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This document contains Appendix C from the 2004 Holland America Veendam Data Report. Appendix C contains Interview Results for Wastewater Generation Systems, including: Graywater, Pesticides, Special Wastes, Collection, Holding, and Transfer Tanks, Wastewater, and Source Water, collected June 20 through June 25, 2004. The report and all the appendices for this sampling event can be downloaded from http://www.epa.gov/owow/oceans/cruise_ships/veendam.html

Holland America Veendam
2004 Analytical Results
Appendix C

March 2006

Appendix C

**INTERVIEW RESULTS FOR ACTIVITIES THAT IMPACT
WASTEWATER GENERATION**

GRAYWATER GENERATION DATA SHEET

Vessel: Holland America Veendam

Date: 6/22/04

Recorded By: D. Falatko

Vessel Point(s) of Contact: Stephen Schuetz, Assistant Food and Beverage Manager
Hobben Sitanggang, Chief Housekeeper

Number of Passengers and Number of Crew Actually on Board:

This cruise includes 1,300 passengers and 520 crew.

Unusual Maintenance or Operational Activities Described By Vessel Point(s) of Contact:

None

Number and Time of Meals Served by Day (include passengers and crew) :

On average, passengers and crew eat 3.5 to 4 meals per day. This includes late night snacks and food at bars. The Veendam budgets for 5,500 to 6,000 meals per day, including crew. The galleys operate at different times on port days, but basically the same number of meals as during ocean days.

Lido

Breakfast: 1,300 passengers + 150 officers

Lunch: 1,200 passengers + 150 officers

Dinner: 180 passengers + 150 officers

Late Night Snack: 30 passengers + 30 officers

Rotterdam Dining Room

Breakfast: 150 passengers

Lunch: 200 passengers

Dinner: 1,200 passengers

Room Service, Teatime, Snacks approx. 250 meals.

Were Dishwashers Operated? (Circle one) Yes / No

Yes. The main galley (Rotterdam) has 2 dishwashers (china and cutlery), 1 glass washer, and 1 pot wash (hand wash and rinse, plus SOMAT). The Lido has 1 pot wash and 1 dish/cutlery washer.

In the main galley (Rotterdam), the dishwashers operate from 1800 to 2400.

If yes, what weight, number of pieces, or number of loads were washed?

What times were dishes washed by day? Main galley dishwashers operate from 1800 to 2400.

All main galley washers operate in the evening. Only one dishwasher operates in the morning to handle to small number of meals served at that time.

Was Laundry Washed? (Circle one) **Yes** / No
Yes.

If yes, number of hours per day laundry was operated: 24 hours per day.

Weight, number of pieces, or number of loads washed per day:

Approximately 5 loads of towels and 2 loads of linens are washed each day. On change-over days, such as in Vancouver, more loads of linen are washed. The current washers are loaded until full of laundry (i.e., not filled by weight or number of pieces). Next month the Veendam will receive a new washer that measures the weight (kg) of each load.

What times were laundry washed by day?

Most laundry is washed from approx 9 pm or 10 pm to 2 am each day. Most laundry wastewater is generated during these times. From 2 am to 10 pm, much less laundry is washed.

Estimated volume of water per load: Unknown.

Detergent and other chemicals names (obtain MSDS if available):

All laundry chemicals provided by Johnson Diversey:

Diver Alik - Liquid alkali. Contains 10% to 30% NaOH and 3% to 7% sodium nitrolotriacetate.

Renew Extra - Liquid laundry detergent. Contains 10% to 30% linear alcohol ethoxylate, 3% to 7% sodium dodecylbenzene sulfonate, and 3% to 7% ethylene glycol monobutyl ether.

Super Impede - Stain remover.

Divercide 6F - Liquid laundry sour. A silicofluorides mineral acid. Contains 10% to 30% hydrofluorosilicic acid.

Valid II - Fabric softener. A cationic surfactant containing 10% to 30% ditallow diamido methosulphate and 1% to 5% isopropanol.

SPECIAL WASTES GENERATION AND DISPOSITION DATA SHEET

Vessel: Holland America Veendam

Date: 6/25/04

Recorded by: D. Falatko

Photo Lab(s) On Board: yes or no (circle one)

Yes

Waste handling and disposition:

Waste photographic chemicals are collected into drums.

Any waste treatment (e.g., silver recovery in photo lab)? What is the disposition of treated waste and any residuals (e.g., silver recovery filter and filtrate)?

