

## CPVEC

### ADEC CPVEC preliminary request for supplemental information RCL CEL SRE Report

**Subject:** SRE Report 1 14 2009 RCL CEL

**Contact:** Rich Pruitt RCL CEL

**Reference:** Information RCL CEL SRE Annual Report 1 14 2009

**Vessels:** RCL CEL Fleet

**Prepared by:** Albert Faure.

**Date:** January 27, 2009.

**To:** Rich Pruitt

Dear Mr. Pruitt:

With reference to your annual SRE Report sent to us on January 14, 2009 (SRER), please find the preliminary list with questions.

ADEC CPVEC is pleased to see the efforts RCL CEL put in the SRE reporting and associated evaluation of the systems.

In case of questions, please contact me or Ed White.

Kind Regards,

Albert Faure  
CPVEC Program Engineer

Attachment: *Preliminary Questions ADEC RCL CEL SRE Report 1 14 09*

## *Preliminary Questions*

General: This review includes the review of RCL CEL SRE report submitted to ADEC CPVEC on 1 14 2009 (SRER).

ADEC used as reference document the approved SRE of August 19, 2008 (approved SRE) (on file ADEC CPVEC).

- The SRER mentioned that that RCCL CEL (RCL) focus is on the Serenade of the Seas because this vessel will discharge in Alaska waters. ADEC likes to remind RCL that all the vessels that are operating under the General Permit are submit to the permit conditions that include the SRE reporting requirements and inclusion of these vessels in the SRER and future reporting. RCL needs to provide / include for all the permitted vessels specific strategies / operations (if applicable). **We will implement technology and process testing and continue to report on actions taken on all ships as they occur. Our plan has been to pilot test new treatment technologies / methodologies on the Serenade of the Seas, a ship that is representative of all of our ships currently visiting Alaska. With the most recent change in our deployment, we will reevaluate our SRE plan, including the timeline. We will certainly shift our technology R&D focus from the Serenade of the Seas onto another ship currently slated to be in Alaska in 2010. If ADEC insists that we must trial technological solutions on every one of our ships operating in Alaska under the General Permit then we will likely choose to remove ships that are currently not discharging in Alaska waters under the General Permit, as conducting research and testing on similar ships (same class) with similar AWP systems (both chemical-mechanical removal) is redundant and not expected to yield materially significant additional data.**
- Page 6: “after we know we can better determine...” - Provide in your response the response sheet from the vendors as per January 14, 2009. Also provide a time line and planning when RCL completes this item. **We are still waiting for all suppliers to respond and our final analysis of the data depends upon their action. This is approximately 95% complete. Per our revised timeline (included in update) we expect to complete this in March 2009. We will also factor in results from the ADEC technology workshop during the week of February 16<sup>th</sup> 2009.**
- Page 6: ADEC understands there is large number of potential products; provide in your response the product inventory list and RCL steps taken to date what was done in 2008 and RCL plans for the 2009 season. The response should also include the carpet cleaners, which RCL identified in the Aug 2008 SRE plan. **The list of chemicals used onboard that both contain ammonia, copper, nickel and zinc and that could possibly enter the Advanced Wastewater Stream are attached. The products already identified include the Floor cleaners: Vectra and Plaza Plus for hard floors and Heavy Duty Pre-spray and Extraction Rinse carpet cleaners, all from Johnson Diversey. MSDSs attached.**
- Page 7: Source water evaluation: Provide in your response the actions taken in 2008, **RCL, along with the industry, commissioned a sampling program of the**

