspended Solids	6.0	mg/l		1.0	SM 2540D	SL	08/10/09

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
BOD	< 10	mg/l		10.	SM 5210B	KF	08/08/09

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	39.3	mg/l		0.005	EPA 350.1	TS	08/12/09

* = The method specifies the test is to be performed in the field; therefore the result is an estimate.

Kathy Fuglel
President

AMTEST
LABORATORIES

QC Summary for sample number: 09-A012937

DUPLICATES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	DUPLICATE VALUE	RPD
09-A012937	BOD	mg/l	< 10	< 10	
09-A012937	Chlorine Residual	mg/l	0.75	0.75	0.00
09-A011978	Ammonia Nitrogen	mg/l	0.041	0.039	5.0
09-A012737	Total Suspended Solids	mg/l	4.0	6.0	40.
09-A012746	Total Suspended Solids	mg/l	160	150	6.5
09-A012914	Total Suspended Solids	mg/l	270	270	0.00

MATRIX SPIKES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	SMPL+ SPK	SPK AMT	RECOVERY
09-A012937	Ammonia Nitrogen	mg/l	39.3	59.6	20.0	101.50 %

STANDARD REFERENCE MATERIALS

ANALYTE	UNITS	TRUE VALUE	MEASURED VALUE	RECOVERY
pH	unit	7.00	7.02	100. %
BOD	mg/l	200	180	90.0 %
Chlorine Residual	mg/l	1.00	0.89	89.0 %
Ammonia Nitrogen	mg/l	0.250	0.231	92.4 %
Total Suspended Solids	mg/l	100	94.	94.0 %
Total Suspended Solids	mg/l	87.	87.	100. %
Total Suspended Solids	mg/l	110	99.	90.0 %

BLANKS

ANALYTE	UNITS	RESULT
BOD	mg/l	< 10
Chlorine Residual	mg/l	< 0.1
Ammonia Nitrogen	mg/l	< 0.005
Total Suspended Solids	mg/l	1.0
Total Suspended Solids	mg/l	< 1
Total Suspended Solids	mg/l	< 1

DEPARTMENT OF ECOLOGY
State of Washington

State of Washington Department of Ecology

Cruise Ship Memorandum of Understanding, Cruise Operations in Washington State Inspection Report

Northwest Regional Office
3190 160th Ave SE
Bellevue, WA 98008
Phone: (425) 649-7000
Fax: (425) 649-7098

Inspection Date	Permit Number	County	Receiving Waters	Ecology Inspector
9/4/2009	NA	King	Marine Waters	Amy Jankowiak, Compliance Specialist
Entry Time 9:42 am Exit Time 12:05 pm	Photos Taken ☒ Yes ☐ No	Samples Taken ☐ Yes ☒ No	Inspection Announced ☒ Yes ☐ No	Discharges to: ☒ Surface Water ☐ Ground Water ☐ Dewater ☐ POTW

Name and Location of Site Inspected:
RHAPSODY OF THE SEAS, Royal Caribbean
Passenger Vessel
Pier 91, Seattle

Additional Participants/Inspectors:
Marietta Sharp, Ecology;
Mark Toy, Department of Health;
Randall Jones, NAVALIS Environmental Systems

On-Site Representative(s): *Name/Title/Phone/e-mail*
Andy England, Environmental Officer
RH_EnvironmentalOfficer@rccl.com

Responsible Official(s): *Name/Title/Address/Phone/e-mail*
Rich Pruitt, Director Environmental Programs
Royal Caribbean International
1080 Caribbean Way, Miami, FL 33132
Office: 305-982-2179; Cell: 305-495-2845; RPruitt@rccl.com

Other Facility Data:
Notification made to Rich Pruitt, September 1, 2009.

Section A: Areas Evaluated

☒ Black/Gray Wastewater System	☒ Residual Solids	☒ Records/Reports	☒ Hazardous Waste/ Solid Waste	☒ Sampling/Monitoring
☒ Discharge Locations	☒ Operation & Maintenance	☒ Sludge Handling/ Disposal	☒ Oily Bilge Water	☒ Other

Section B: For Vessels Discharging ≥ 1nm from Berth and ≥ 6 Knots Only [2.1.3(A)]

☐ Schematics Match Black/Gray Wastewater System	
☐ Operations as Described in Submitted Documentation	
☐ Daily 24-hour Continuous Monitoring for Turbidity or Equivalent Monitoring	
☐ Turbidimeter or Equivalent Monitoring Equipment Functioning Properly	
☐ Auto Shut Down or Operational Controls to Insure System Shut Down If High Turbidity Occurs	

Turbidity or Equivalent:
Last Calibration:
Trigger Level for Early Alarm: Trigger Level for Shutdown:
Recorded Turbidity/Equivalent Levels Above Triggers:

☐ Daily 24-hour Continuous Monitoring for Disinfection Effectiveness	
☐ Disinfection Effectiveness Monitoring Equipment Functioning Properly	

Disinfection Effectiveness Monitoring:

☐ Auto Shut Down or Operational Controls to Insure System Shut Down If Disinfection System Upset Occurs	
☐ Disinfection System Operated and Maintained Properly	

Disinfection System:

Section C: For Vessels Discharging Continuously [2.1.3(B)]

☐ Schematics Match Black/Gray Wastewater System	
☐ Operations as Described In Submitted Documentation	
☐ Daily 24-hour Continuous Monitoring for Turbidity or Equivalent Monitoring	
☐ Turbidimeter or Equivalent Monitoring Equipment Functioning Properly	
☐ Auto Shut Down or Operational Controls to Insure System Shut Down If High Turbidity Occurs	
Turbidity or Equivalent:	
Last Calibration:	
Trigger Level for Early Alarm: Trigger Level for Shutdown:	
Recorded Turbidity/Equivalent Levels Above Triggers:	
☐ Daily 24-hour Continuous Monitoring for Disinfection Effectiveness	
☐ Disinfection Effectiveness Monitoring Equipment Functioning Properly	
Disinfection Effectiveness Monitoring:	
☐ Auto Shut Down or Operational Controls to Insure System Shut Down If Disinfection System Upset Occurs	
☐ Disinfection System Operated and Maintained Properly	
Disinfection System:	
Section D: General (Approved to Discharge)	
☐ No Discharges Within ½ Miles From Shellfish Beds/ Protocol (President's Point, Apple Tree Cove, Tyee Shoal)	
☐ Discharges Immediately Stopped When High Turbidity Occurs	
☐ Discharges Immediately Stopped When Disinfection System Upset Occurs	
☐ Immediate Notifications Made to WA Department of Health for Disinfection System Upset	
☐ Sampling Conducted 2/month, 1/month in Seattle (BOD, TSS, Fecal Coliform, pH, Chlorine Residual)	
☐ Whole Effluent Toxicity Testing 1 per 2 Years (homeported) or 1/40 Calls for Continuous	
Section E: General	
☒ Wastewater Discharge Records Review	Discharge records were reviewed (blackwater/graywater/residual solids) and are maintained properly. All discharges occurred outside of MOU waters (beginning of cruise season to date).
☒ Residual Solids Managed Properly/Disposal Protocol per MOU	Residual solids are either held to be discharged at greater than 13 nautical miles and outside of MOU waters and the Olympic Coast National Marine Sanctuary, incinerated, or drummed and landed ashore.
☒ Hazardous Waste Managed Properly	Hazardous waste is typically off-loaded in Seattle with Clean Harbors or is occasionally off-loaded in Victoria. Hazardous waste records were reviewed and appear to be consistent with MOU requirements.
☒ WA Hazardous Waste Guidelines Followed (Appendix vii)	Hazardous waste is typically off-loaded in Seattle with Clean Harbors or is occasionally off-loaded in Victoria. Hazardous waste records were reviewed and appear to be consistent with MOU requirements.
☒ Solid Waste Managed Properly	Solid waste is being managed properly. The various solid waste streams are collected, sorted, stored, and sent ashore or incinerated as appropriate. Records showed only food waste being discharged and only outside of MOU waters.

☒ Oily Bilge Water Managed Properly	Oily bilge water is treated and discharged at less than 5 ppm and outside of MOU waters.

Other:

Section F: Sampling Results

Parameter	Results
Biochemical Oxygen Demand 5-Day (BOD_5)	
Total Suspended Solids (TSS)	
Fecal Coliform	
Residual Chlorine	
pH	
Ammonia, Nitrogen	

Section G: Summary of Findings/Comments

Introduction

Amy Jankowiak, Washington State Department of Ecology (Ecology) Northwest Regional Office, Water Quality Program, Marietta Sharp, Ecology, Solid Waste Program (biosolids), and Mark Toy, Washington State Department of Health – Shellfish Program, conducted the inspection of the Royal Caribbean RHAPSODY OF THE SEAS on September 4, 2009. The main contacts on board the RHAPSODY OF THE SEAS included Andy England, Environmental Officer; and Randall Jones, NAVALIS Environmental Systems®, LLC. Prior notification of the visit was given on September 1, 2009 for security protocol. The purpose of the inspection was to evaluate compliance with the *Memorandum of Understanding Cruise Operations in Washington State* (MOU), as amended.

The RHAPSODY OF THE SEAS arrived on May 15th, 2009 at the Port of Seattle to begin the 2009 cruise season which consists of 18 calls to Seattle. They currently have both a traditional marine sanitation device for blackwater that includes screening, aeration and chlorination and have just recently installed a new advanced wastewater treatment system for both black and gray water. The new AWTS is still undergoing start-up with the manufacturers, but is operating. The new AWTS is a NAVALIS Environmental Systems® treatment system (photo #01) includes equalization, aeration, solids separation, ultrafiltration, advanced oxidation and ultraviolet light disinfection. Approval for continuous discharge from Ecology has not been requested nor issued. The vessel has been holding effluent and not discharging in MOU waters since the beginning of the season.

The RHAPSODY OF THE SEAS' maiden voyage was in 1997, and is 915 feet long with a width of 105.6 feet.

Inspection

We arrived and boarded the ship at about 9:42 am and began with introductions and a plan for the day with Andy England, the Environmental Officer. Mr. England is new to the vessel, but has been the fleet environmental trainer for a number of years. We first discussed the various waste streams and discharge protocols. We then reviewed discharge records for hazardous waste, garbage and black water and graywater. A copy of the current MOU was available. We then headed to the control room for a discussion of the two wastewater treatment systems. We then viewed the black water and gray water systems. We then toured the garbage and recycling area. The inspection was then finalized and we disembarked the vessel at about 12:05 pm.

Discharge Types and Protocols:

All discharges occur outside of 13 nautical miles (they add a one mile buffer beyond their normal policy) with the exception of non-contact cooling water. If a discharge is to occur (although not occurring in MOU waters), the Bridge contacts the engine control room and confirms location. The control room also logs the information. A pre-determined voyage plan is used as guidance, but locations are always verified prior to discharge. The discharge ports have padlocks on them and the keys are kept in the control room under the Watchkeeper's eye. For black water and gray water, the latitude and longitude coordinates are recorded in the *Sewage and Graywater Discharge Record Book* and in the deck log. The date, time and location of both the start and the stop of the discharges are recorded, along with port location, effluent type, and volumes. All wastewater discharge records that were reviewed appeared to be in compliance with the MOU and did not occur in MOU waters.

The vessel currently has both a traditional marine sanitation device for blackwater that includes screening, aeration and chlorination and have just recently installed a new advanced wastewater treatment system for both black and gray water. The new AWTS is still undergoing start-up with the manufacturers, but is operating. Blackwater includes toilet waste and infirmary drains. Gray water includes sink and shower water, laundry water, spa water and galley water. Black water first goes through a three-level shaker screen, while gray water goes through a two-level shaker screen. The black water and gray water is then combined and is treated with the AWTS that includes equalization, aeration, solids separation, ultrafiltration, advanced oxidation and ultraviolet light disinfection. The coarse screenings are collected and incinerated or drummed (photo #16) and sent ashore and the bioresidue collected is sent first through the Solids Reduction System of the NAVALIS system and it is then sent to the traditional marine sanitation device for further treatment before discharge or drumming and sending ashore. Both black water and gray water and bioresidue (also known as sewage sludge or biomass) is currently discharged outside of MOU waters, and outside of 13 nautical miles (nm) from shore.

Oily bilge water is treated with a Marinfloc® sytstem and discharged at less than 5 ppm at greater than 13 nm. A white box is used for additional monitoring assurance. The white box is programmed to prevent discharge at less than 5 ppm. When the white box is opened, the effluent is routed back to the dirty bilge tank. The white box is padlocked and requires two keys. The Engineer on Watch has one key and the Chief Engineer has the other. Sink water from the engine area goes to the oily bilge water system.

Pool water can be held for about 72 hours and is discharged overboard outside of MOU waters. If the pool needs to be emptied while in MOU waters, the pool is closed and covered until they are out at sea. If there sanitation incidents on deck, the area is sanitized and steam units are used. Spa water is discharged to the gray water tanks every 24 hours.

Food waste is collected in various locations and is sent to the pulping system. The Environmental Officer oversees the pulpers and makes sure that it is regularly screened for plastics. Pulped food waste is discharged outside of 13 nm. Used water from the pulpers is sent to the black water collection tanks. Some food wastes such as pineapple rinds, banana peels, coffee, cake and breads which clog up the pulpers is sent to the incinerators. The vessel has a Fats, Oils and Grease (FOG) program to prevent the materials from being discharged. Grease traps are in every galley location as well as restaurant prep areas. Grease is landed ashore in Juneau for biodiesel recycling (approximately 1 ton for every 2 cruises).

Potable water is either bunkered or produced by desalinization when out at sea. An evaporator or a Reverse Osmosis system is used for desal and the brine is discharged outside of 13 nautical miles.

Laundry uses phosphate free Ecolab® products. Dry cleaning uses Perchloroethylene (PERC) which is drummed and off-loaded as hazardous waste. Other hazardous waste materials include photo waste filters (photo liquid waste from the silver recovery system is sent off as non-hazardous waste), spent chemicals, paints and paint thinners, aerosol condensate (photo #17) and filters from the fluorescent bulb mercury removal system (photo #22). Hazardous waste (photo #15) is typically off-loaded in Seattle with Clean Harbors or is occasionally off-loaded in Victoria. Hazardous waste records were reviewed and appear to be consistent with MOU requirements.

Oily rags, medical waste (except sharps), food-contaminated cardboard, some plastics, some paper and wastewater system screenings are all incinerated (photo #21). The vessel is currently using fuel with less than 1.5% sulfur content. Incinerators are not used within 4 nautical miles of Port.

Plastics, cardboard (photo #19), glass (photo #20), sand-filters from the pools/spas, aluminum, tin (photo #18), scrap metals, and batteries are all recycled. Recycling currently takes place in Canada. Dry garage is offloaded as non-hazardous waste. Some materials are also donated when feasible. Ashes and flowers from at-sea funerals are discharged at greater than 13 nautical miles. Garbage records looked to be in good order.

HAMANN® Black water System traditional marine sanitation device:
Blackwater or bioresidue is collected by vacuum. The liquid is coarsely screened and then screened by a drum screen. All solids collected are either incinerated or drummed and off-loaded. The screened liquid is sent to one of two treatment tanks where it is mixed with seawater. The type I marine sanitation device (MSD) consists of aeration, baffles, a minimizing pump and then chlorination by sodium hypochlorite. The liquid is then held for discharge. Any solids collected from the MSD is also collected into the drums for shore side off-loading.

NAVALIS® Black and Gray water Advanced Wastewater Treatment System:
The new AWTS is still undergoing start-up with the manufacturers, but is operating. Blackwater is collected by vacuum and is sent through a three-level shaker screen (photo #08). Plastics and screenings are collected and incinerated or landed ashore. Bioresidue is sent to the Sludge Reduction Tank (photos #02, #03, #04 and #05) for further treatment. Liquid is sent to the Aerated Equalization Tank (AET). Graywater is collected and sent through a two-level shaker tank.

