

Source Reduction Evaluation 2008 2009 Part I

For Science Panel
ADEC 2010

Source Reduction Evaluations

- Requirement of 2008 General Permit for interim limits for ammonia, copper, nickel, and zinc
- Two year program to transition to original 2010 long-term limits

Interim Limits (required SRE)

Ammonia		Copper	
interim (mg/L) 80.4	long term (mg/L) 2.9	interim (ug/L) 66	long term (ug/L) 3.1
Nickel		Zinc	
interim (ug/L) 180	long term (ug/L) 8.2	interim (ug/L) 230	long term (ug/L) 81
pH		Biological oxygen demand (BOD)	
Minimum 6.5	Maximum 8.5	Maximum 60 mg/L	Monthly Average 30 mg/L
Fecal Coliform			
Maximum 43/ 100 ml	Monthly Average 14/ 100 ml		
Total Suspended Solids (TSS)		Total Residual Chlorine	
Maximum 150 mg/L		Maximum 0.0075 mg/L	

**Source Reduction Evaluation (SRE)
Elements in a Nutshell** *[continued]*

- The SRE reports provided by the vessels included these elements (generally):
 - I) Influent Source Reduction
 - Source water evaluation
 - Chemical use evaluation
 - Water supply evaluation
 - II) Treatment technology evaluation / Implementation
 - III) AWTS Operations Optimization

**Ship Operations / Systems I
Potable Water**

- Vessels use potable water (drinking water) for cleaning, food preparation, for laundry/ wash operations, flush operations, bath wash, drinking water, and for technical process (e.g. cooling water / steam generation)
- Water use can be divided into Hotel use (pax crew) and Technical Department use
- Water can be produced onboard by desalination of seawater

**Ship Operations / Systems I
Potable Water** *[continued]*

- Onboard produced water can be obtained by:
 - Evaporator systems
 - Reverse Osmosis systems
 - Collection of condensate / permeate (Technical Water)
- Water can be loaded (bunkered) from trusted shore side facilities. This water is called “bunker water”
- Water produced / bunker water is treated onboard (“sanitized / chlorination”)
- Water that is produced on board or bunkered is stored onboard in dedicated water tanks.

Ship Operations / Systems I
Potable Water [continued]

- From these water tanks the water is distributed to the vessel's consumers through piping (distribution) system.
- Distribution system vertical piping "columns" to bring the water to the next level / deck are sometimes called "risers"
- Piping materials differ: Copper / stainless / metal free piping (plastics)/ fitting stainless steel metallic.
- Drain piping from "consumer" to collecting tanks metallic piping (galvanized) / non-metallic piping.

Ship Operations / Systems I
Waste Water

- General Definitions:
 - Black water (BW) and Gray Water (GW)
 - Influent is the BW / or GW that enters the waste water treatment system
 - Collecting Tanks collect the BW or GW flows
 - Effluent is the BW and or GW flow that is discharged overboard or discharged in holding tanks

Ship Operations / Systems I
Waste Water [continued]

- BW generated from toilets. Toilet systems are vacuum systems (water conservation).
- Toilet flush water (conveyance water) on some vessels is technical water.
- BW collecting system dedicated systems / collecting tanks
- GW collection system dedicated systems / collecting tanks
- GW generated from Hotel- galleys, laundry, cabins, cleaning stations.
- BW flow relatively small compared to GW volumes (influent)
- GW flow the majority of the wastewater flow volume (influent)

Ship Operations / Systems I
Waste Water [continued]

- Boiler water generated from steam boiler system (engine room)
- Spa, Jacuzzi, Pool water generated from the Hotel systems (hotel).
- Other wastewater sources

Ship Operations / Systems I
Waste Water Treatment

- Wastewater treatment systems are a Marine Sanitation Device MSD II, but a very advanced one. Therefore we call these systems Advanced Wastewater Treatment Systems (AWTS)
- All vessels that participated in SRE Reporting have AWTS systems.
- AWTS system are currently designed to remove the “conventional” pollutants (e.g. Fecal, BOD, TSS etc) not metals.