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- potential bunker ports to determine levels of targeted metals. RCL strategies, like bunker strategies, tank dedication, etc. Still in development as 4 of the ships have installed diesel generators that impact their ability to produce potable water from excess steam.
- Page 7: RCL consulted their engineering department. Provide the responses from this action. This is a large body of in person and telephone conversations and email correspondence, the essence is provided in summary form in the update.
  - Page 9: includes an impressive overview of piping replacement on the vessels. Provide in your responses for each vessel:
    - Why was all this plumbing replaced on these vessels? The condition of the existing pipe warranted replacement. Corrosion in some sections which led to replacement of larger sections to avoid having future problems.
    - Does the replacement include fittings, valves, pumps, impellers etc? Typically no, but based on the condition of the devices at the time of repairs, they may have been replaced. Given the lengths of pipe in question, possibly hundreds of meters of pipe, the list could be rather extensive.
    - Was the root cause identified why the piping needed to be replaced after a few years of use? Typically was the result of many synergistic causes, such as soft water, chlorine as disinfectant, chloride generation, dissimilar metals, varying chemistry of potable water found in ports of call and produced onboard.
    - What materials were used (replacements). Non-metallic pipe, principally “George Fisher” or equivalent.
    - Was this corrosion related triggered replacement? Are corrosion controls on board? Yes, in varying degrees.
    - In the SRER verbiage was included “replace as necessary”, how is the “necessary replacement: determined? Typically if weepage or leakage is found. How is RCL systematically finding “trouble spots” in the plumbing systems? Leaks may be detected by any crew member or during routine inspections by the technical staff. What causes the troubles? (e.g. the medium, chemical use, materials, galvanic corrosion? Just to name a few). In the gray water lines it is the waste water itself that may be low pH and effect the piping. With potable water, if it is not hardened properly, it may induce corrosion. The mandated use of high levels of chlorine as a disinfectant is also a contributing factor. Our assessment leads us to believe that the cleaning chemicals used onboard do not play a material role in increasing the corrosion.
    - Time line and plan of attack to identify the caused / evaluation plan to be included in detail. Under development.
  - RCL includes a description of the on board produced potable water. Provide characterization of the “home made” potable water for each vessel. Principally all water produced onboard is made through flash evaporation using waste heat or steam produced by the oil fired boilers. It is desalinated, chlorinated to the USPH VSP mandated minimum 2ppm, pH balanced to a range of 7.2 – 7.8 units and

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treated for alkalinity. Also, under USPH guidelines, water in the distribution lines must be maintained between 0.2-1.0ppm chlorine at the furthestmost point in the system. The use of Reverse Osmosis for production of Potable Water is rare and not considered a significant source. Technical water appears to be used as well more information regarding this water is needed and its use on each vessel. Technical water from HVAC condensate is an immaterial amount of the total, and in most cases not even used on all but one ship. Going forward we will likely cease using condensate in our laundry systems.

- Page 11: “A forecast for potable water sourcing for 2009” is being developed by the ships. Provide in your response for each vessel this forecast plan. We understand that this may not be completed, provide the forecast as per January 26, 2009.

Completed an inventory of the sources of potable water used onboard, although, as the itineraries for some of the ships have changed, the information is now of limited analytical value. In addition, with the installation of the new Diesel Generators, the Gas Turbine ships will not produce as much excess steam as in years past. This will require them to bunker more potable water along the itinerary. This change along with the normal shifting of ports, makes this forecast extremely difficult. The ships will know much more after the first few cruises. Regardless, the ships will be forced to bunker in ports where the ACA sampling has indicated metals of concern above the permit levels.

Radiance of the Seas: Ketchikan - south bound - only bunker if needed due to low levels of FW and fuel, Juneau, Skagway. Produce the balance.

Serenade of the Seas: Vancouver, Juneau and possibly Skagway. Produce the balance.

Rhapsody of the Seas: Possible to not bunker in any Alaskan ports, with the exception that if critical, bunker a small amount in Skagway. Will bunker primarily in Victoria and Seattle and produce the balance.

Millennium: Vancouver, Ketchikan, Juneau, Skagway and Seward. Produce the balance.

Celebrity Infinity: (estimated) Vancouver: 300 m<sup>3</sup>, Ketchikan: 100 - 150 m<sup>3</sup>, Juneau: 100 – 150 m<sup>3</sup> and Seattle: 300 – 400 m<sup>3</sup>, actual amounts will vary. Produce the balance.