Solids are sent to the solids tank and liquid is sent to the AET. From the AET, flocculation mixing occurs and goes to the Hydraulic Separator (photo #07) which is similar to a dissolved air flotation tank. From their, liquid goes through pre-filters and then to ultrafiltration with tubular ceramic ultrafilters (photo #09). The ultrafilters are inside-out filters where liquid enters through the center and then is filtered outwards through the ceramic. The filters are washed automatically (photo #10), daily. From the ultrafilters, liquid goes to an Advanced Oxidation Batch Reactor. The reject water is sent back to the AET. The filtration filters down to three hundredths of a micron. From the reactor, flow is disinfected with ultraviolet (UV) light (photos #11 and #13) and is then treated with ozone (~230 grams/hr). Effluent is then sent to holding tanks and goes to another UV system immediately prior to discharge (photo #12). Chemicals including polymer and hydrogen peroxide (~10-20 ppm) are used in the system.

The solids are sent first through a Solids Reduction System which includes mineralization, decanting and ozone. The residue is sent to the residue storage tank (photo #06) and is then sent to the HAMANN® unit for further treatment prior to discharge or off-loading. Royal Caribbean is currently evaluating the best option for how to treat and dispose of bioresidue.

Sampling is done on the vessel for process control with an on-board sampling laboratory (photos #23 and #24)

Conclusions and Recommendations
Staff was very knowledgeable of the protocols and systems for treatment and discharges.

The installation of an advanced purification system is applauded for the overall environmental benefits that it will provide. And keeping the traditional MSD on board for additional bioresidue treatment is also an advantage.

Attachments: Photographs

Copies to:
Rich Pruitt, RCCL
Andy England, RCCL
Mark Toy, Department of Health
Karen Burgess, Ecology
Kevin Fitzpatrick, Ecology
Amy Jankowiak, Ecology
Marietta Sharp, Ecology
Central Files: Royal Caribbean – RHAPSODY OF THE SEAS; WQ 6.1

Section H: Signatures

Name and Signature of Inspector:	Agency/Office/Telephone:	Date
Amy Jankowiak Amy Jankowiak	Department of Ecology Northwest Regional Office Water Quality Program Municipal Compliance Specialist 425-649-7195	10/22/09
Name and Signature of Reviewer:	**Agency/Office/Telephone:**	**Date**
Kevin C Fitzpatrick Kevin C Fitzpatrick	Department of Ecology Northwest Regional Office Water Quality Section Manager 425-649-7033	10/23/09

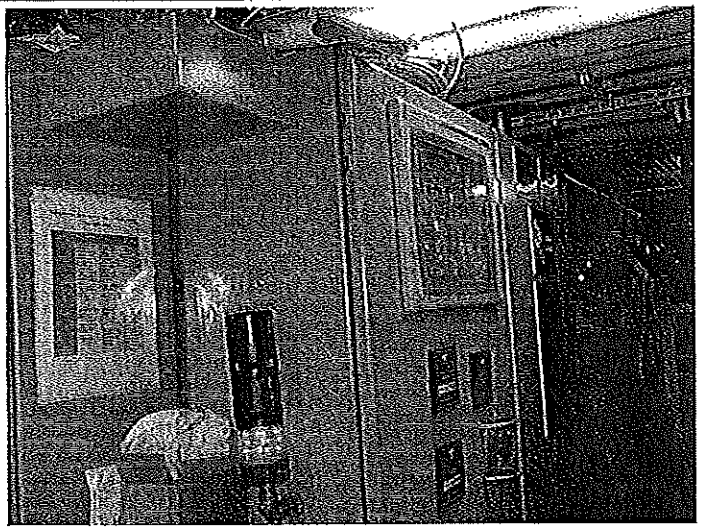

PHOTO #:01 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P9040001
DESCRIPTION: NAVALIS® SYSTEM CONTROLS

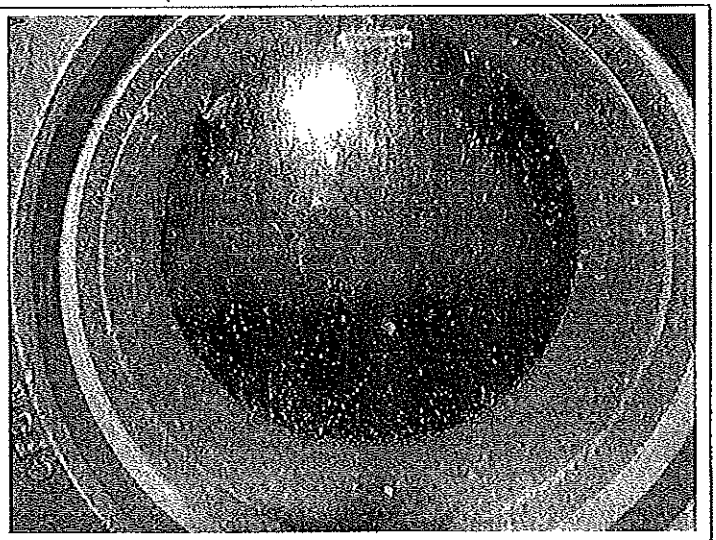

PHOTO #:02 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P9040002
DESCRIPTION: SLUDGE REDUCTION TANK (SRT)

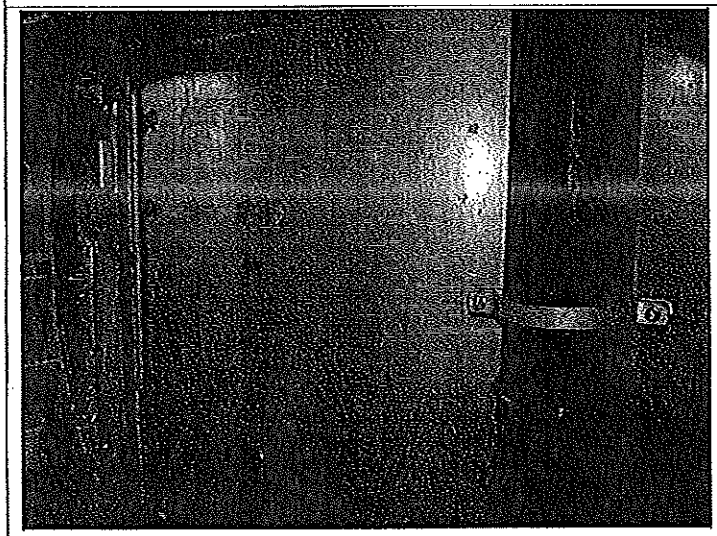

PHOTO #:03 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P9040003
DESCRIPTION: SRT

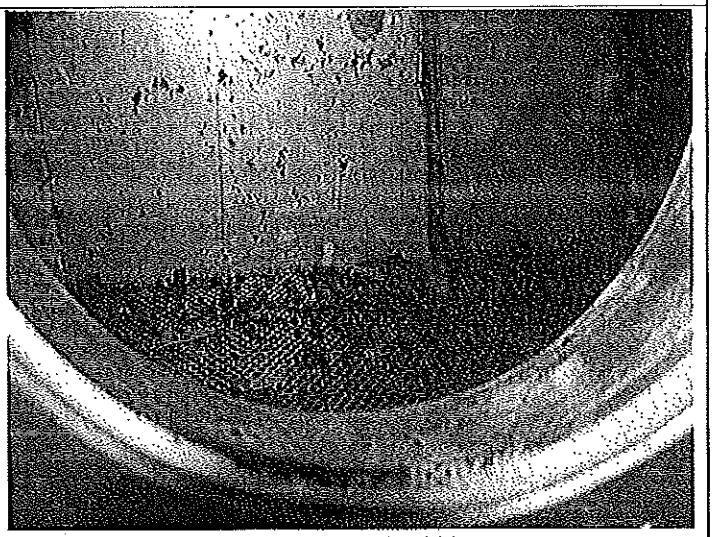

PHOTO #:04 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P9040004
DESCRIPTION: SRT

PHOTO #:05 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P9040005
DESCRIPTION: SRT

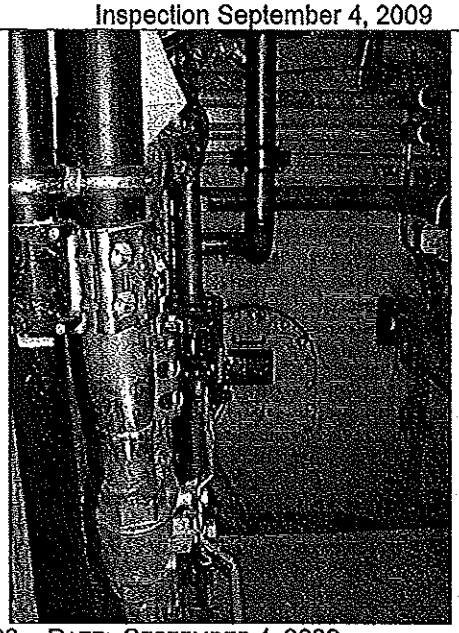

PHOTO #:06 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P9040006
DESCRIPTION: RESIDUE HOLDING TANK

PHOTO #:07 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P9040007
DESCRIPTION: HYDRAULIC SEPARATOR

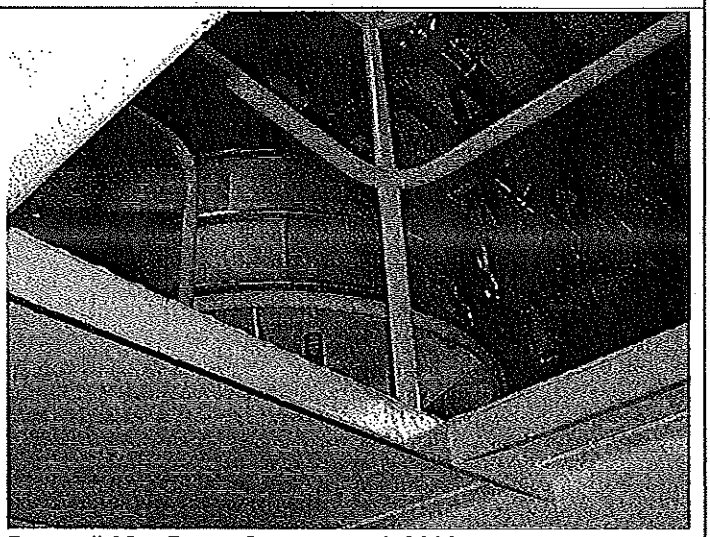

PHOTO #:08 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P9040008
DESCRIPTION: SHAKER SCREENS

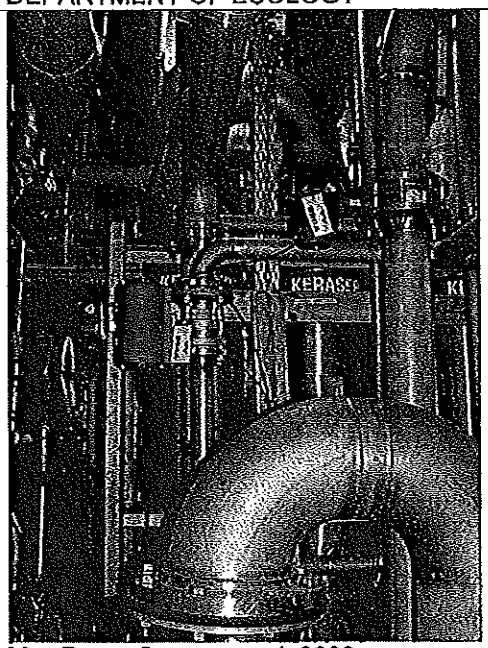

PHOTO #:09 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P9040009
DESCRIPTION: ULTRAFILTERS

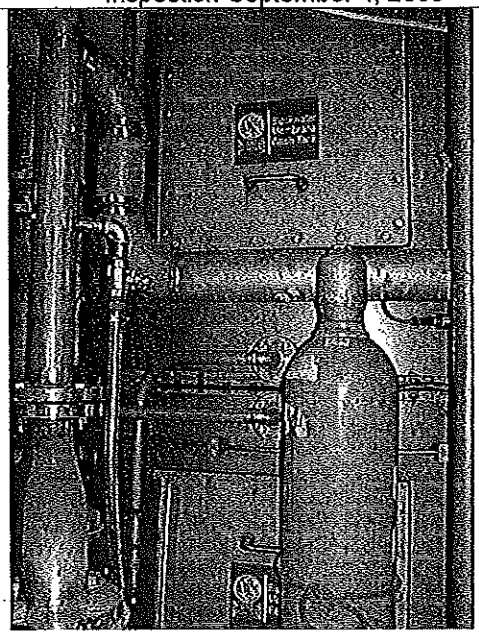

PHOTO #:10 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P9040010
DESCRIPTION: MEMBRANE WASH TANK AND FEED TANK

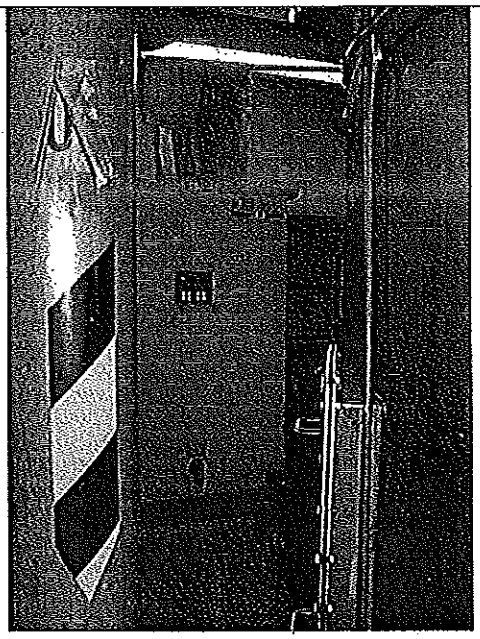

PHOTO #:11 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P9040011
DESCRIPTION: ULTRAVIOLET (UV) DISINFECTION SYSTEM

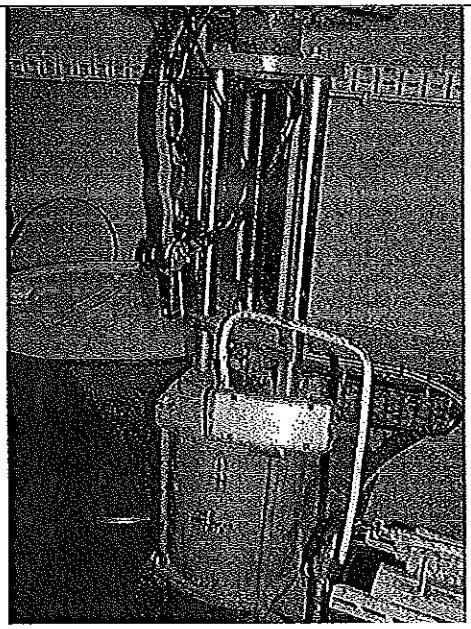

PHOTO #:12 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P9040013
DESCRIPTION: DISCHARGE PORT WITH PADLOCK

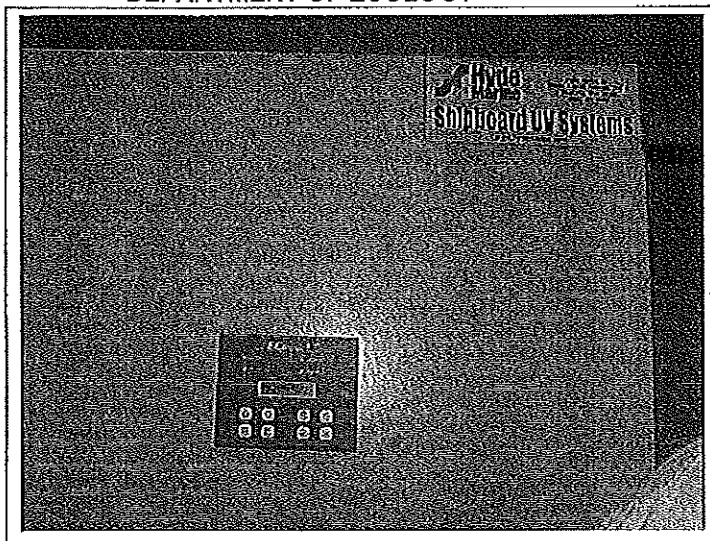

PHOTO #:13 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P9040014
DESCRIPTION: UV DISINFECTION SYSTEM

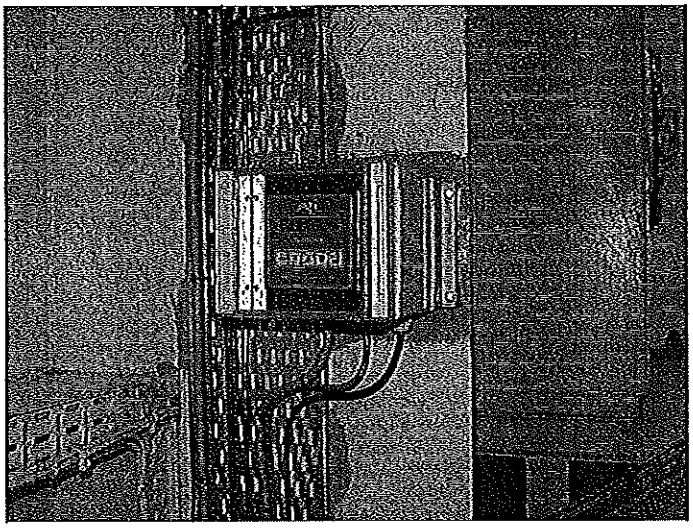

PHOTO #:14 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P9040015
DESCRIPTION: TURBIDIMETER

