31st October 2008

Interim Influent Source Reduction Evaluation Report
for SRE (Cu & Ni) rev.1 of m/v Silver Shadow
as per ADEC's LCPVWDP #2007DB0002, authorization 0025

Following ADECs SRE Completeness Review letter of Silver Shadow's SRE (Cu & Ni) rev.0, dated 01st August 2008, in the general Comments Section (Additional Information Needed in SRE, 4th bullet point), the following was required:

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"V.Ships Leisure must submit at least one interim Influent Source Reduction Evaluation report no later than October 2008."

ADEC Expectations for Interim Reports Submitted under the SRE

- *Each interim evaluation report, as well as the annual progress report, should discuss the methodology used to obtain the information.*

- *The "Influent Source Reduction Evaluation" report should include all findings that affect the effluent quality including options for operating the existing advanced wastewater treatment system. This could include a discussion of the effect that mixing ratios of blackwater and graywater have on effluent quality, any chemicals used in the treatment process, the oxygen ratio used in the process, etc.*

- *The "Influent Source Reduction Evaluation" should also identify whether there are any intermittent .operations or systems that could contribute to the source of metals.*

- *The "Influent Source Reduction Evaluation" should include the sample results taken at different points in the distribution and production plant and at the intake to the vessel for different ports where you bunker water. This section of the SRE should also include the volumes of potable water that the Silver Shadow typically bunkers at particular ports.*

- *The "Treatment Technology Evaluation" interim report(s) should detail the efforts that are being made to research existing or emerging technologies and the findings. This research effort could be tailored to the specific vessel or the industry as a whole. Such research should include at a minimum an examination of the space requirements, installation and maintenance costs, reliability, energy requirements, specific pollutant removal rates, benefits to the environment and any other pertinent information.*

- *The "Treatment Technology Evaluation" interim report(s) should include the findings of any work or research with the vendors of the advanced wastewater treatment system to optimize the current system as well as the potential for any add-on components to address the*

pollutants of concern.

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UPDATE

Ref	Action	Time Limit & Status	Person(s) in Charge	Update			
				Methodology Used	**Findings on Effluent Quality**	**Interim Operations or Systems Contributors**	**Sampling Results**
1.	**Influent Source Reduction Evaluation**						
i	**Use of Chemicals**						
i a)	collect technical sheets and identify all cleaning products and maintenance products used on board. Evaluation and estimation of potential contributions from cleaning products to copper, nickel in the effluent.	01 Jan 09 progress report	Env. Off., Mar. Suptd. (Env.)	Analysis of data (chemical composition) in data sheets (technical and safety) . Enquiry with the manufacturers of the chemicals Engine department chemicals list and MSDS received. Five chemicals identified that enter the wastewater stream for discharge. Other shipboard departments (deck and hotel) list (and data/safety sheets) of chemicals also requested. Pending receipt.	Upon review of the data sheets of the five chemicals no Copper or Nickel components identified. (a toilet cleaner and descaler by Hepburn – Bio WC and Bo Scale Zapper Gla; two wastewater treatment system chemicals by Meitler Consulting Inc – MC 730 and 335; one Sodium Hydroxide chemical by Andrea Gallo Genoa) Enquired with manufacturers, one producer for two of the five chemicals (Hepburn) confirmed no Copper and Nickel in the chemicals composition. Will pursue confirmation with the other three chemicals manufacturers.	No change in the inventory of the engine department chemicals have been identified (ie no interim conditions)	Unable to relate to use of these chemicals
i b)	Based on the outcome of the above review, adoption of operational practices to reduce pollutants sources	01 Mar 09 **report not**	Tech. Suptd, Purch. Agent				