A silver recovery unit retains silver within the filter. The filtrate is collected into a drum and tested for silver to determine whether or not it is hazardous. The filtrate is off loaded for disposal as either a hazardous or nonhazardous waste.

Inspect area for floor drains. Are drains blocked or open? Where do the floor drains lead? Describe any streams that enter the floor drains.

The photo lab has no floor drains. The lab experienced a burst pipe a few days prior, which flooded into public areas.

Inspect area for sinks. Is sink drain blocked or open? What is the disposition of sink water? What streams enter or potentially the sink (e.g., hand washing, rinse/clean equipment, prepare chemical solutions)?

A lab sink is used to rinse chemical trays, etc. The sink is completely blocked. Lab staff try to minimize rinse water because the sink contents are pumped to the silver recovery unit.

Inspect area for chemical storage. Are chemicals stored over a sump or other secondary containment?

The drums are located on a sump/containment area to catch any spills.

SPECIAL WASTES GENERATION AND DISPOSITION DATA SHEET

Vessel: Holland America Veendam

Date: 6/25/04

Recorded by: D. Falatko

Print Shop(s) On Board: yes or no (circle one)

Yes

Waste handling and disposition:

Did not observe any print shop wastes.

Any waste treatment (e.g., silver recovery in photo lab)? What is the disposition of treated waste and any residuals (e.g., silver recovery filter and filtrate)?

No waste treatment.

Inspect area for floor drains. Are drains blocked or open? Where do the floor drains lead? Describe any streams that enter the floor drains.

The print shop has no floor drains.

Inspect area for sinks. Is sink drain blocked or open? What is the disposition of sink water?

What streams enter or potentially the sink (e.g., hand washing, rinse/clean equipment, prepare chemical solutions)?

A print shop sink is used for hand washing (print inks) and to dilute chemicals for use. The sink is plumbed to the accommodations graywater system. Print shop staff are careful not to overflow chemicals into the sink.

Inspect area for chemical storage. Are chemicals stored over a sump or other secondary containment?

Did not observe any chemical storage.

SPECIAL WASTES GENERATION AND DISPOSITION DATA SHEET

Vessel: Holland America Veendam

Date: 6/25/04

Recorded by: D. Falatko

Dry Cleaning On Board: yes or no (circle one)

Yes

Waste handling and disposition:

Solvent waste is disposed of on shore as a hazardous waste.

Any waste treatment (e.g., silver recovery in photo lab)? What is the disposition of treated waste and any residuals (e.g., silver recovery filter and filtrate)?

No waste treatment.

Inspect area for floor drains. Are drains blocked or open? Where do the floor drains lead?

Describe any streams that enter the floor drains.

Condensate cooling water drains to the forward holding tank, which joins the accommodations graywater system.

Inspect area for sinks. Is sink drain blocked or open? What is the disposition of sink water?

What streams enter or potentially the sink (e.g., hand washing, rinse/clean equipment, prepare chemical solutions)?

A sink adjacent to the dry cleaning machine is used for hand washing. Squirt bottles containing stain removal chemicals are stored over the sink.

Inspect area for chemical storage. Are chemicals stored over a sump or other secondary containment?

Solvent is stored in plastic drums.

The dry cleaning machine, machine piping, and solvent storage are all located on containment sumps.

SPECIAL WASTES GENERATION AND DISPOSITION DATA SHEET

Vessel: Holland America Veendam

Date: 6/25/04

Recorded by: D. Falatko

Chemical Storage Area On Board: yes or no (circle one)

Yes

Waste handling and disposition:

No wastes, only chemical storage.

Any waste treatment (e.g., silver recovery in photo lab)? What is the disposition of treated waste and any residuals (e.g., silver recovery filter and filtrate)?

Not applicable.

Inspect area for floor drains. Are drains blocked or open? Where do the floor drains lead?

Describe any streams that enter the floor drains.

Didn't observe any floor drains, but difficult to inspect since storage pallets covered the floor.

Inspect area for sinks. Is sink drain blocked or open? What is the disposition of sink water?

What streams enter or potentially the sink (e.g., hand washing, rinse/clean equipment, prepare chemical solutions)?

No sinks present in the chemical storage area.

Inspect area for chemical storage. Are chemicals stored over a sump or other secondary containment?

Chemicals include primarily laundry chemicals, general purpose cleaner for rooms, hand cleaner, etc. All chemicals are stored on pallets with no containment.