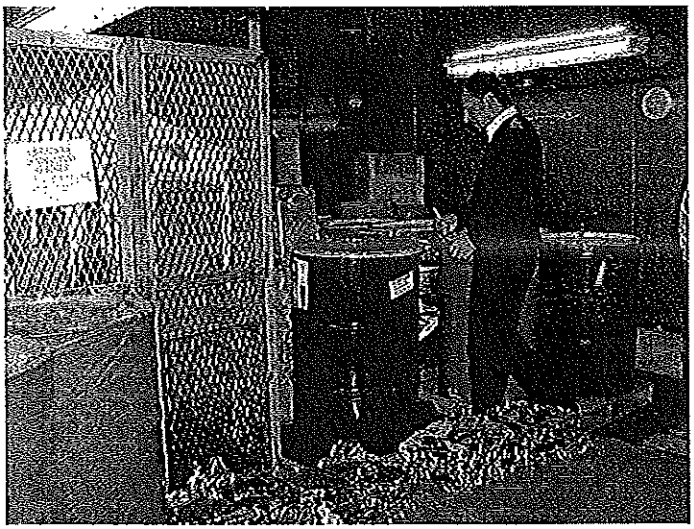

PHOTO #:15 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P9040018
DESCRIPTION: GARBAGE/RECYCLING/MATERIALS COLD STORAGE

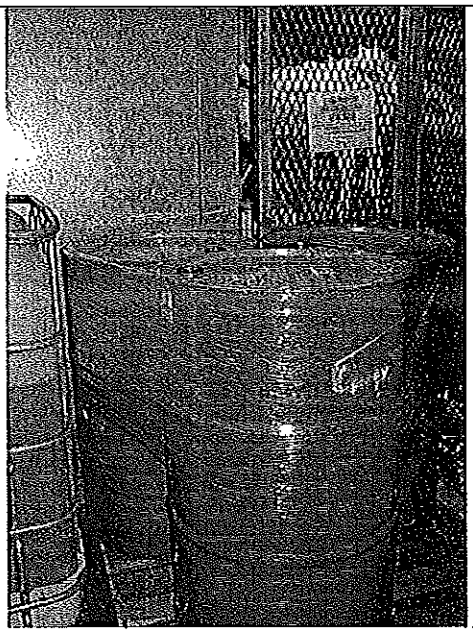

PHOTO #:16 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P9040017
DESCRIPTION: BIORESIDUE (SEWAGE SLUDGE) DRUMS

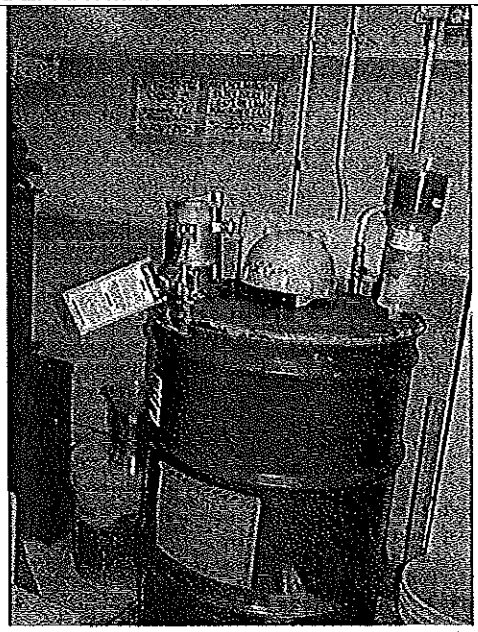

PHOTO #:17 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P9040019
DESCRIPTION: AEROSOL PUNCTURE UNIT

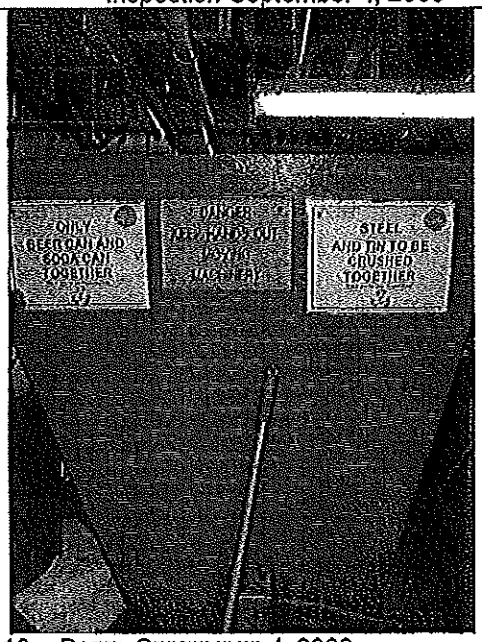

PHOTO #:18 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P9040020
DESCRIPTION: STEEL/TIN CRUSHER

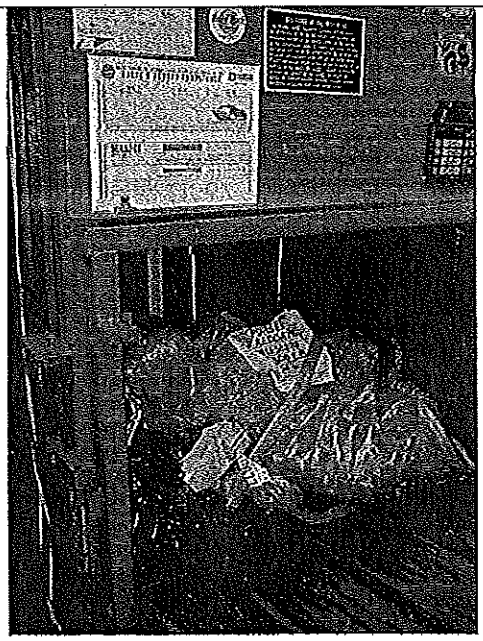

PHOTO #:19 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P9040021
DESCRIPTION: CARDBOARD/PLASTICS COMPACTOR

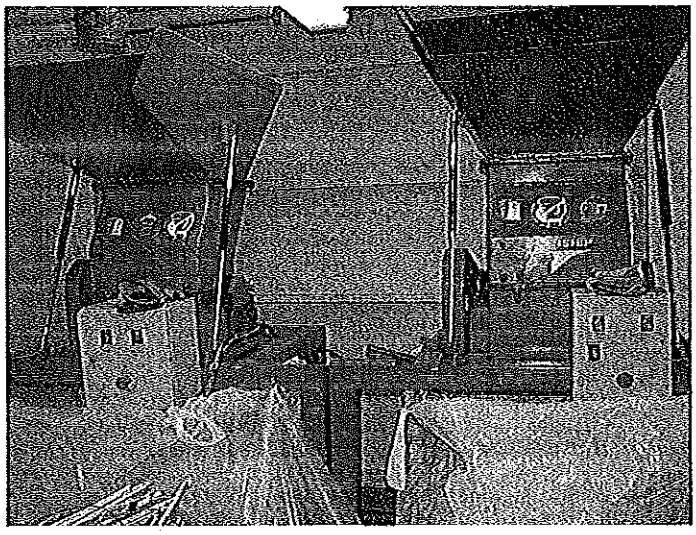

PHOTO #:20 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P9040022
DESCRIPTION: GLASS CRUSHERS

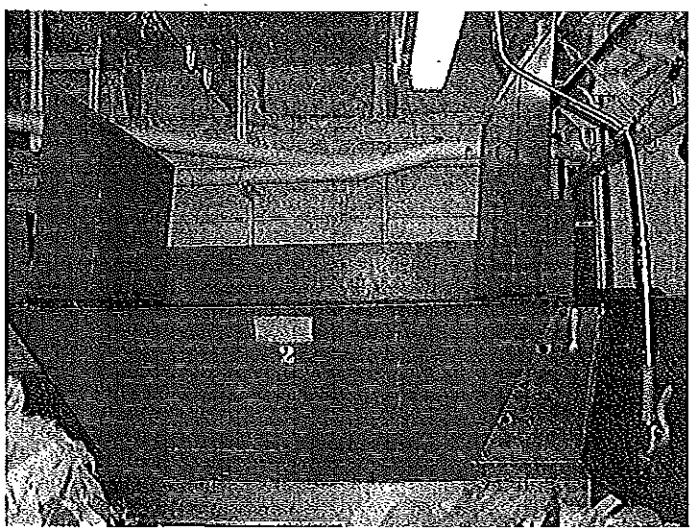

PHOTO #:21 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P9040023
DESCRIPTION: INCINERATOR LOADING

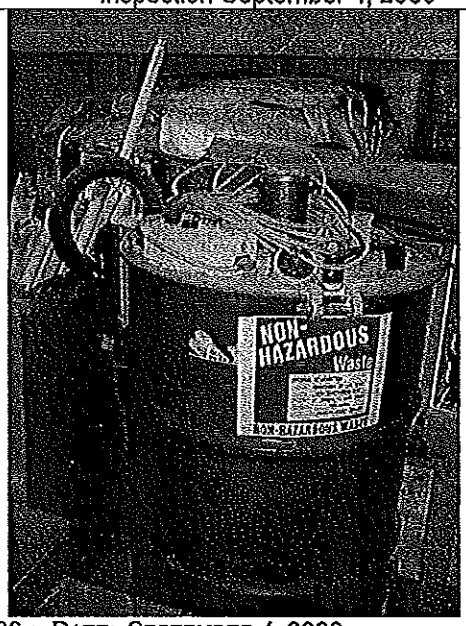

PHOTO #:22 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P9040025
DESCRIPTION: FLUORESCENT BULB MERCURY REMOVAL SYSTEM

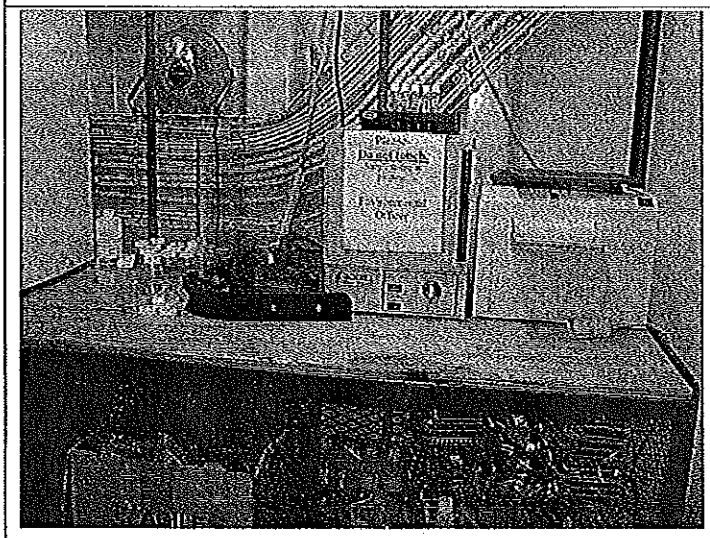

PHOTO #:23 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: P9040026
DESCRIPTION: SAMPLING LABORATORY

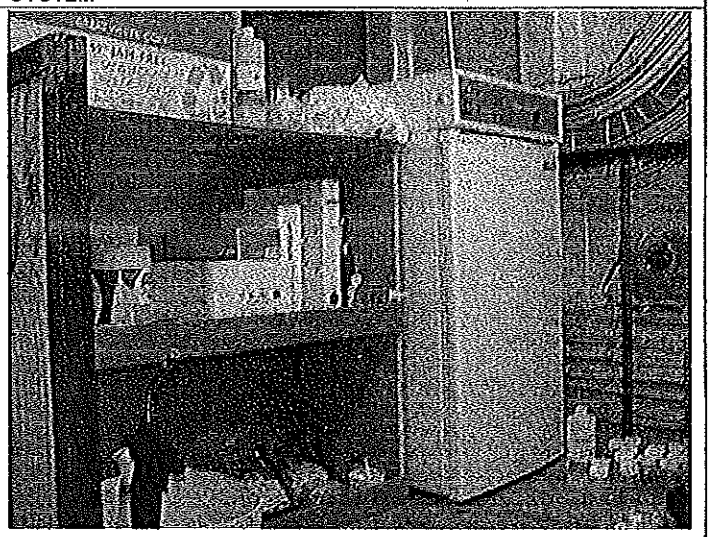

PHOTO #:24 DATE: SEPTEMBER 4, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:P9040027
DESCRIPTION: SAMPLING LABORATORY

DEPARTMENT OF ECOLOGY
State of Washington

State of Washington Department of Ecology

Cruise Ship Memorandum of Understanding, Cruise Operations in Washington State Inspection Report

Northwest Regional Office
3190 160th Ave SE
Bellevue, WA 98008
Phone: (425) 649-7000
Fax: (425) 649-7098

Inspection Date	Permit Number	County	Receiving Waters	Ecology Inspector
09/18/2009	N/A	King	Marine Waters	Amy Jankowiak, Compliance Specialist
Entry Time: 9:45 AM Exit Time: 11:50 AM	Photos Taken ☒ Yes ☐ No	Samples Taken ☐ Yes ☒ No	Inspection Announced ☒ Yes ☐ No	Discharges to: ☒ Surface Water ☐ Ground Water ☐ Dewater ☐ POTW

Name and Location of Site Inspected:
ZAANDAM, Holland America Line
Passenger Vessel
Pier 91, Seattle

Additional Participants/Inspectors:
Mark Henderson, Ecology

On-Site Representative(s): *Name/Title/Phone/e-mail*
Bart Vaartjes, Chief Officer
Jon Turvey, Senior Manager, Auditing, Training and ISO 14001 Coordination
206-298-3849
JTurvey@HollandAmerica.com

Responsible Official(s): *Name/Title/Address/Phone/e-mail*
William J. Morani Jr., Vice President – Environmental Management Systems
Holland America Line
300 Elliott Ave. West, Seattle WA 98119
206-281-3535

Other Facility Data:
Notification made to HAL on September 15, 2009

Section A: Areas Evaluated

☒ Black/Gray Wastewater System	☒ Residual Solids	☒ Records/Reports	☒ Hazardous Waste/ Solid Waste	☒ Sampling/Monitoring
☒ Discharge Locations	☒ Operation & Maintenance	☒ Sludge Handling/ Disposal	☒ Oily Bilge Water	☒ Other

Section B: For Vessels Discharging ≥ 1nm from Berth and ≥ 6 Knots Only [2.1.3(A)]

☐ Schematics Match Black/Gray Wastewater System	
☐ Operations as Described in Submitted Documentation	
☐ Daily 24-hour Continuous Monitoring for Turbidity or Equivalent Monitoring	
☐ Turbidimeter or Equivalent Monitoring Equipment Functioning Properly	
☐ Auto Shut Down or Operational Controls to Insure System Shut Down if High Turbidity Occurs	

Turbidity or Equivalent:
Last Calibration:
Trigger Level for Early Alarm: Trigger Level for Shutdown:
Recorded Turbidity/Equivalent Levels Above Triggers:

☐ Daily 24-hour Continuous Monitoring for Disinfection Effectiveness	
☐ Disinfection Effectiveness Monitoring Equipment Functioning Properly	

Disinfection Effectiveness Monitoring:

☐ Auto Shut Down or Operational Controls to Insure System Shut Down if Disinfection System Upset Occurs	
☐ Disinfection System Operated and Maintained Properly	

Disinfection System:

Section C: For Vessels Discharging Continuously [2.1.3(B)]	
☐ Schematics Match Black/Gray Wastewater System	
☐ Operations as Described in Submitted Documentation	
☐ Daily 24-hour Continuous Monitoring for Turbidity or Equivalent Monitoring	
☐ Turbidimeter or Equivalent Monitoring Equipment Functioning Properly	
☐ Auto Shut Down or Operational Controls to Insure System Shut Down If High Turbidity Occurs	
Turbidity or Equivalent:	
Last Calibration:	
Trigger Level for Early Alarm: Trigger Level for Shutdown:	
Recorded Turbidity/Equivalent Levels Above Triggers:	
☐ Daily 24-hour Continuous Monitoring for Disinfection Effectiveness	
☐ Disinfection Effectiveness Monitoring Equipment Functioning Properly	
Disinfection Effectiveness Monitoring:	
☐ Auto Shut Down or Operational Controls to Insure System Shut Down If Disinfection System Upset Occurs	
☐ Disinfection System Operated and Maintained Properly	
Disinfection System:	

Section D: General (Approved to Discharge)	
☐ No Discharges Within ½ Miles From Shellfish Beds/ Protocol (President's Point, Apple Tree Cove, Tyee Shoal)	
☐ Discharges Immediately Stopped When High Turbidity Occurs	
☐ Discharges Immediately Stopped When Disinfection System Upset Occurs	
☐ Immediate Notifications Made to WA Department of Health for Disinfection System Upset	
☐ Sampling Conducted 2/month, 1/month in Seattle (BOD, TSS, Fecal Coliform, pH, Chlorine Residual)	
☐ Whole Effluent Toxicity Testing 1 per 2 Years (homeported) or 1/40 Calls for Continuous	

Section E: General	
☒ Wastewater Discharge Records Review	Discharge records were reviewed (blackwater/graywater/residual solids) and are maintained properly. No discharges in MOU waters were present from the beginning of the 2009 cruise season to present.
☒ Residual Solids Managed Properly/Disposal Protocol per MOU	Residual solids are either incinerated or held to be discharged at greater than 12 nautical miles and outside of MOU waters and the Olympic Coast National Marine Sanctuary.
☒ Hazardous Waste Managed Properly	All hazardous waste that is collected is being sent off-shore in Victoria, Canada. Records were reviewed for hazardous waste off-loads.
☒ WA Hazardous Waste Guidelines Followed (Appendix vii)	All hazardous waste that is collected is being sent off-shore in Victoria, Canada. Records were reviewed for hazardous waste off-loads.
☒ Solid Waste Managed Properly	Solid waste is being managed properly. The various solid waste streams are collected, sorted, stored, and sent ashore or incinerated as appropriate.
☒ Oily Bilge Water Managed Properly	Oily bilge water is treated and discharged at less than 15 ppm and outside of MOU waters.

Other:

Section F: Sampling Results

Parameter	Results
Biochemical Oxygen Demand 5-Day (BOD_5)	
Total Suspended Solids (TSS)	
Fecal Coliform	
Residual Chlorine	
pH	
Ammonia, Nitrogen	

Section G: Summary of Findings/Comments

Amy Jankowiak, Washington State Department of Ecology (Ecology) - Northwest Regional Office - Water Quality Program, and Mark Henderson, Ecology - Bellingham Field Office - Water Quality Program, conducted the inspection of the Holland America Line ZAANDAM on September 18, 2009. The main contacts on board the ZAANDAM included Bert Vaartjes, Chief Officer, Martin Rohn, Chief Engineer, and Jon Turvey, Environmental Officer. Prior notification of the visit was given on September 15, 2009 for security protocol. The purpose of the inspection was to evaluate compliance with the *Memorandum of Understanding Cruise Operations in Washington State* (MOU), as amended.

The ZAANDAM arrived on May 8, 2009 at the Port of Seattle to begin the 2009 season which consists of 22 calls to Seattle. The vessel currently has a ZENON advanced wastewater treatment system (AWTS) that treats both blackwater and graywater. Approval for discharge in MOU waters has not been requested nor issued for the 2009 season. The vessel was previously approved in 2005 and 2006 for discharges greater than 1nm and 6 knots. The vessel only made one call in both 2007 and 2008. The vessel has been holding effluent and not discharging in MOU waters since the beginning of the season.

The ZAANDAM was dedicated in May 2000, is 781 feet long and has a passenger capacity of about 1432 with a crew capacity of about 615.

Inspection:
We arrived and boarded the ship at about 9:45 am and began with introductions and a plan for the day with Bart Vaartjes, Chief Officer and Martin Rohn, Chief Engineer. The Environmental Officer had to take leave of the ship due to a death in the family. We then discussed discharge protocols and various waste streams. Discharge records were reviewed for blackwater, graywater and residual solids, garbage and hazardous waste. We then discussed the ZENON AWTS system in more detail and toured the system. We also toured the oily bilge water treatment system and the dry cleaning system. The inspection was then finalized and we disembarked the vessel at about 11:50 am.

Discharge Types and Protocols:

All discharges to water occur at greater than 12 nautical miles and outside of MOU waters. No discharges occur in the Olympic Coast National Marine Sanctuary. Only upon verification of location between the Bridge and the Engine Control Room (ECR), will a discharge occur. If a discharge is allowed, the Bridge authorizes any discharge. There is a communication from between the bridge and the ECR staff at the beginning of each shift for status and ECR staff work off of an approximate schedule. The bridge notifies ECR staff an hour before they are in an area allowed for discharge and again 15 minutes before. The bridge does the same when entering an area to turn off a discharge. For wastewater discharges, the latitude and longitude coordinates (photo #02) are recorded in the *Sewage and Graywater Discharge Record Book* and in the deck log. The Environmental Officer compares the logs. There is an overboard valve monitoring system (photo #01) on the bridge. The system has four lights:

- >12 nm
- > 4, <12 nm
- <4 nm
- Special Areas

The "special areas light" means no discharges. Currently, MOU waters are considered "special areas". The computer system "Overboard Valve Monitoring" system details where certain discharges can and cannot take place and includes

alarms. The Environmental Officer reviews the event alarm settings periodically. When any overboard valve is open, the location (lat and long) is automatically recorded. The date, time and location of both the start and the stop of the discharges are recorded, along with port location, effluent type, volumes, and speed. Discharges are tentatively scheduled ahead of time by matrix, but locations are always verified prior to discharges. Discharge ports have a micro-switch which is connected to the valve monitoring system. This system does not allow for discharges unless the valve monitoring system allows for a discharge. All discharge records that were reviewed appeared to be in compliance with the MOU.

A copy of the current MOU was available and notification procedures were well known and available.

Blackwater includes toilet waste, medical drains. Gray water includes sink and shower water, day spa water and galley water. Laundry water is collected separately. Black water, gray water and laundry water is combined and treated with a ZENON AWTS and is then discharged outside of MOU waters.

Pool water is changed out about once every two months outside of MOU waters. If there is an accident in the pool while in MOU waters, the pool is closed down until out at sea. Spa water is sent to gray water collection and to the ZENON system.

The outside of the vessel is cleaned with technical water, which is potable water without the addition of chlorine or nutrients. No detergents are used.

Screenings are collected and off-loaded in Victoria about once every four weeks. Biomass from the bioreactors is collected and discharged outside of MOU waters, >12 nautical miles from shore, and outside of the Olympic Coast National Marine Sanctuary.

Food waste is collected in various locations including the galley and the garbage sorting area. The food is macerated with a SOMAT system. The liquid from the food waste is extracted and recycled, and then cleaned out periodically and discharged to the ZENON system for treatment. The macerated food waste is discharged outside of MOU waters. Grease is collected separately by grease trap and is incinerated. Cooking oil is recycled for biodiesel.

Oily bilge water is sent to the 50 ppm oily water separator (FACET) (photo #15), then to the 15 ppm oily water separator (SERAP) (photo #16). If the effluent does not meet 15ppm, it is automatically sent back for further treatment. The effluent that meets 15 ppm is either discharged at greater than 12 nautical miles and outside of MOU waters or is sent to a clean tank and later discharged. All effluent first goes through the "white box" (photo #14) for monitoring prior to discharge.

Dry cleaning (photos #17, #18, and #19) currently does not use Perchloroethylene (PERC). A banana-oil type system is used for "wet-dry" cleaning. Chemicals are still used, MSDS's were available and reviewed, but no chlorofluorocarbons.

Silver is captured from the photo waste by silver recovery, collected and off-loaded as dangerous waste in Victoria. All hazardous wastes to shore are off-loaded in Victoria. X-ray's are done digitally, and therefore there is no x-ray waste. Other hazardous wastes include batteries, paints, and mercury filters. Fluroescent bulbs are crushed in a mercury vapor removal system. Hazardous waste records were reviewed and showed that all off-loads have been occurring in Victoria.

Oily rags, food-contaminated cardboard, some plastics, grease, white-bag medical waste and some expired medications and narcotics are incinerated. Red-bag medical waste and sharps are off-loaded as biohazardous waste. Some expired medications can be returned to the vendor.

Cardboard, paper, glass, tin, aluminum and scrap metals, and plastics are recycled. Some materials are donated.

Garbage records were reviewed and only showed food waste as being discharged and all food waste discharges occurred outside of MOU waters.

Holland America Line is ISO 14001 Certified.

ZENON System:
Black (photo #03) and gray water is combined, along with laundry water and is then screened (photo #04) to remove solids. The two screens require manual cleaning and hosing down. From the screens, liquid is sent to the raw water tank (photo #07) before being sent (photo #06) to the bioreactors (photo #05). Residual solids from the screenings are landed ashore in Victoria about once every four weeks. Aeration promotes the biological treatment in the two-stage bioreactor. Solids from the bioreactor are sent (photo #09) to a solids tank for later discharge outside of MOU waters.

Effluent from the bioreactor goes through the membrane ultra filters. The filters are cleaned by backpulsing every ten

minutes, and a daily chemical cleaning. A recovery acid clean about once every 1-2 months. Effluent from the filters goes to the ultraviolet (UV) light disinfection unit (photos #10 and #11). Some of the flow from the membranes goes back to the bioreactor and caustic soda is added here for pH control. An on-line turbidity meter (photo #08) continuously reads the turbidity prior to UV. The turbidity meter has an alarm set at 50 NTU and again at 5 NTU. Turbidity read 0.513 at the time of the inspection. The UV system consists of one unit with eight lamps. There are alarms for the lamps only, no intensity alarms. From the UV system, flow either goes straight overboard (photos #12 and #13)) if in an area approved for discharge, or is sent to holding tanks for later discharge.

There are two ZENON trains for treatment (2 screens, 2 bioreactors, 2 membrane filters, 2 permeate tanks, 1 UV unit). One train can be taken down for maintenance while the other is still in use. ZENON monitors the treatment system and test results with information daily and visits the vessel about once every 6 months. Maintenance is done per the AMOS system.

Sampling is not required per the MOU when not approved and not discharging. No samples were taken by Ecology.

Conclusions and Recommendations

The staff on board the vessel were very knowledgeable of the systems and protocols. The discharge protocols and notification procedures were very clear.

The efforts made towards waste minimization and energy conservation are impressive.

It is recommended that staff continue to work towards high functioning wastewater treatment systems.

Attachments:
Photographs

Copies to:
John Turvey, HAL
William Morani, Jr., HAL
Bob Diaz, HAL
Tina Stoltz, HAL
Bart Vaartjes, Chief Officer
Martin Rohn, Chief Engineer
Amy Jankowiak, Ecology
Mark Henderson, Ecology
Mark Toy, Health
Kevin Fitzpatrick, Ecology
Karen Burgess
Central Files: Holland America Line – HOLLAND ZAANDAM; WQ 6.1

Section H: Signatures

Name and Signature of Inspector:	Agency/Office/Telephone:	Date
Amy Jankowiak	Department of Ecology Northwest Regional Office Water Quality Program Municipal Compliance Specialist 425-649-7195	10/22/09
Name and Signature of Reviewer:	Agency/Office/Telephone:	Date
Kevin C Fitzpatrick	Department of Ecology Northwest Regional Office Water Quality Section Manager 425-649-7033	10/23/09

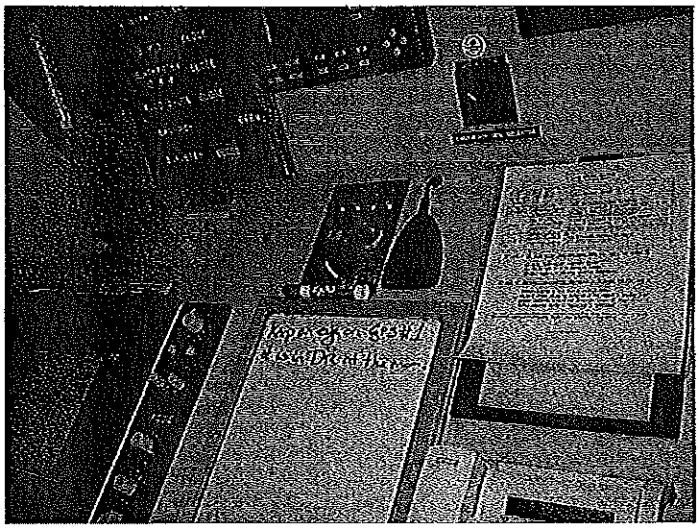

PHOTO #:01 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_001
DESCRIPTION: OVERBOARD VALVE MONITORING SYSTEM (SPECIAL AREAS LIT)

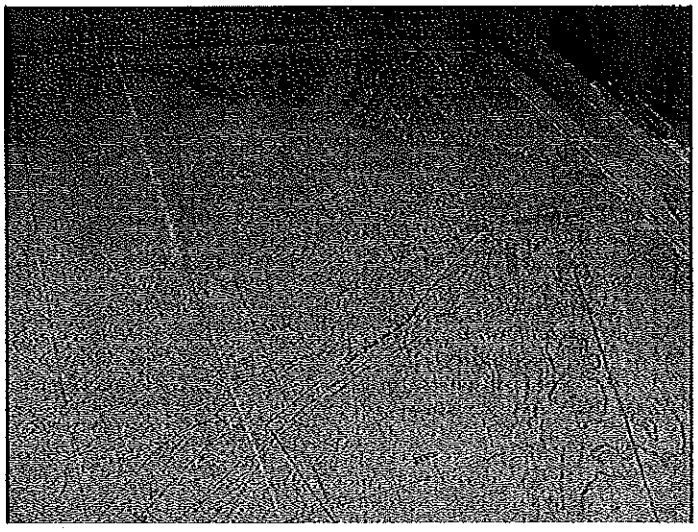

PHOTO #:02 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_002
DESCRIPTION: NAVIGATION CHARTS (SHOWED WHERE DISCHARGES STOP PRIOR TO MOU WATERS/OCNMS)