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				Methodology Used	**Findings on Effluent Quality**	**Interim Operations or Systems Contributors**	**Sampling Results**
1.	**Influent Source Reduction Evaluation**						
	such as use of alternative cleaning products to take place	**due yet**					
i c)	produce and analyze the technical sheets of the paints used on board for the potable water tanks, water purifier, double bottoms of tanks used for grey water collection	15 Oct 08 outcome report OPEN till manufacturers confirm	Env. Off., Mar. Suptd. (Env.)	Analysis of data (chemical composition) in data sheets (technical and safety). Enquiry with the manufacturers of the coatings Two epoxy based coatings of the water tanks have been identified.	Upon review of the info in the data sheets of the two coatings: Sigmaguard CSF 85 by Sigma - two component epoxy water tank coating and Epicon T-800, Marine - epoxy phenolic primer coating, no copper or nickel have been found listed as components. Confirmation enquiry send with manufacturers, no response received yet.	No change in the type of tanks coatings during dry docks or other maintenance reasons have been identified since the ship was built	Unable to relate to use of these chemicals
i d)	Based on the outcome of the above review, consideration to be given on changing some of the paint coatings with others with lesser amount of copper or nickel if feasible	01 Mar 09 **report not due yet**	Tech. Suptd., St. Capt.				
ii.	**Water Source Evaluation**						
ii a)	Additional sampling of potable water to be carried in different points of the distribution and	10 Sep 08	Env. Off., St. Capt., Mar. Mgr., Mar. Suptd. (Env.)	Lab analysis (EPA relevant test methods) by Admiralty Environmental Samples of water from various locations within	In general, levels of dissolved copper and dissolved nickel at the various sampling points within the Silver Shadow seem to be mainly generated by sources within the ship.	Occasional failure of the water system pressure controller device and due following pressure hammering effect causing accelerated erosion effect of	As per Attachment 1

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				Methodology Used	**Findings on Effluent Quality**	**Interim Operations or Systems Contributors**	**Sampling Results**
1.	**Influent Source Reduction Evaluation**						
	production plant in order to locate anomalies, if any	outcome report the target date would need to be extended and the SRE revised according ly **suggested till 01 Mar 09**		the Silver Shadow were collected on June 6, Sep 8, 2008 and Sep 9, 2008	There appears to be a substantial source of dissolved copper originating within the graywater system, although the scope of sampling performed did not allow for identification of the point source. In addition, only single data points are available – repeated samplings would be necessary in order to confirm whether these trace metals levels are constant in the various points within the ship.	the cupronickel piping. (Planned maintenance inspection is being implemented on the pressure controlling device)	
ii b)	plan water sampling analysis of the shore water supply bunkered in Alaska and determine also the volumes bunkered there	10 Sep 08 outcome report COMPL ETED	Env. Off., St. Capt., Mar. Mgr., Flt. Mgr.	Lab analysis (EPA relevant test methods) by Admiralty Environmental Samples were taken from potable water bunker connections at various ports visited by the ship in Alaska (Juneau 08/30/08, Wrangell 09/07/08, Skagway 09/08/08, Ketchikan 09/10/08)	In general, levels of dissolved copper and dissolved nickel do not appear to be a direct result of high levels of dissolved metals taken on board from bunker water Preferred water bunker ports should be: 1. Ketchikan and 2. Skagway. Potable water should be avoided to be bunkered if possible in: 1. Juneau 2. Wrangell The quantity of water bunkered and used in Alaska in the ports with low level of dissolved metals is greater (Skagway 35.5%, Ketchikan 26.0%)	1. Low level of chlorination of bunkered water at some ports, requiring halogenation to 2ppm Chlorine (USPH) 2. 2. The lower temperature towards the end of the season requiring increased heating – the higher temperature combined with the increased Chlorination could lead to greater corrosion effect on the cupronickel water distribution piping onboard	As per Attachment 2

Ref	Action	Time Limit & Status	Person(s) in Charge	Update			
				Methodology Used	**Findings on Effluent Quality**	**Interim Operations or Systems Contributors**	**Sampling Results**
1.	**Influent Source Reduction Evaluation**						
ii c)	plan water sampling analysis of the shore water supply bunkered outside Alaska and determine also the volumes bunkered there	15 Oct 08 outcome report COMPLETED	Env. Off., St. Capt., Mar. Mgr., Flt. Mgr.	Lab analysis (EPA relevant test methods) by Admiralty Environmental Samples were taken from potable water bunker connections at two ports visited by the ship outside Alaska, but in Canada from which the water is used in Alaska (Victoria 09/04/08, Vancouver 09/05/08)	In general, levels of dissolved copper and dissolved nickel do not appear to be a direct result of high levels of dissolved metals taken on board from bunker water Preferred water bunker ports in Canada should be: 1. Vancouver. Potable water should be avoided to be bunkered if possible in: 1. Victoria The quantity of water bunkered and used in Alaska in the ports with low level of dissolved metals is greater (Vancouver 73.9% versus Victoria 26.1%) Comparison between the amounts of bunkered water used in Alaska bunkered from outside (Canada) versus from bunkered in ports of Alaska is 26.4% vs 73.6%. Out of the **total** quantity of bunkered water from shore (from both Alaskan and non Alaskan ports), the greater amount is bunkered from ports with low sampling levels of dissolved metals (Skagway 26.1%, Vancouver 19.4%, Ketchikan 19.1%)	1. Low level of chlorination of bunkered water at some ports, requiring halogenation to 2ppm Chlorine (USPH) 2. 2. The lower temperature towards the end of the season requiring increased heating – the higher temperature combined with the increased Chlorination could lead to greater corrosion effect on the cupronickel water distribution piping onboard	As per Attachment 3