PESTICIDE, FUNGICIDE, AND RODENTICIDE USE DATA SHEET

Vessel: Holland America Veendam

Date: 6/23/04

Recorded by: D. Falatko

Vessel Point(s) of Contact: Paul Young, Second Officer, Safety/Pest Control

Pesticides Used On board: yes or no (circle one)

Yes.

Insect Monitoring: Use Maxforce (a.i. Fipronil) capsules to monitor ship for insects. The capsules contain the attractant, but don't allow water wash to enter (i.e., capsules protects against splashes, etc.). Traps the insects inside.

Insect Infestation: Veendam uses two types of poisons: Cykick (spray insecticide; a.i. Cyfluthrin) and Siegebait (crack, crevice, grout, tiles; a.i. Hydramethylnon). Insects that eat the poison lose the desire to eat. The poison is spread to other insects by eating the dead, pesticide-contaminated insects.

Amount used is unknown.

Did not obtain MSDS.

List Locations Where Pesticides are Normally Applied and Stored On Board and Dates Applied:

Monitoring capsules are placed in the galleys, bars, garbage rooms, and some cabins. They are tucked under refrigerators, ovens, etc. Bait traps are used at all times. The traps are inspected once per week.

Insect infestation sprays are used in insect harborages (cracks, crevices, etc.). Sprays are used when monitoring identifies an infestation. In general, sprays are used less often than once per week. Mr. Young would like to spray in the galley once per week as a precaution; however, his program is not quite yet organized.

Pesticides and traps are stored in a locker on B-deck.

Potential to Enter Graywater/Blackwater Systems (e.g., application, spills, floor drains)?

Floor washing is only possible means to enter graywater system. Storage locker does not have a floor drain.

There are always insects aboard, and the pest control officer's job is to keep the insects from becoming a problem. Insect traps don't work if the insects have alternative food sources. Once or twice per week the ship's crew takes apart and disinfects the galley equipment to remove potential insect food sources.

Person(s) Responsible for Pesticide Application: Second Officer, Safety/Pest Control

Fungicides Used On board: yes or no (circle one)

Fungicides not used on board Veendam.

Fungicide Name	Target Fungi	Amount Used/yr	MSDS Obtained (yes/no)
_____	_____	_____	_____
_____	_____	_____	_____

List Locations Where Fungicides are Normally Applied and Stored On Board and Dates Applied:

Potential to Enter Graywater/Blackwater Systems (e.g., application, spills, floor drains)?

Person(s) Responsible for Fungicide Application:

Rodenticide Used On Board: yes or no (circle one)

No rodenticides used. They have traps on board that they inspect; however, Mr. Young has never found any rats.

Every 6 months a contractor conducts an inspection and issues the ship a derat certificate.

Rodenticide Name (yes/no)	Target Rodent	Amount Used/yr	MSDS Obtained
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

List Locations Where Rodenticides are Normally Applied and Stored On Board and Dates Applied:

Potential to Enter Graywater/Blackwater Systems (e.g., applications, spills, floor drains)?

Person(s) Responsible for Rodenticide Application:

COLLECTION, HOLDING, AND TRANSFER (CHT) TANK DATA SHEET

Vessel: Holland America Veendam

Date: 6/26/04

Recorded by: D. Falatko

Tank Number or Identification:

- (1) Galley 1P* (capacity 37 m³)
- (2) Laundry 4C (capacity 47.4 m³)
- (3) Accommodations 1P*/2P/3S (capacities 11.1 m³, 12.2 m³, and 12.2 m³)
- (4) Graywater storage tanks 4S/4P (capacities 120 m³ and 119 m³)
- (5) Graywater storage tanks 2S/2P (capacities 89 m³ and 89 m³)
- (6) Graywater storage tanks 5S/5C/5P (capacities 183 m³, 232 m³, and 146 m³)
- (7) Biosolids and membrane cleaning wastewater (capacities 118 m³ and 118 m³)
- (8) Food pulper wastewater (capacity unknown)
- (9) Blackwater evacuation tanks (4 tanks, capacities unknown)

* The tank identification numbers for either the galley or accommodations holding tanks are incorrect. Tank log located in engine control room included this inconsistency.

Wastewater Source(s):

Galley, laundry, accommodations, and biosolids/membrane cleaning wastewater tanks as listed above. Other minor sources include:

- Garbage room floor drains to galley wastewater.
- Dry cleaning condensate cooling water drains to accommodations graywater system.
- Medical sinks and floor drains to blackwater system.
- All scuppers throughout ship, except for the galley and garbage room scuppers, drain to the accommodations graywater system.