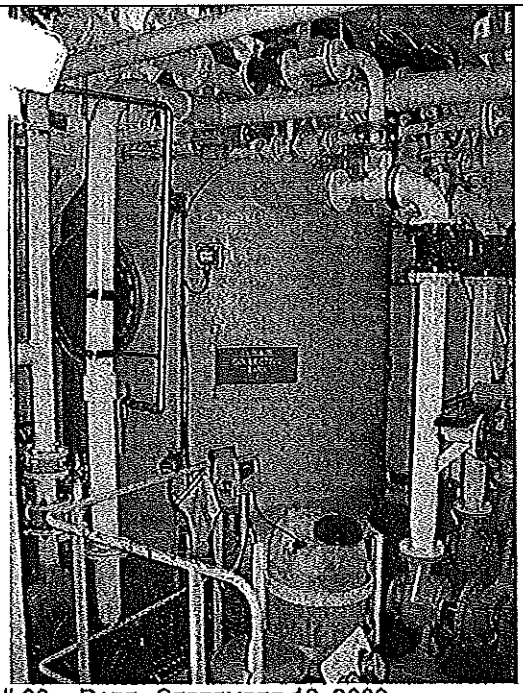

PHOTO #:03 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_004
DESCRIPTION: AWTS – BLACK WATER COLLECTION TANK

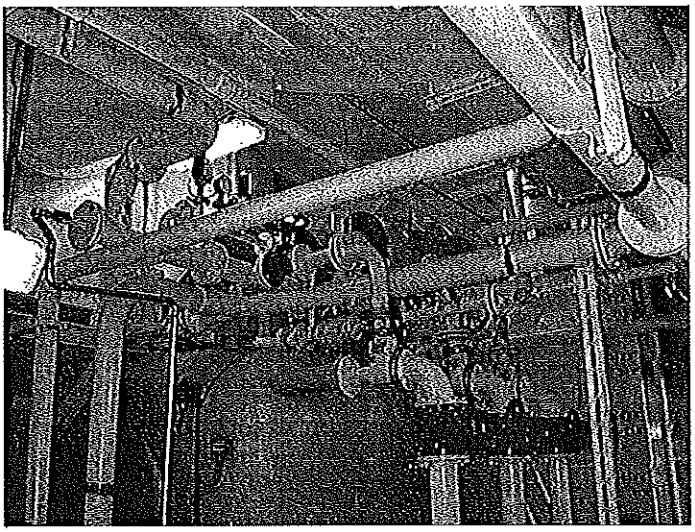

PHOTO #:04 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_006
DESCRIPTION: AWTS – SCREENS (TWO STEEL AT TOP OF PHOTO)

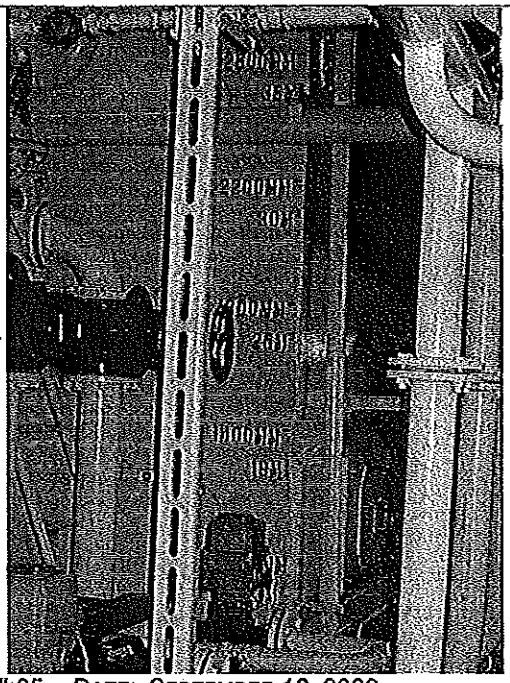

PHOTO #:05 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_007
DESCRIPTION: AWTS – BIOREACTOR (WHITE TANK)

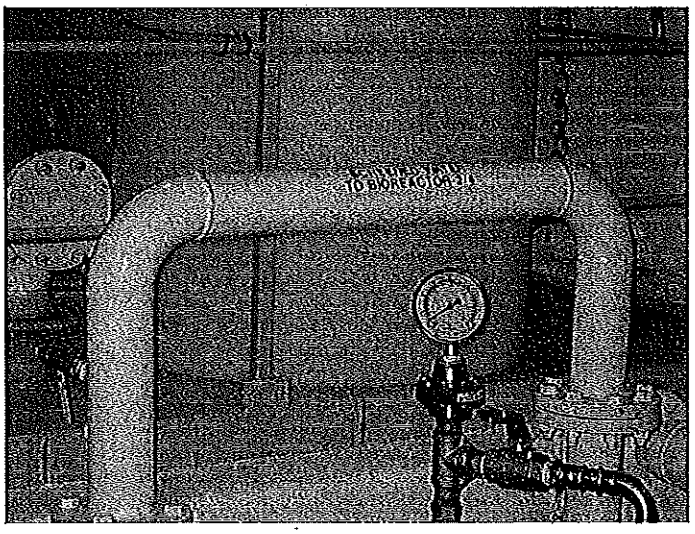

PHOTO #:06 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_008
DESCRIPTION: AWTS – PIPES TO BIOREACTOR

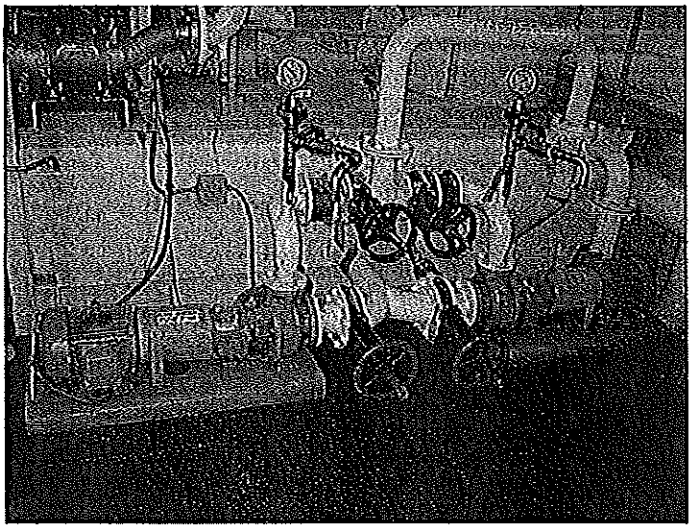

PHOTO #:07 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_009
DESCRIPTION: AWTS – PUMPS AND RAW WATER TANK (WHITE TANK BEHIND PUMPS)

PHOTO #:08 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_013
DESCRIPTION: AWTS – TURBIDIMETER

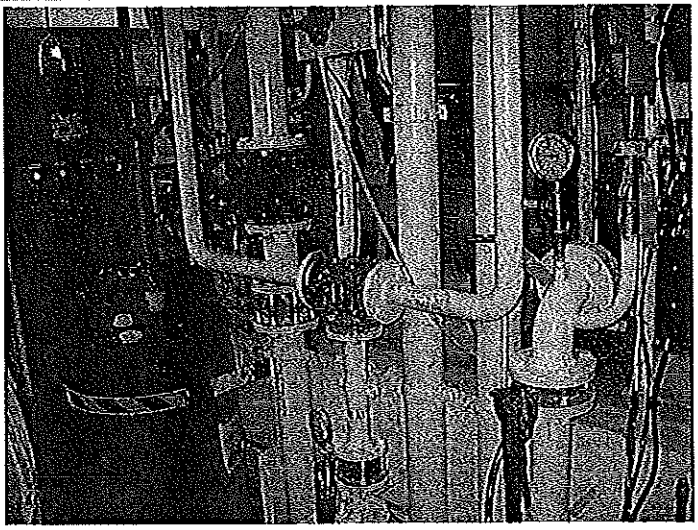

PHOTO #:09 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_014
DESCRIPTION: AWTS – PIPING TO SOLIDS TANK/TECHNICAL WATER AND CHEMICAL FEED

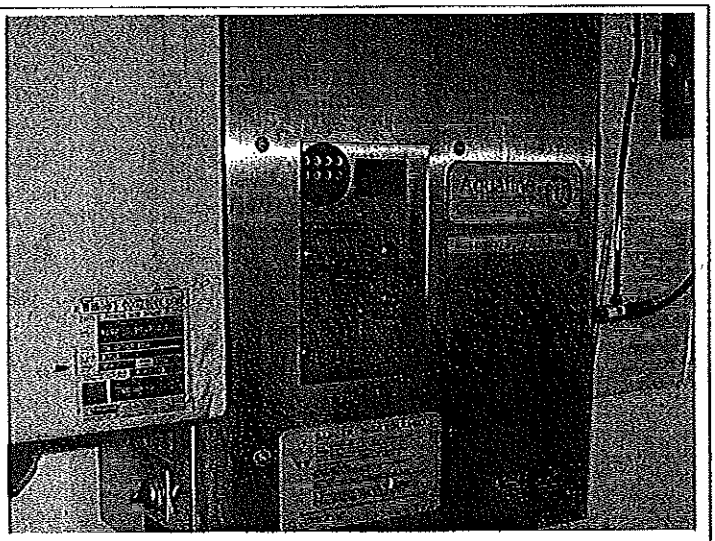

PHOTO #:10 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_015
DESCRIPTION: AWTS – ULTRAVIOLET LIGHT DISINFECTION CONTROL PANEL

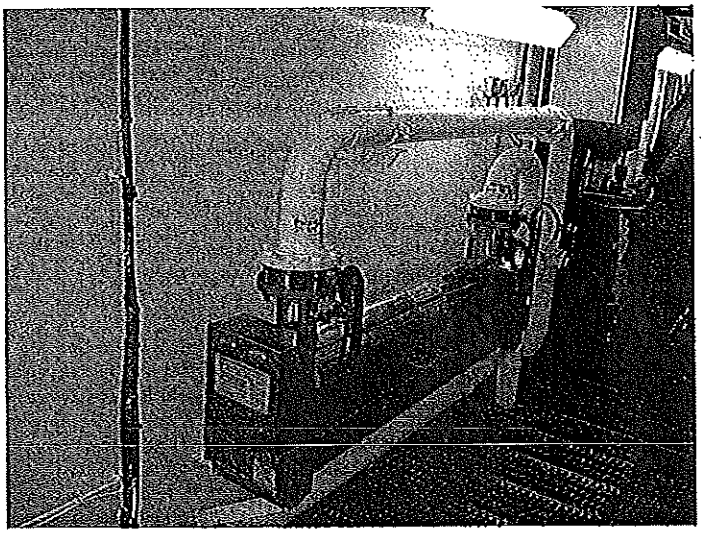

PHOTO #:11 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_017
DESCRIPTION: AWTS – ULTRAVIOLET LIGHT DISINFECTION UNIT

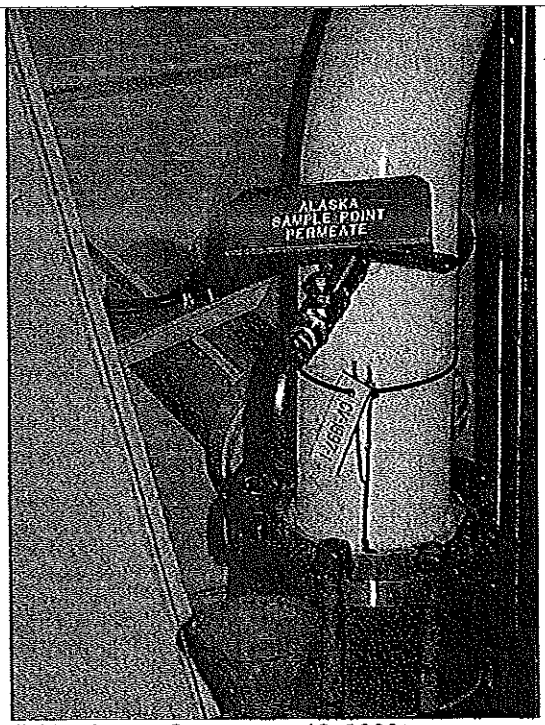

PHOTO #:12 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_022
DESCRIPTION: AWTS – FINAL EFFLUENT SAMPLE POINT

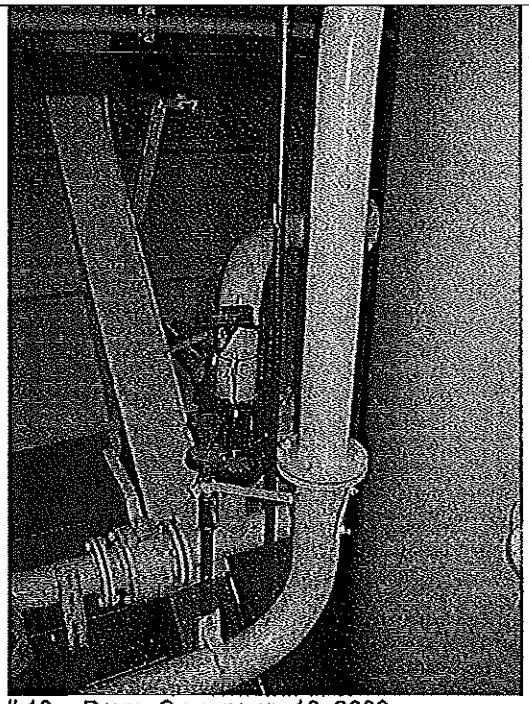

PHOTO #:13 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_023
DESCRIPTION: AWTS – DISCHARGE PORT

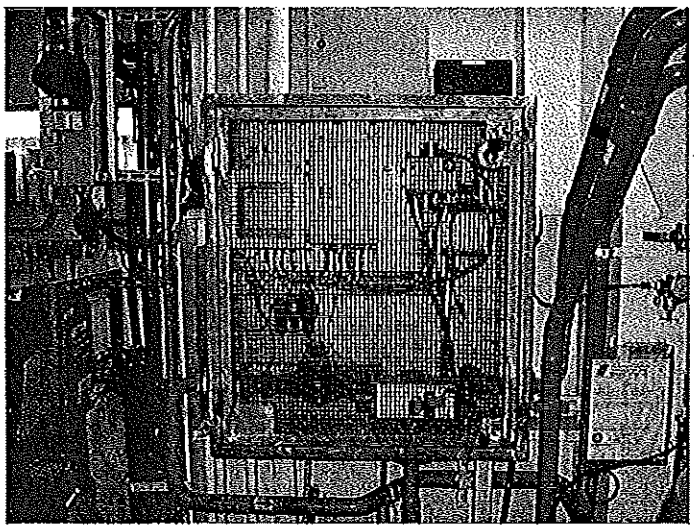

PHOTO #:14 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_018
DESCRIPTION: OILY WATER SEPARATOR (OWS) – WHITE BOX

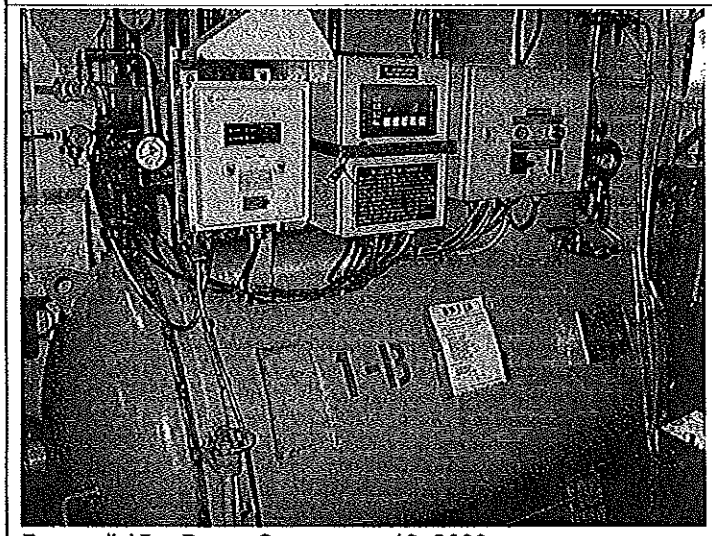

PHOTO #:15 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_019
DESCRIPTION: OWS – FACET SYSTEM

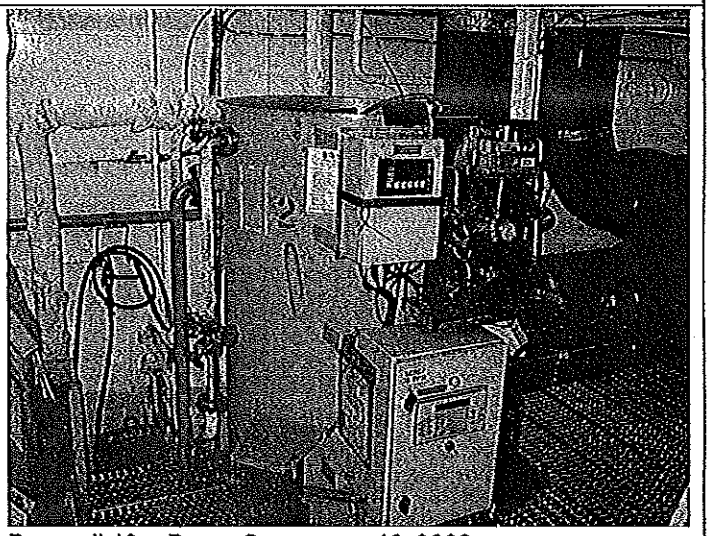

PHOTO #:16 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_020
DESCRIPTION: OWS – SERAP SYSTEM