Ship Operations / Systems I
Waste Water Treatment [continued]

- AWTS systems used:
 - Zenon System: Membrane Bioreactor (MBR) system
 - Hamworthy: Membrane Bioreactor (MBR) system
 - Scanship: Bioreactor with flotation/polishing
 - Rochem: RO and ultra filtration system
 - Biopure Marisan: Bioreactor with microfiltration

ACA Bunker Water Samples

- Referenced in most cruise line SREs
- DEC had questions regarding QA/QC of sampling
- Most sample events not correlated to vessels bunkering water
- Wide range of results for different weeks, or nearby locations
- Some samples shown in following tables from Princess SRE efforts.

ACA Bunker Water Samples

- Sample Locations

Port	Cu Ni Zn	Qty	Notes
San Francisco	Yes	2	
Seattle	Yes	23	
Victoria (BC)	Yes	12	
Vancouver (BC)	Yes	28	
Ketchikan	Yes	21	
Wrangell	Yes	1	ACA was not aware of 2008 cruise ship visits
Juneau	Yes	24	
Haines	Yes	1	ACA was not aware of 2008 cruise ship visits
Skagway	Yes	23	
Whittier	Yes	6	
Seward	Yes	6	

ACA Bunker Water Sample Results

Part 1

Port Location	Date	Cu ug/L	Ni ug/L	Zn ug/L	Notes
San Francisco	7/18/08	0.89	<0.5	<5	PCL sample
San Francisco	8/26/08	3.4	<0.5	250	ACA sample
Pier 25	6/30/08	34	1.3	2500	PCL sample
Seattle North Berth PCL	8/26/08	7.0	<1	<5	ACA sample
Victoria Pier A south	8/26/08	7.0	<1	16	ACA sample
Victoria North	6/21/08	2.47	0.431	8.92	PCL sample
Victoria	6/5/09	2.6	2.8	120	PCL sample
Vancouver North Con	7/24/08	1.5	<0.2	209	PCL sample
Vancouver Central Con	7/24/08	15	<0.2	280	PCL sample
Vancouver South Con	7/24/08	7.8	<0.2	6.0	PCL sample
Vancouver Can Place East	8/27/08	110	<1.0	<5	ACA sample
Vancouver Can Place West	8/27/08	4.0	<1.0	12	ACA sample
Ketchikan	6/27/08	3.62	0.212	4.34	PCL sample
Ketchikan St. FMO Port	6/27/08	0.43	0.2	6.49	PCL sample
Ketchikan Berth 2	8/29/08	<1	<1	3.4	ACA sample
Ketchikan Berth 4	8/29/08	2.2	<1	10	ACA sample
Ketchikan Berth 3	8/29/08	1.3	<1	16	ACA sample

Note: Selected from Princess Cruise Lines SRE Reporting (08/09) and ACA Bunker water Synopsis 2008.

ACA Bunker Water Sample Results

Part 2

Port Location	Date	Cu ug/L	Ni ug/L	ZN ug/L	Notes
Juneau AJ Dock	6/18/08	28.1	1.24	13.7	PCL sample
Juneau AJ Dock	7/21/08	58.4	0.771	26.8	
Juneau South Franklin dock	6/25/08	41.7	2.35	16	PCL sample
Juneau South Franklin dock	6/1/09	2.2	1.3	33	PCL sample
Juneau South Franklin Dock	8/18/08	280	2.9	77	ACA sample
Juneau South Franklin Dock	8/11/08	2.3	0.46	13	ACA sample
Juneau AK 55 dock	9/4/08	34	1.2	75	ACA sample
Skagway	6/12/08	0.688	1.48	6.53	PCL sample
Skagway	6/2/09	3.2	1.5	49	PCL sample
Skagway BR dock	8/26/08	20	22	54	ACA sample
Skagway Ore station Dock	8/26/08	2.3	2.2	13	ACA sample
Haines	9/17/08	2.1	<1	<20	ACA sample
Whittier	9/11/08	1.2	<1	7.6	ACA sample
Seward	8/15/08	9.5	0.26	6.1	ACA sample
Seward	7/30/08	0.904	1.46	6.91	ACA sample