The graywater storage tanks are used when additional untreated graywater storage capacity is needed (e.g., wastewater treatment system is down or operating at reduced capacity).

Tanks 4S/4P are filled first, followed by 2S/2P, and then 5S/5C/5P. Note that only some double bottom holding tanks can be pumped to the wastewater treatment system. Tanks that cannot be pumped to treatment are pumped to direct discharge at sea outside 12 nm.

Tank Volume: _____ m³ or gallons

See above.

Does the Tank Have Vacuum: yes or no (circle one):

Graywater is not under vacuum. Blackwater evacuation tanks are under vacuum.

Vacuum: ____ mm Hg

Blackwater tank volume unknown.

Tank Material of Construction:

Unknown.

Is this a double bottom tank: yes or no (circle one)?

Graywater storage tanks 4S/4P, 2S/2P, and 5S/5C/5P are double bottom tanks. The remaining graywater and blackwater tanks are not. The double bottom tanks are generally not used.

Normal Operating Volume: _____ m³

Unknown.

Automated Tank Gauging and Discharge System: yes or no (circle one)

None of the graywater/blackwater holding tanks are tied into the engine control room monitoring system. All tanks discharge to the treatment system (or graywater storage) based on automatic high and low tank level indicators. Laundry holding tank appeared to operate on a timer, presumably to maintain a more constant feed to the wastewater treatment system.

Discharge Type: batch or continuous (circle one)

Tanks discharge based on tank level indicators.

Totalizer or Flow Meter on Discharge Line: yes or no (circle one)

No totalizers or flow meters on any holding or storage tanks.

Discharge Flow Rate: _____ m³/min or m³/day

See flow data collected via strap-on ultrasonic flow meters (Appendix D).

Wastewater Destination After Leaving the Tank:

Graywater holding tanks discharge to two graywater equalization tanks, each with 121 m³ capacity, and then into the wastewater treatment system. Blackwater evacuation tanks discharge directly to the wastewater treatment system.

Approximate Diameter of Discharge Line: _____ inches

Pipe diameter information collected from measurement of pipe circumferences

(1) Galley - 6.05 in

(2) Laundry - 4.8 in

(3) Accommodations - 3.82 in

(4) Influent to Treatment - 4.77 in

Screens or Filters Present on Either Influent or Discharge Lines (describe):

Galley wastewater is pretreated using grease traps. Accommodations wastewater also pretreated by gross particle filters.

Chemical Additions to Tank:

No chemical addition to CHT tanks.

Chemical Name	Purpose	Amount	MSDS (yes/no)
_____	_____	_____ kg/day	_____
_____	_____	_____ kg/day	_____
_____	_____	_____ kg/day	_____

Is sludge removed from this tank (describe frequency, amount, destination)?:

Unknown whether CHT tanks are cleaned.

WASTEWATER TREATMENT UNIT DATA SHEET

Vessel: Holland America Veendam

Date: 6/26/04

Recorded by: D. Falatko

Description of Treatment Unit: ZeeWeed Membrane Bioreactor

Manufacturer: Zenon Environmental Inc.

Model: Unknown.

Design Drawings Obtained: yes or no (circle one) Yes

Design Capacity: _____ gpd or gpm (circle one)
Unknown.

Typical Operating Flow Rate: _____ gpd or gpm (circle one)
Daily wastewater treatment system production is approximately 600 m³/day.

Operational period: _____ hours
The wastewater treatment system operates 24-hours per day.

Chemical Additions:

- (1) Defoamer (rarely used) and caustic are added to the bioreactor. Nitrogen addition (ammonia) is no longer used, and has been disabled.
- (2) The membrane chamber is periodically cleaned with sodium hypochlorite and acid.
- (3) Citric acid and sodium hypochlorite are added to the membrane backwash tank on alternate days.

The membrane cleaning cycle is initiated when Zenon operators recommend, which is generally when the TMP (differential pressure across the membranes) reaches approximately -0.45 bars. The cleaning cycle requires two days. The first step of the cleaning cycle is to add two drums (406 L) of sodium hypochlorite to the membrane chamber, plus water from the permeate tanks to fill the chamber. The hypochlorite solution remains in the chamber overnight and is then wasted to tanks 6S/6P. Next, six bags at 25 kg each of citric acid are added to the chamber, plus water from the permeate tanks to fill the chamber. The solution remains in the chamber for six hours and is then wasted to tanks 6S/6P.

Electrical Requirements:
Unknown.

Sludge Generation: yes or no (circle one) Yes.