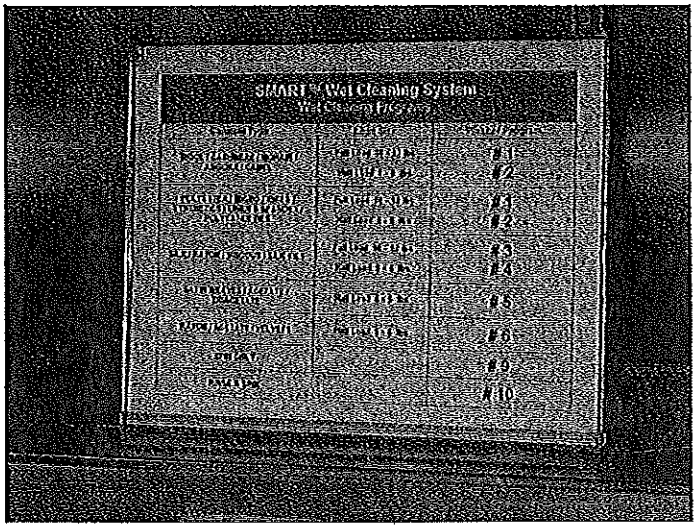

PHOTO #:17 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_025
DESCRIPTION: DRY CLEANING (WET – DRY CLEANING SYSTEM (PERC-FREE)

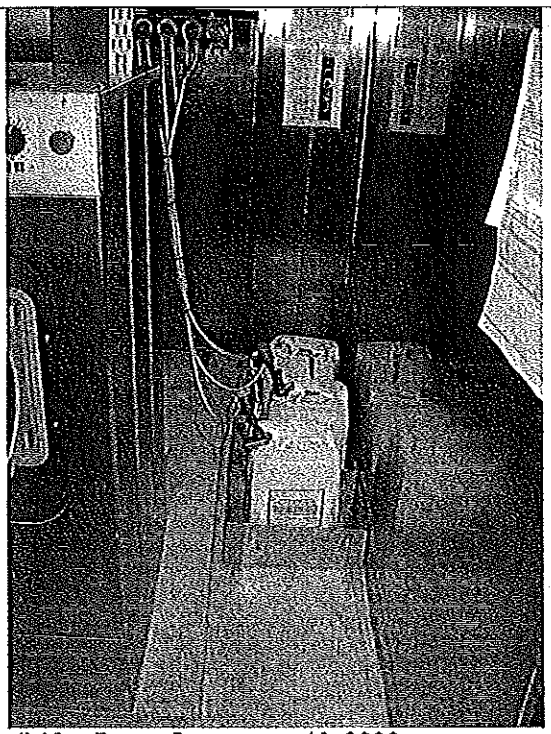

PHOTO #:18 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_026
DESCRIPTION: DRY CLEANING (WET – DRY CLEANING SYSTEM (PERC-FREE)

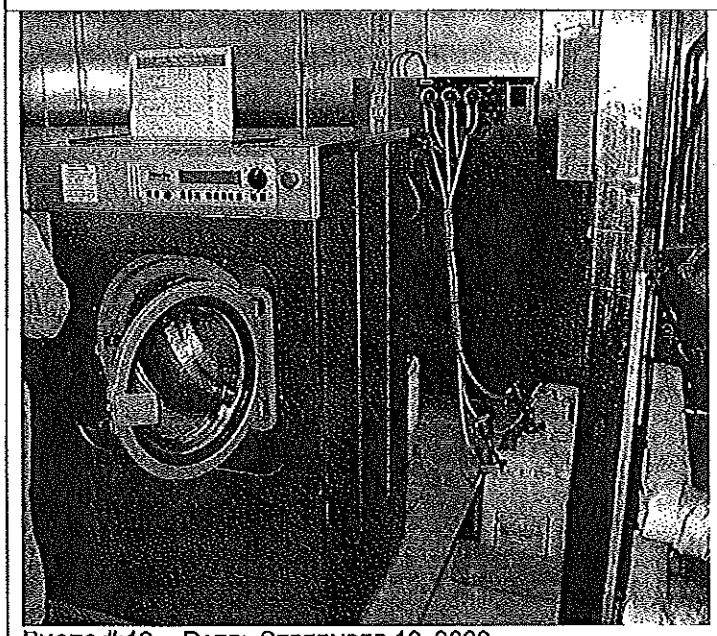

PHOTO #:19 DATE: SEPTEMBER 18, 2009
TAKEN BY: MARK HENDERSON FILE NO.: IMG_027CROPPED
DESCRIPTION: DRY CLEANING (WET – DRY CLEANING SYSTEM (PERC-FREE)

DEPARTMENT OF ECOLOGY
State of Washington

State of Washington Department of Ecology

Cruise Ship Memorandum of Understanding, Cruise Operations in Washington State Inspection Report

Northwest Regional Office
3190 160th Ave SE
Bellevue, WA 98008
Phone: (425) 649-7000
Fax: (425) 649-7098

Inspection Date	Permit Number	County	Receiving Waters	Ecology Inspector
10/5/2009	NA	King	Marine Waters	Amy Jankowiak, Compliance Specialist
Entry Time 9:29 am Exit Time 12:31 pm	Photos Taken ☒ Yes ☐ No	Samples Taken ☐ Yes ☒ No	Inspection Announced ☒ Yes ☐ No	Discharges to: ☒ Surface Water ☐ Ground Water ☐ Dewater ☐ POTW

Name and Location of Site Inspected:
MERCURY, Celebrity Cruises
Passenger Vessel
Pier 91, Seattle

Additional Participants/Inspectors:

On-Site Representative(s): *Name/Title/Phone/e-mail*
Nikolas Asproudas, Environmental Officer
MR_EnvironmentalOfficer@celebrity.com

Responsible Official(s): *Name/Title/Address/Phone/e-mail*
Rich Pruitt, Director Environmental Programs
Royal Caribbean International
1080 Caribbean Way, Miami, FL 33132
Office: 305-982-2179; Cell: 305-495-2845; RPruitt@rccl.com

Other Facility Data:
Notification made to Rich Pruitt, September 29, 2009

Section A: Areas Evaluated

☒ Black/Gray Wastewater System	☒ Residual Solids	☒ Records/Reports	☒ Hazardous Waste/ Solid Waste	☐ Sampling/Monitoring
☒ Discharge Locations	☒ Operation & Maintenance	☒ Sludge Handling/ Disposal	☒ Oily Bilge Water	☒ Other

Section B: For Vessels Discharging ≥ 1nm from Berth and ≥ 6 Knots Only [2.1.3(A)]

☐ Schematics Match Black/Gray Wastewater System	
☐ Operations as Described in Submitted Documentation	
☐ Daily 24-hour Continuous Monitoring for Turbidity or Equivalent Monitoring	
☐ Turbidimeter or Equivalent Monitoring Equipment Functioning Properly	
☐ Auto Shut Down or Operational Controls to Insure System Shut Down if High Turbidity Occurs	

Turbidity or Equivalent:
Last Calibration:
Trigger Level for Early Alarm: Trigger Level for Shutdown:
Recorded Turbidity/Equivalent Levels Above Triggers:

☐ Daily 24-hour Continuous Monitoring for Disinfection Effectiveness	
☐ Disinfection Effectiveness Monitoring Equipment Functioning Properly	

Disinfection Effectiveness Monitoring:

☐ Auto Shut Down or Operational Controls to Insure System Shut Down if Disinfection System Upset Occurs	
☐ Disinfection System Operated and Maintained Properly	

Disinfection System:

Section C: For Vessels Discharging Continuously [2.1.3(B)]

☐ Schematics Match Black/Gray Wastewater System	
☐ Operations as Described in Submitted Documentation	
☐ Daily 24-hour Continuous Monitoring for Turbidity or Equivalent Monitoring	
☐ Turbidimeter or Equivalent Monitoring Equipment Functioning Properly	
☐ Auto Shut Down or Operational Controls to Insure System Shut Down if High Turbidity Occurs	
Turbidity or Equivalent: Last Calibration: Trigger Level for Early Alarm: Trigger Level for Shutdown: Recorded Turbidity/Equivalent Levels Above Triggers:	
☐ Daily 24-hour Continuous Monitoring for Disinfection Effectiveness	
☐ Disinfection Effectiveness Monitoring Equipment Functioning Properly	
Disinfection Effectiveness Monitoring:	
☐ Auto Shut Down or Operational Controls to Insure System Shut Down if Disinfection System Upset Occurs	
☐ Disinfection System Operated and Maintained Properly	
Disinfection System:	
Section D: General (Approved to Discharge)	
☐ No Discharges Within ½ Miles From Shellfish Beds/ Protocol (President's Point, Apple Tree Cove, Tyee Shoal)	
☐ Discharges Immediately Stopped When High Turbidity Occurs	
☐ Discharges Immediately Stopped When Disinfection System Upset Occurs	
☐ Immediate Notifications Made to WA Department of Health for Disinfection System Upset	
☐ Sampling Conducted 2/month, 1/month in Seattle (BOD, TSS, Fecal Coliform, pH, Chlorine Residual)	
☐ Whole Effluent Toxicity Testing 1 per 2 Years (homeported) or 1/40 Calls for Continuous	
Section E: General	
☒ Wastewater Discharge Records Review	Discharge records were reviewed (blackwater/graywater/residual solids) and are maintained properly. All discharges occurred outside of MOU waters (beginning of cruise season to date).
☒ Residual Solids Managed Properly/Disposal Protocol per MOU	Residual solids are incinerated and not discharged in MOU waters or the Olympic Coast National Marine Sanctuary.
☒ Hazardous Waste Managed Properly	All hazardous waste records showed that all off-loads occurred outside of Washington State (typically go to Vancouver, B.C.).
☒ WA Hazardous Waste Guidelines Followed (Appendix vii)	All hazardous waste records showed that all off-loads occurred outside of Washington State (typically go to Vancouver, B.C.).
☒ Solid Waste Managed Properly	Solid waste is being managed properly. The various solid waste streams are collected, sorted, stored, and sent ashore or incinerated as appropriate. Records showed only food waste being discharged and only outside of MOU waters.
☒ Oily Bilge Water Managed Properly	Oily bilge water is treated and discharged at less than 15 ppm and outside of MOU waters.
Other:	

Section F: Sampling Results	
Parameter	Results
Biochemical Oxygen Demand 5-Day (BOD_5)	Not Applicable
Total Suspended Solids (TSS)	Not Applicable
Fecal Coliform	Not Applicable
Residual Chlorine	Not Applicable
pH	Not Applicable
Ammonia, Nitrogen	Not Applicable

Section G: Summary of Findings/Comments

Introduction

Amy Jankowiak, Washington State Department of Ecology (Ecology) Northwest Regional Office, Water Quality Program, conducted the inspection of the Celebrity Cruises MERCURY on October 5, 2009. The main contact on board the MERCURY included Nikolas Asproudas, Environmental Officer. Prior notification of the visit was given on September 29, 2009 for security protocol. The purpose of the inspection was to evaluate compliance with the *Memorandum of Understanding Cruise Operations in Washington State* (MOU), as amended.

The MERCURY made one call in Seattle on May 15, 2009 and then returned September 21st for the first of 7 more calls for shorter 3-4 day cruises between Washington and Canada. The vessel has been holding effluent and not discharging wastewater in MOU waters since the beginning of the season.

Biopure is a traditional marine sanitation device including aeration, settling, and chlorination for blackwater only. This system is run at all times. Approval for discharge from Ecology has not been requested or issued. The vessel has been holding effluent and not discharging in MOU waters since the beginning of the season.

Inspection

I arrived and boarded the ship at about 9:29 am and began with introductions and a plan for the day with Nikolas Asproudas, the Environmental Officer. We first discussed the various waste streams and discharge protocols. We then reviewed discharge records for hazardous waste, garbage and black water and graywater. A copy of the current MOU was available. We then headed to the Bridge to review navigation charts and notification postings. We then headed to the medical facility to overview the various waste streams and then viewed some of the solid waste sorting areas. We then viewed the oily water separator system and the marine sanitation devices. The inspection was then finalized and I disembarked the vessel at about 12:31 pm.

Discharge Types and Protocols:

The MERCURY has not requested, and is not approved to discharge in waters subject to the MOU. All blackwater is treated with a marine sanitation device (MSD), Biopure, and is discharged outside of MOU waters. Currently, untreated graywater is sent to a holding tank and discharged outside of MOU waters along with the MSD treated blackwater. This season, the vessel is running three or four day cruises between Seattle and Canada, and is discharging all blackwater and graywater in pre-designated areas in Canadian waters near Victoria (photos #03 and #04), in Canada at the north end of the Strait of Georgia (photo #05), or off of Washington's coast west of the entrance to the Strait of Juan de Fuca (outside of 12 nautical miles and outside of the Olympic Coast National Marine Sanctuary – photo #06). About every 6 days, the vessel goes out to open sea for certain discharges such as food waste and oily bilge water. No discharges of any kind are occurring in the Olympic Coast National Marine Sanctuary. All wastewater discharges are logged in the *Sewage and Graywater Discharge Record Book* based on the coordinates from the bridge.

The discharge requirements for Washington State are posted on the Bridge (photo #01), along with the wastewater discharge exemption from RCCL for Canadian waters (photo #02) and the MOU waters map and notification numbers for the MOU non-compliance (photo #07).

The Environmental Officer and vessel staff conducted extensive pre-planning accounting for the vessels itinerary, route, and holding tank capacity in order to assure that all discharges would take place in accordance with regulations and the MOU.

Discharge locations for a number of discharge records reviewed were verified as being outside of MOU waters with the use of Google™ Earth during the inspection. The record books appear to be managed properly. It is noted that staff does an excellent job of showing corrections in a proper manner. Mistakes are crossed off with a single line and dated and initialed. Changes are also explained.

Discharge ports are padlocked with the 2nd Engineer on watch having control of the keys. The time that the ports are opened and closed is recorded. The Bridge notifies the Engine Control Room when discharges can start and stop. The Environmental Officer also verifies the bridge information.

Sewage residuals (sludge or biomass) are strained and incinerated. Biomass is collected from the MSDs about once a month. Food waste (photo #11) is pulped and then either incinerated with some cardboard materials or discharged at greater than 12 nautical miles from shore. The galley water goes to the graywater holding tanks. Some of the food waste (photo #15) such as bones, meat, and fruit with heavy skins cannot be pulped and is therefore mixed with some cardboard material and incinerated. Cooking oil (photo #20) is re-used on the vessel after warming and filtering. The filtered solids are incinerated.

Laundry water is sent to the graywater holding tanks along with shower and sink water from accommodations and throughout the vessel. Laundry uses Ecolab® products (photo #10). Ecolab® is also used for housekeeping. The graywater is not treated, but held for discharge outside of MOU waters. Spa/Jacuzzi water is neutralized and then discharged outside of MOU waters. Pool water is also held and discharged outside of MOU waters.

Oily bilge water is treated with the Turbulo and Marinfloc systems (photos #22 and #23). A white box (photo #21) was recently installed on the vessel for added protection of discharges less than 15 ppm. The system is cleaned about every two months.

The drains from the medical facility go to the blackwater system (photo #26). Sharps are collected in sharps containers, are then boxed and landed ashore as biohazard waste. Red bag waste (photo #09) from the medical facility is incinerated. Expired medications and narcotics are logged, and with witnesses incinerated outside of 12 nautical miles.

Other materials incinerated (photo #17) include light plastics, food-contaminated cardboard and oily rags.

Dry cleaning currently uses Perchloroethylene (PERC) which is collected and off-loaded as hazardous waste. Photo waste is treated to less than 5 ppm through silver recovery along with x-ray waste. Fluorescent light bulbs are crushed with the bulb eater with mercury vapor removal. Materials such as paint, batteries, electronics, fluorescent bulb waste (photo #16), pyrotechnics, photo/x-ray waste (photo #08) and oily sludge are landed ashore in Canada as hazardous waste. All hazardous waste records showed that all off-loads occurred outside of Washington State (typically go to Vancouver, B.C.). Some materials are donated such as housekeeping items, mattresses, rugs, and furniture.