Ref	Action	Time Limit & Status	Person(s) in Charge	Update			
				Methodology Used	Findings on Effluent Quality	Interim Operations or Systems Contributors	Sampling Results
1.	**Influent Source Reduction Evaluation**						
ii d)	based on the outcome of the above sampling analysis to determine if it would be feasible to either bunker more water from shore and from where - in or outside Alaska, or produce own water onboard. This to take also in consideration other impacts from producing more water onboard (energy consumption, public health requirements)	01 Mar 09 **report not due yet**	Env. Off., St. capt., Mar. Mgr., Flt. Mgr.				
iii.	**Other Potential Contributors**						
iii a)	identify all possible sources of water influents going for treatement and currently formed by: laundry water, water originated by passengers and crew accommodations, water from the	15 Dec 08 progress report	Ch. Eng., Tech. Suptd.	Studying shipboard documentation (drawings, diagrams, manuals). Verifying by tracking pipe lines	It has been verified and confirmed that the following grey water is the influent source for the effluent discharge in Alaskan waters: accommodation waters (sinks, showers), laundry and very seldom Jacuzzi water	Not known	Not available as of now separately for these waste streams

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				Methodology Used	Findings on Effluent Quality	Interim Operations or Systems Contributors	Sampling Results
1.	**Influent Source Reduction Evaluation**						
	toilets						
iii b)	Based on the review, any new sources identified to be further analyzed as influents for contributors to copper and nickel	01 Mar 09 **report not due yet**	Env. Off., Ch. Eng., Tech. Suptd.				
iii c)	identify the different types of materials used in the piping of the fresh water and waste water systems of the discharge	15 Dec 08 **report not due yet**	Env. Off., Ch. Eng., Tech. Suptd.				
iii d)	Based on the outcome of the above review to consider change of pipes made of different materials, metals and alloys	01 Mar 09 **report not due yet**	Ch. Eng., Flt Mgr.				
iii e)	identify the mixing ratio of sewage and greywater influent before it is treated. To identify if changing this ratio affects effluent quality. This to be done by additional sampling	15 Dec 08 progress report	Env. Off., Ch. Eng., Mar. Mgr., Flt. Mgr.				

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				Methodology Used	Findings on Effluent Quality	Interim Operations or Systems Contributors	Sampling Results
1.	**Influent Source Reduction Evaluation**						
iii f)	consider separating and landing waste water from galley to shore facilities (procedure already in place) and to identify through sampling if this changes the effluent quality for copper and nickel	15 Dec 08 progress report	Env. Off., St. Capt., Mar. Mgr, Flt. Mgr	Studying shipboard documentation (drawings, diagrams, manuals). Verifying by tracking pipe lines and valve arrangements	Galley grey water does not go for treatment to the AWWTP and is not a possible influent source	Unknown, this has been a standard operating practice (no galley water to the AWWTP)	No separate sampling deemed feasible

Ref	Action	Time Limit & Status	Person(s) in Charge	Update	
				Research Efforts – New Technologies	Research efforts – Current AWWTP
2.	**Treatment Technology Evaluation**				
i	**Investigation with the Manufacturers of AWWPS re available technology to reduce copper and nickel with the following scope**				
i a)	Need for different Instructions on the way of operating the current system	15 Dec 08 progress report	Env. Off., Ch. Eng., Flt. Mgr.	Not applicable	Enquiry with manufacturers (ISIR, Italy) made. Initial verbal indication has been that different operating instructions of the plant are unlikely to affect quantity of metals in effluent. Further investigation and a detailed response in writing promised. Awaiting feedback.
i b)	chemical treatment processes changes or introduction of new/different	15 Dec 08	Ch. Eng., Flt. Mgr.	Not applicable	Enquiry with manufacturers (ISIR, Italy) made. Initial verbal indication has been that different chemicals used in the plant are unlikely to affect quantity of metals in effluent. Further investigation and a detailed response in

Ref	Action	Time Limit & Status	Person(s) in Charge	Update	
				Research Efforts – New Technologies	**Research efforts – Current AWWTP**
2.	**Treatment Technology Evaluation**				
	chemicals	progress report			writing promised. Awaiting feedback.
i c)	need for modifications or add-ons to the existing plant	15 Dec 08 progress report	Ch. Eng., Flt. Mgr.	Ongoing investigation for new technology (evaporation of metals)	Enquiry with manufacturers (ISIR, Italy) made. Initial verbal indication has been that currently they cannot suggest a modification of the plant to reduce the quantity of metals in effluent. Further investigation and a detailed response in writing promised. Awaiting feedback.