Screening solids are removed to the solids collection tank, which is equipped with a macerator pump to chop and recirculate the solids. Macerating the solids also serves to release additional water. As a result, four to five times per day the Zenon operator pumps the solids tank to screen filters to remove water. Approximately 15 to 20 m³ of screening solids are generated monthly and disposed of on shore.

The Zenon operator measures the bioreactor TSS concentration to calculate the recommended waste biosludge volume. The typical TSS concentration is 11,759 mg/L. In Alaska, the target TSS concentration is 9,000 to 10,000, while in the Caribbean the target TSS concentration is 10,000 to 12,000. This difference is caused by differences in operating temperatures.

The waste biosludge volume is calculated as follows:

Waste (m³) = Mixed liquor volume (m³) x (1 - [Target TSS (mg/L)/Current TSS (mg/L)])

The calculated TSS values and other key measurements are provided to Zenon representatives daily via the internet.

The typical waste biosludge volume actually wasted is generally 15 m³, regardless of the calculation. If additional waste volume is recommended by Zenon representatives, for example 20 m³, then 15 m³ would be wasted in the morning, with an additional 5 m³ wasted in the evening.

Was maintenance performed on treatment unit: yes or no (circle one)

If maintenance was performed, estimate labor: _____ hours

Solids do accumulate on the membranes, and the membranes need to be cleaned physically. Physical cleaning is performed by the Zenon service technician. The membranes are cleaned with hoses, and the chamber is then pumped to tanks 6S/6P for discharge at sea outside 12 nm.

The UV lamp bulbs (quartz sleeves) are replaced every 13,000 hours. Lights on the ends of the lamps indicate any failures or clogging.

The rubber paddles on the screen filters wear off at the bottom that presses against the screens. The rubber periodically needs to be lowered and ultimately replaced.

The Zenon operator also periodically inspects and maintains the blowers on the aerators (to ensure adequate air production) and the solids screens.

List operating parameters recorded (e.g., flow, temperature, pressure, pH), typical values, and range for this unit. Record or obtain copy or printout of logs for the duration of the sampling episode.

See the daily operator log in the Cruise Ship Rulemaking Record.

Wastewater flow through the treatment system is typically controlled by the graywater pumps. However, during periods of high membrane TMP, the TMP control automatically reduces the

wastewater flow rate to maintain TMP.

When not discharging permeate overboard (e.g., when cruising in Glacier Bay), the permeate is routed to double bottom ballast tanks (tank 1C, capacity 411 m³). The double bottom tanks are discharged at sea outside 12 nm.

SOURCE WATER DATA SHEET

Vessel: Holland America Veendam

Date: 6/24/04

Recorded by: D. Falatko

Is Potable Water Generated On Board the Vessel: yes or no (circle one)

Yes. Water is produced every day, as soon as the engines start. Approximately $\frac{1}{2}$ of the water used is produced, and the other $\frac{1}{2}$ is bunkered in ports.

Describe the On-board Potable Water Treatment and Disinfection Method:

The ship operates two tubular vacuum evaporators. Each evaporator produces 14 m³/hr, for a total ship production of 28 m³/hr and 250 m³/day. Produced water is "prechlorinated" to approx 2.5 ppm chlorine and then pumped to storage tanks. From the storage tanks the water is "postchlorinated" to approx 1.5 ppm chlorine. The water is 1.3 ppm at the highest point, which is the bridge, which is equipped with a chlorine meter. The chlorination system is inspected every 2 hours.

Port (City) Where Source Water is Obtained if Not Generated On board: _____

Water is also bunkered at selected ports: Vancouver, Juneau, and Ketchikan have the best water.

Treatment Method for Source Water Obtained in Port:

Bunkered water passes through a mineralizer filter (adds minerals and controls pH), followed by chlorination.

Disinfection Method for Source Water Obtained in Port:

Bunker water chlorination is the same process as for produced water, but performed in a separate system.

Fluoride Added to Water Obtained in Port: yes or no (circle one)

No. Fluorination is not performed on board or in port.

Additional Disinfection Performed On Water Obtained in Port: yes or no (circle one)

No. The Alaska municipalities do not chlorinate their water. Method of drinking water treatment in ports is unknown.

Describe Additional On-board Disinfection Method:

Bromination for pools only.

Description of Source Water Sample Collection Point On Board Cruise Ship:

For bunkered water, ship's crew test for total coliform and E. coli. Testing is not required for water produced on board because water temperatures exceed 65°C.