Materials such as aluminum, cardboard, paper, glass (photos #12 and #14), plastics, scrap metal, wood pallets and broken china are recycled (photo #13). The vessel has improved its recycling percentages in the last couple of years. The recycled material is usually landed ashore (photo #19) in Vancouver, B.C. or Victoria, Canada. The MERCURY was awarded "City of San Diego Recycler of the Year", Port of San Francisco Environmental Gold Award and Celebrity Cruises Environmental Ship of the Year for 2008.

Blackwater and Graywater Systems:
The marine sanitation device (MSD), Biopure (photos #24 and #25), operates by first collecting blackwater into a storage collection tank. The wastewater then flows into the Biopure system (four separate identical units) by suction. The system includes aeration, pH adjustment, some settling by addition of polymer, and chlorination for disinfection all in one tank partially divided. Solids cleaned out of the tank are strained and incinerated periodically. Effluent from the Biopure system (photo #27) is sent to a holding tank prior to discharge. Staff take on-board samples about weekly for process control.

The advanced wastewater treatment system (AWTS) Rochem, is currently not in regular operation. The system was on only briefly earlier in the season after a unit was replaced. The Rochem system does not have the capacity to handle the wastewater on the vessel. The vessel is not certified or approved this year for discharge in Alaska.

At this time, the MERCURY vessel is not scheduled to return to MOU waters next season. In an e-mail from Per Holand, the Environmental Manager for Royal Caribbean Cruises Ltd., provided during the inspection, it is stated that if the installation of the new advanced wastewater treatment system, NAVALIS on the Rhapsody is successful, there will be more installations of the same type for the rest of the fleet. This may happen sometime next year.

Samples were not taken, as the vessel does not discharge in MOU waters.

Conclusions and Recommendations
Mr. Asproudas, the Environmental Officer was very knowledgeable of the wastewater system and the other environmental systems and protocols.

Attachments: Photographs

Copies to:
Nikolas Asproudas, RCCL
Rich Pruitt, RCCL
Mark Toy, Department of Health
Karen Burgess, Ecology
Kevin Fitzpatrick, Ecology
Amy Jankowiak, Ecology
Central Files: Celebrity Cruises – MERCURY; WQ 6.1

Section H: Signatures

Name and Signature of Inspector:	Agency/Office/Telephone:	Date
Amy Jankowiak	Department of Ecology Northwest Regional Office Water Quality Program Municipal Compliance Specialist 425-649-7195	10/23/09
Name and Signature of Reviewer:	Agency/Office/Telephone:	Date
Kevin C Fitzpatrick	Department of Ecology Northwest Regional Office Water Quality Section Manager 425-649-7033	10/25/09

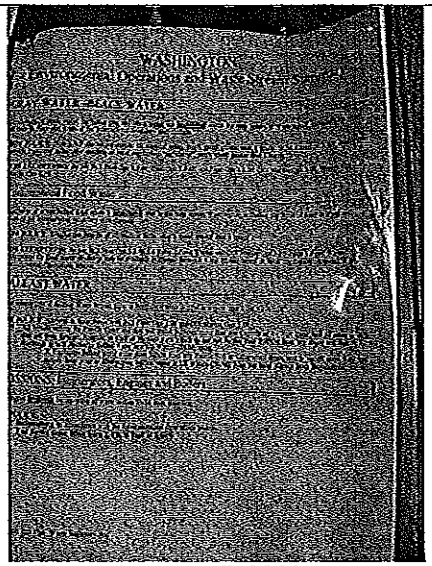

PHOTO #:01 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:PA05001
DESCRIPTION: BRIDGE – POSTING OF WASHINGTON STATE DISCHARGE REQUIREMENTS

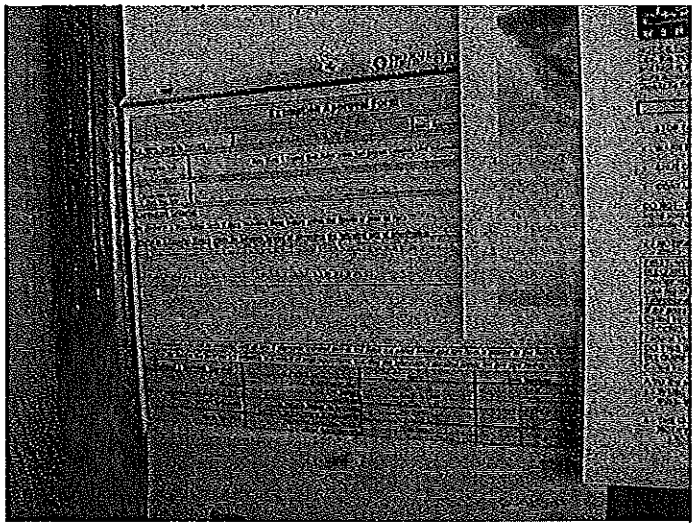

PHOTO #:02 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05002
DESCRIPTION: BRIDGE – POSTING OF CANADIAN WATERS DISCHARGE EXEMPTION BY RCCL

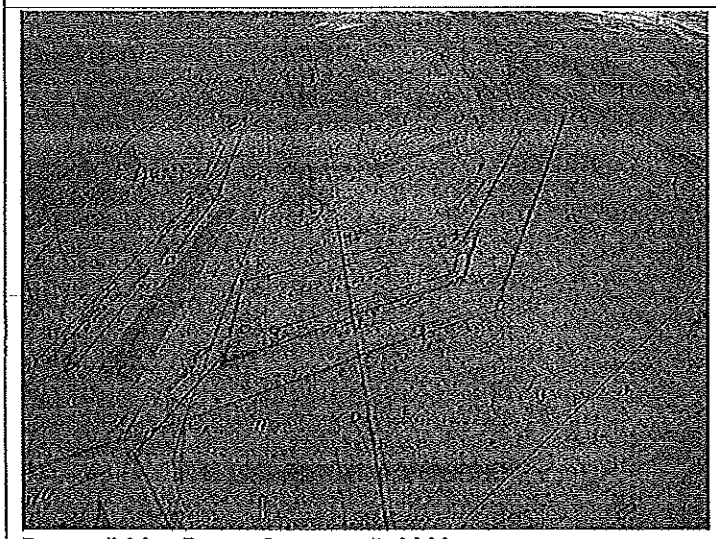

PHOTO #:03 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05004
DESCRIPTION: BRIDGE – NAVIGATION CHART OF DISCHARGE AREA NEAR VICTORIA

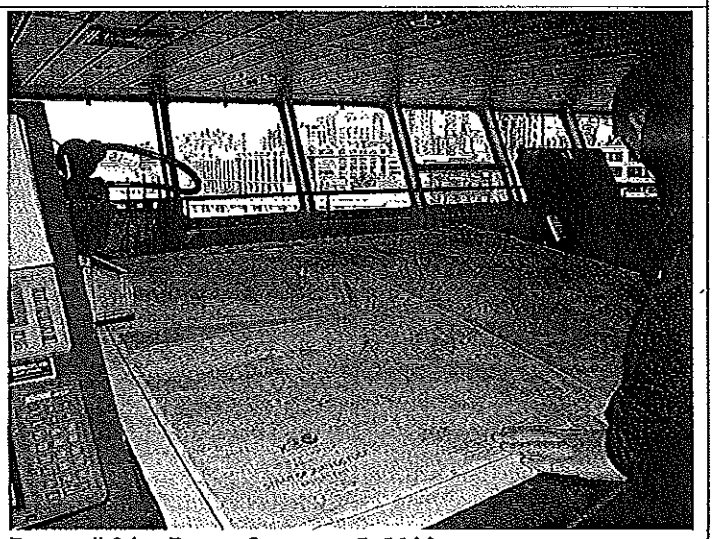

PHOTO #:04 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05005
DESCRIPTION: BRIDGE – NAVIGATION CHART OF DISCHARGE AREA NEAR VICTORIA

PHOTO #:05 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:PA05006
DESCRIPTION: BRIDGE – NAVIGATION CHART OF DISCHARGE AREA NORTH OF STRAIT OF GEORGIA

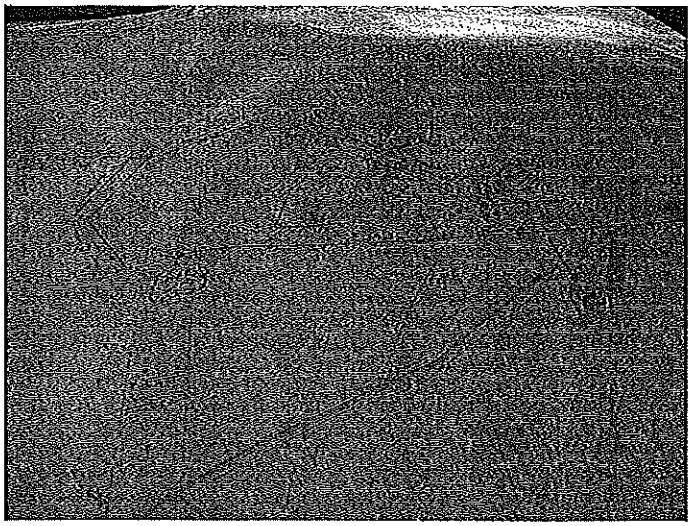

PHOTO #:06 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05008
DESCRIPTION: BRIDGE – NAVIGATION CHART OF DISCHARGE AREA WEST OF STRAIT OF JUAN DE FUCA

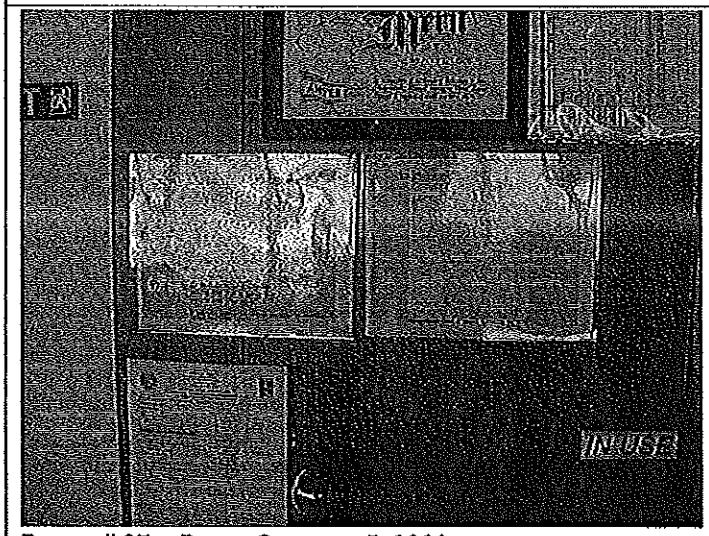

PHOTO #:07 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05009
DESCRIPTION: BRIDGE – POSTINGS OF MOU WATERS AND NON-COMPLIANCE NOTIFICATION NUMBERS

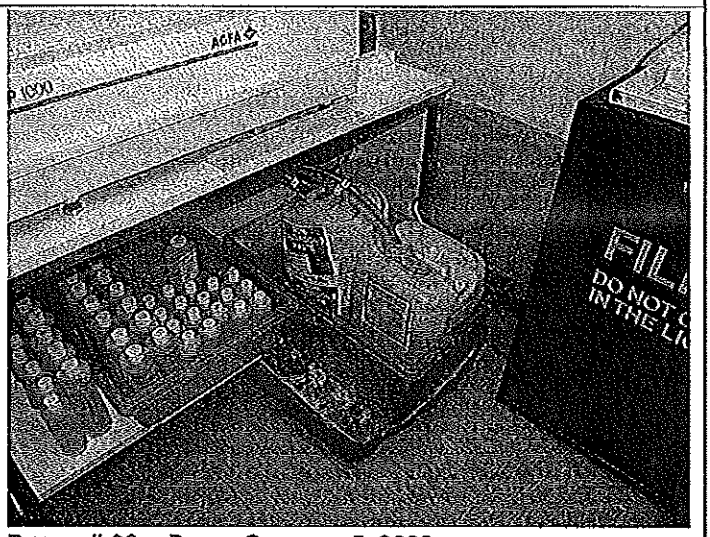

PHOTO #:08 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05010
DESCRIPTION: MEDICAL – X-RAY CHEMICALS AND WASTE

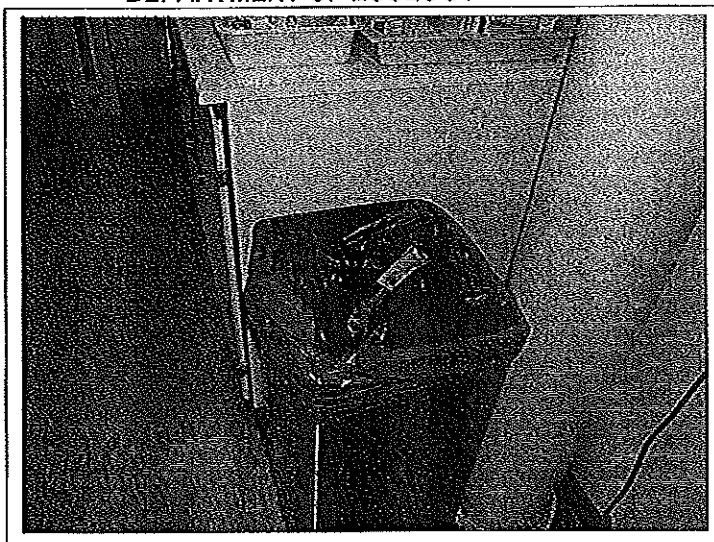

PHOTO #:09 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:PA05011
DESCRIPTION: MEDICAL – RED BAGS

PHOTO #:10 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05012
DESCRIPTION: LAUNDRY CHEMICALS (FOREGROUND AND BACKGROUND)

PHOTO #:11 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05014
DESCRIPTION: FOOD WASTE

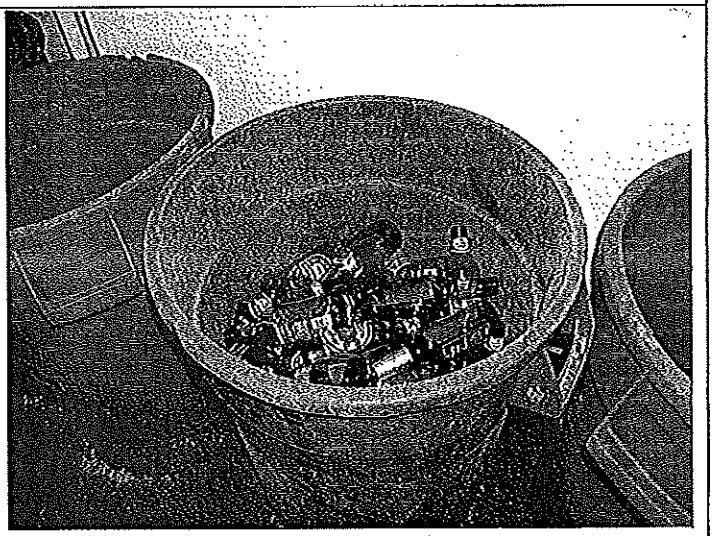

PHOTO #:12 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05015
DESCRIPTION: RECYCLING - SORTING

PHOTO #:13 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:PA05016
DESCRIPTION: SOLID WASTE SORTING AND INCINERATION

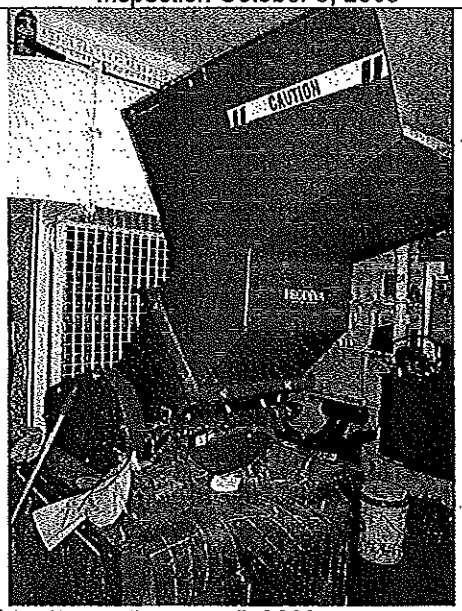

PHOTO #:14 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05018
DESCRIPTION: GLASS CRUSHER