Prepared by
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(Environmental)
V.Ships Leisure

Attachment 1

Water Distribution Locations Samples

- Results that are in excess of the 2010 ADEC general permit regulatory limits are in **bold**.
- Consistent results in exceedance during both sampling dates are highlighted

Date	Metal Sampled	Evaporator 1 Port	Evaporator 2 Starboard	Reverse Osmosis Before Tank	FW Tk 3 SB Influent	Domestic Water Heater Outlet	Gray water Inlet to Marisan	Deck 3 Hot Water	Deck 5 Cold Water	Deck 9 Hot Water	FW Bunker Station	FW Tk 4 SB
06/06/08	Dissolved Cu (µg/L)	**17.7**	**19.9**		0.602			**26.1**	**6.38**	**25.9**	0.345	2.25
09/08/08	Dissolved Cu (µg/L)	**55**	**32**	**5.3**		**30**	**110**	**35**	**18**	**40**		
06/06/08	Dissolved Ni (µg/L)	4.18	5.42		2.24			**16.6**	1.59	**17.2**	<0.15	1.29
09/08/08	Dissolved Ni (µg/L)	**29**	8.0	2.5		**57**	**11**	**9.1**	3.0	**8.6**		

Attachment 2

Water Bunkered from shore IN Alaska Samples

- Results that are in excess of the 2010 ADEC general permit regulatory limits are in **bold**

Date	Port	Dissolved Cu (µg/L)	Dissolved Ni (µg/L)
08/30/08	Juneau Potable Water Connection	**70**	**17**
09/07/08	Wrangell Potable Water Connection	**7.7**	4.3
09/08/08	Skagway Potable Water Connection	2.4	7.8
09/10/08	Ketchikan Potable Water Connection	2.3	<1.0

Water Bunkered from shore IN Alaska AND used in Alaska, cubic meters (highest income highlighted)

Port /Date	06/06/08	06/14/08	07/05/08	08/03/08	29/08/08			**TOTAL**	**% from total AK bunkered water**	***% from ALL bunkered water used in AK (from outside and AK)***
Ketchikan	**293**	**313**	**357**	**206**	**309**			**1478**	26.0	*19.1*
Port /Date	08/06/08	07/07/08	07/19/08	07/27/08	08/22/08	30/08/08	09/08/08			
Skagway	**360**	**207**	**214**	**302**	**641**	**93**	**198**	**2015**	35.5	*26.1*
Port /Date	06/15/08	06/16/08	07/18/08	08/23/08	08/30/08					
Juneau	**169**	**22**	**201**	**112**	**99**			**603**	10.5	*7.8*
Port /Date	08/05/08									
Haines	**456**							**456**	8.0	*5.9*
Port /Date	08/13/08	09/07/08								
Wrangell	**259**	**218**						**477**	8.4	*6.2*
Port /Date	08/17/08									
Seward	**499**							**499**	8.8	*6.5*
Port /Date	08/18/08									
Valdez	**159**							**159**	2.8	*2.1*
TOTAL								**5678**	100.0	*continued*

Attachment 3

Water Bunkered from shore OUTSIDE Alaska Samples

- Results that are in excess of the 2010 ADEC general permit regulatory limits are in **bold**.

Date	Port	Dissolved Cu (µg/L)	Dissolved Ni (µg/L)
09/04/08	Victoria (Canada) Potable Water Connection	**21**	<1.0
09/05/08	Vancouver (Canada) Potable Water Connection	**1.7**	<1.0

Water Bunkered from shore OUTSIDE Alaska AND used in Alaska, cubic meters (highest income highlighted)

Port /Date	06/04/08	07/03/08	07/15/08			**TOTAL**	**% from total outside AK bunkered water**	***% from ALL bunkered water used in AK (incl. from out AK and from AK)***
Victoria	**218**	**177**	**136**			**531**	26.1	*6.9*
Port /Date	06/12/08	06/21/08	07/23/08	08/01/08	08/10/08			
Vancouver	**313**	**183**	**167**	**247**	**594**	**1504**	73.9	*19.4*
TOTAL						**2035**	100.0	
GRAND TTL	**of ALL water bunkered from shore and used in AK (from outside AK and from AK)**					**7713**	**26.4% from outside AK vs 73.6% from AK**	*100.0*