- Page 7: 2008-2009 winter season will used to include evaluating the Technical water and HVAC water. Provide in your response for each vessel:
  - Actions taken in 2008 season and to date; During the Alaska Season, HVAC condensate production is essentially non-existent due to the lack of Air Conditioning used. Therefore, all water, technical or otherwise is sourced from the potable water system, either bunkered or produced. Only typical gray (laundry, accommodations, galley, and pulper) and black (sewage) water are treated by the Advanced Wastewater Purification (AWP) systems and discharged in Alaska State waters. Technical water

- that is used in any machinery or engineering system is treated or discharged in Alaskan waters.
- Is on board sampling identification performed on these streams? If sampling results are obtained provide results. **Not as of yet.**
  - RCL plan for the 2009 season time line and “plan of attack”. ADEC understood that RCL will provide this evaluation by March 31, 2009, however ADEC requests to see an overview of the actions taken to date. **We are in the process of verifying conformance with best management practices for potable water treatment as of the date of this response.**
  - Tanks, Tank coatings, warm water heaters etc, Are these part of the equipment evaluated? **No, tanks and tank coatings are not considered a possible source for the contaminants, and these “systems” are ultimately aggregated in the influent and effluent sample data.**
  - RCL SRE identified that potable waters may be “corrosive” aggressive what are the characteristics of the potable water produced on board? **Typically soft until treated by mineralizing filters to introduce more stable alkalinity characteristics.** What are the characteristics of the technical waters? **Produced by the collection of condensate form the HVAC cooling coils in the Fan Coils. However, as there is little to air conditioning needed, there is an immaterial amount, likely will cease usage in Alaska.**
  - RCL includes water production per day, what is (per vessel) waste-water volume production per day? **Average is approximately: 600-700m<sup>3</sup>, but this is not what will necessarily be discharged, as only the Serenade of the Seas and possibly the Radiance of the Seas will discharge any waste water in Alaskan State waters this season.**
  - RCL included in the SRER an extensive description of Ammonia removal controls and metal controls, however this useful information is not brought in “correlation” with the vessels. Provide detailed information for each vessel:
    - What actions has RCL taken to date regarding the Ammonia control / reduction? This may include Vendor recommendations, additives etc. **Per our SRE timeline, no modifications have been made to the equipment or procedures onboard. Discussions have been conducted with other lines to deconflict types of research to avoid duplicating efforts. Unfortunately the installation on the Rhapsody of the Seas’ Navalis system has been significantly delayed and as such we have been unable to gauge its effectiveness in removing ammonia through advanced oxidation processes. We hope to have this system fully certified by mid-April and at that time should have a much better understanding of its potential.**
    - What actions RCL took to date regarding the metal controls / reduction and related installation upgrade/update evaluations. This may include vendor recommendations, additives, add on controls etc. **We are continuing to evaluate the potable water treatment procedures and are making recommendations on improvements. We are planning for non-metallic piping replacement projects. Radiance of the Seas and Serenade of the Seas are slated to receive significant replacement of metallic pipe in 2009. Our Newbuilding Department Technical staff has been in**

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discussions with European vendors regarding the metals removal through either Reverse Osmosis (RO) or ionic exchange. There are serious doubts on their part that Ionic Exchange can reduce the metals to the extremely low levels (ppb) set in the permit. They feel that RO is more promising, but are concerned if used as an after treatment on ships with polymer/flocculant-based solids removal technologies. There are concerns that the residual flocculants and polymers may cause RO membrane fouling.

- Page 17: RCL includes verbiage about a pilot study in the Spring of 2009 of certain technologies. Provide information regarding the Vendor discussed technologies. Biological nitrification to reduce ammonia through increased aeration, possibly a Reverse Osmosis pilot installation and the new Navalis system on Rhapsody of the Seas with advanced oxidation technology for ammonia reduction. We will investigate the use of different pH and flocculant combinations for metals removal.
- “RCL looks forward to obtain any information from the workshop”. Provide a preliminary time line and action plan in case RCL identifies a promising control technology for the vessels, and how RCL would follow up on such technology. No longer applicable.

The goal is that the Department has all the relevant SRE reporting information regarding on file for future reference.

We are looking forward to RCL CEL’s response.