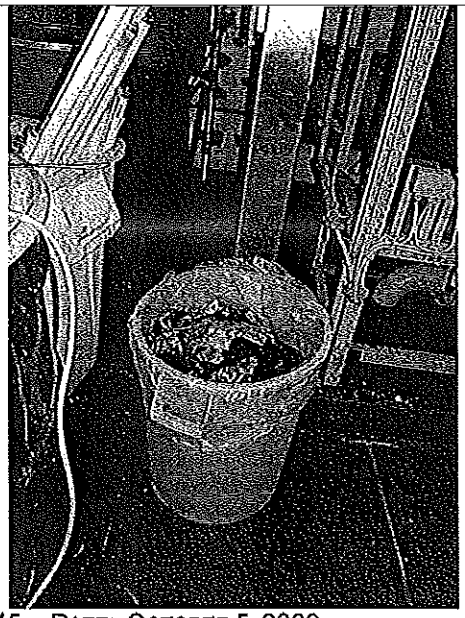

PHOTO #:15 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05019
DESCRIPTION: FOOD WASTE FOR INCINERATION

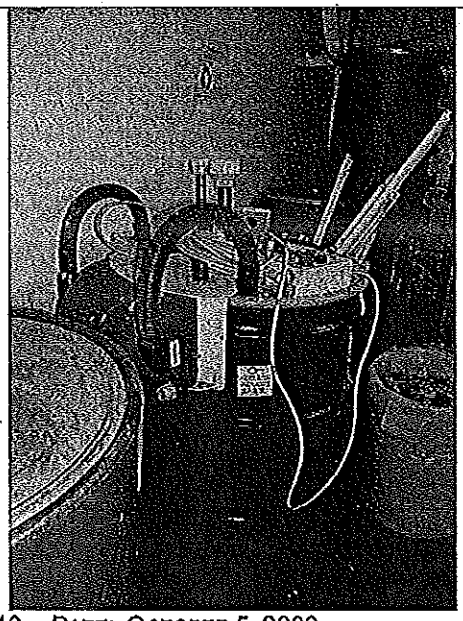

PHOTO #:16 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05020
DESCRIPTION: FLUORESCENT BULB – MERCURY REMOVAL SYSTEM

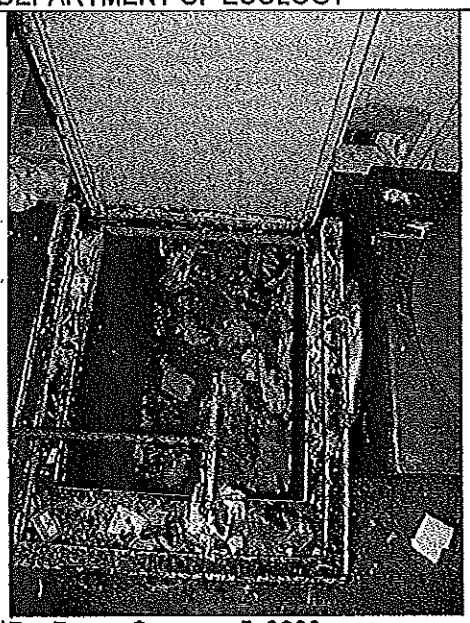

PHOTO #:17 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:PA05021
DESCRIPTION: INCINERATOR ACCESS

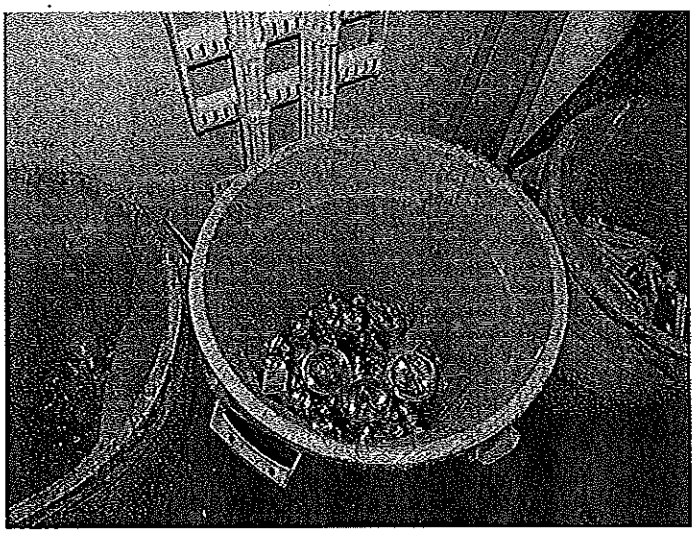

PHOTO #:18 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05022
DESCRIPTION: LIGHT BULB SORTING

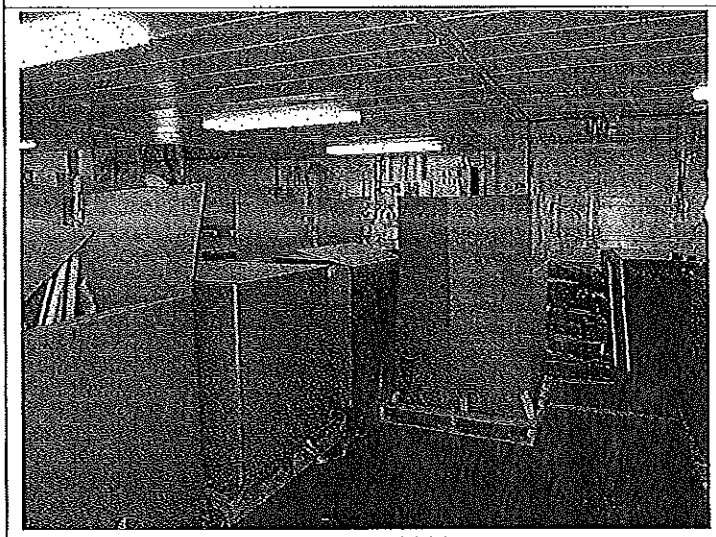

PHOTO #:19 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05023
DESCRIPTION: SOLID WASTE MATERIALS FOR OFF-LOADING

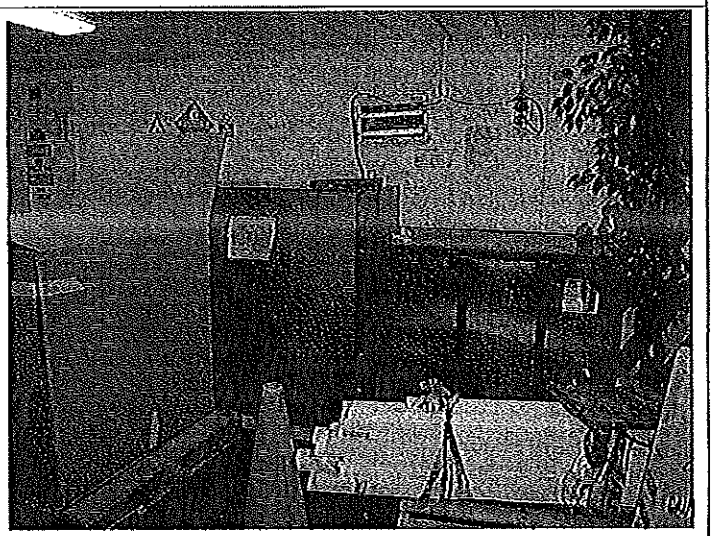

PHOTO #:20 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05024
DESCRIPTION: COOKING OIL (SILVER CONTAINERS)

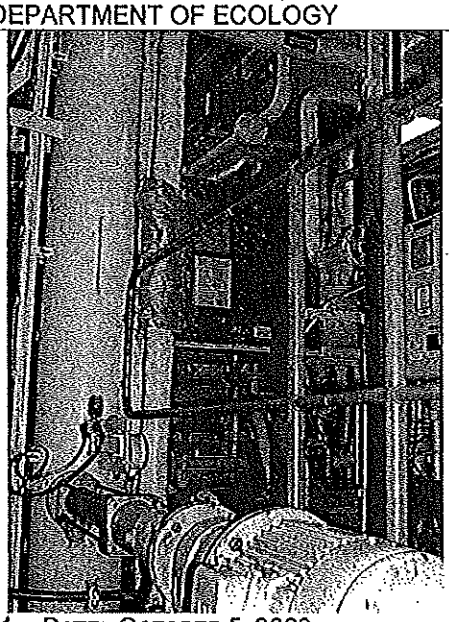

PHOTO #:21 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:PA05025
DESCRIPTION: WHITE BOX FOR OILY WATER SEPARATOR

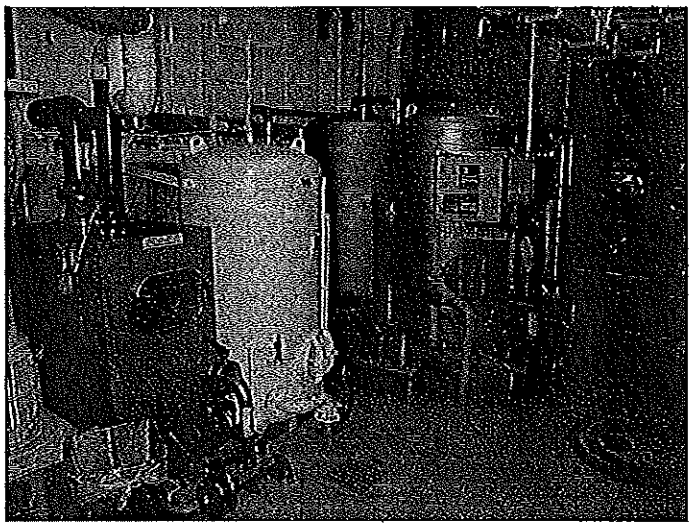

PHOTO #:22 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05026
DESCRIPTION: OILY WATER SEPARATOR

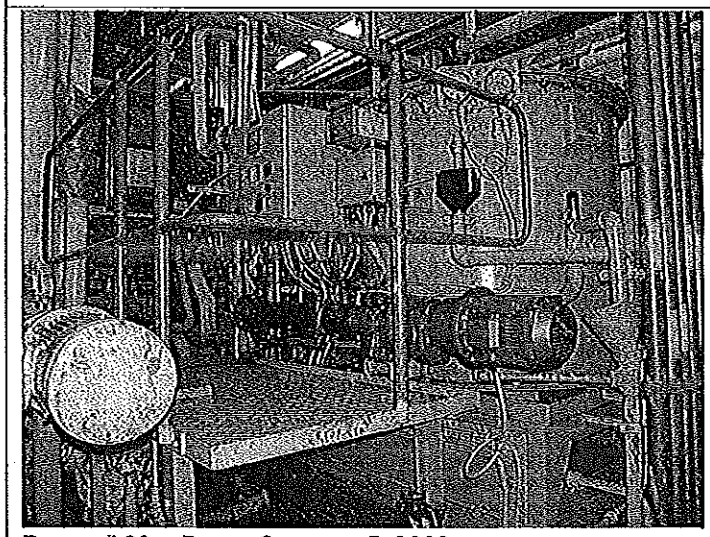

PHOTO #:23 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05027
DESCRIPTION: OILY WATER SEPARATOR

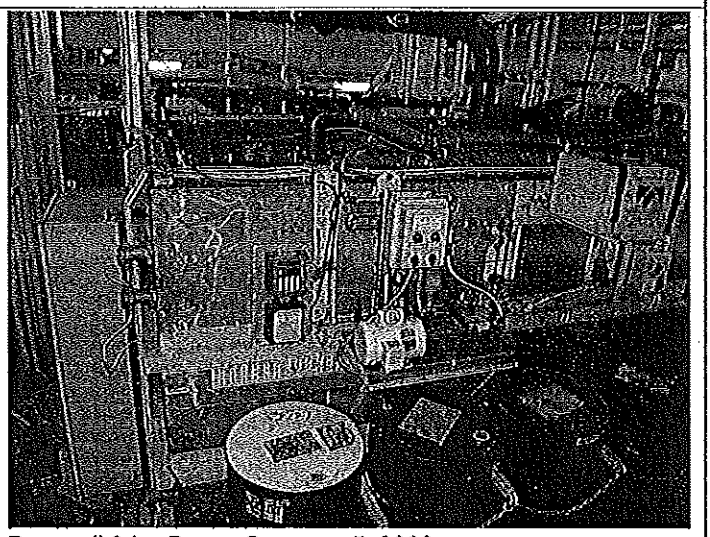

PHOTO #:24 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05028
DESCRIPTION: TRADITIONAL MARINE SANITATION DEVICE (1 OF 4)

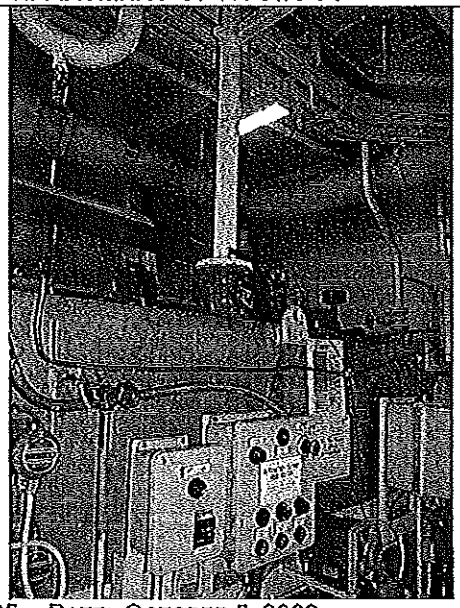

PHOTO #:25 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.:PA05029
DESCRIPTION: MARINE SANITATION DEVICE (2 OF 4)

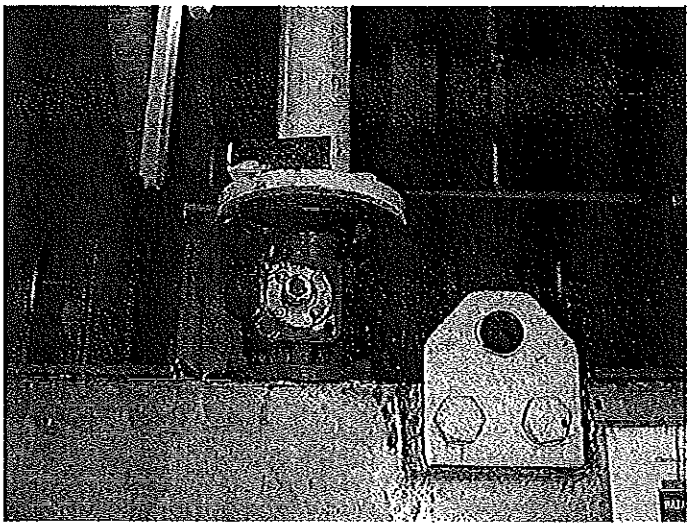

PHOTO #:26 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05030
DESCRIPTION: MARINE SANITATION DEVICE – MATERIAL FROM MEDICAL DRAINS TO MSD

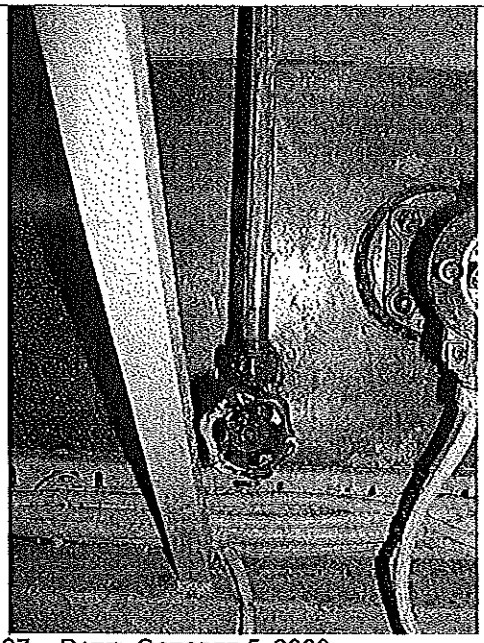

PHOTO #:27 DATE: OCTOBER 5, 2009
TAKEN BY: AMY JANKOWIAK FILE NO.: PA05031
DESCRIPTION: MARINE SANITATION DEVICE EFFLUENT (BOTTOM OF TUBE)