

Type Approval for UV based systems, USCG vs IMO

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ABSTRACT

Optimarin AS, a pioneer in ballast water treatment, has become the first system supplier to receive the USCG Type Approval (TA) Letter meeting the most stringent US Coast Guard test requirements. In a series of land-based tests, both the standard Most Probable Number (MPN) (regrowth) method and the more exacting technique known as FDA/CMFDA, or 'instant kill', benchmark was successfully assessed. Testing of the Optimarin system was carried out by DNV GL at the Norwegian Institute of Water Research (NIVA) test facility in Norway. The system was also tested in parallel on a bulk carrier trading worldwide for the ship board portion of the TA testing. Optimarin's objective has been to keep the system that have been TA under the International Maritime Organization (IMO) regime as is so that existing users can continue to use it as a USCG TA system. This paper details the challenges and differences with the USCG required Environmental Technology Verification (ETV) test protocol versus the existing and new G8 test protocol used for IMO TA testing, especially the challenges using Ultraviolet (UV) to meet the CMFDA counting method for organism between 10 to 50 μm .

Keywords: Type Approval, USCG, testing, MPN, CMFDA, UV, Scaling

1. Introduction

History

Optimarin delivered its first ballast system in April 2000 to Princess Cruises. The system was based on solid separation through a low-pressure loss separator and low pressure UV, and there were a total of 7 of these systems delivered. There were several studies conducted through the Great Lakes Ballast Demonstration Project and California State Land Commission. The system had great promise but when the Ballast Water Management Convention (BWMC) was adopted in February 2004 it was clear that changes had to be done to meet the new size based treatment standard.

Optimarin launched a new system in 2007 using filters and medium pressure UV. The UV lamp used by Optimarin is unique in water treatment with its 35 kW capacity. While testing for IMO Type Approval at NIVA in 2008/9 both MPN and CFDA-AM staining method was used to analyse the efficiency of killing/inactivating the organism between 10-50 μm .

Table 1. Test data from the IMO land based testing

	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
CFD A	0.7 ± 0.6	0±0	0±0	0±0	0±0	3.3 ± 0.6	4.7 ± 2.1	7.7 ± 0.6	5.3 ± 2.1	5.3 ± 2.9	0±0	0±0
UVT	62.3 - 90 %											

Optimarin have since then sold more than 400 systems and all customers will get USCG TA without altering the system that was TA in 2009.

2. Product

The Optimarin Ballast System is based on filtration and UV. Customers can choose between 3 filters, since three different manufacturers have been tested and TA, Boll & Kirch, FilterSafe and Filtrex all using 40 micron and automatic back flushing filters.

The UV is proprietary using a single lamp system inside a CuNi pipe. The UV lamp can draw up to 35 kW for up to 167 m³/h. This high-powered UV lamp have proven to be crucial in killing the organism instead of rendering them non-viable.

3. USCG Type Approval

The test results from the IMO testing gave the confidence that it would be possible to meet the USCG requirements using CMFDA and a proposal was sent to use the existing test data for USCG TA. This was declined because of Optimarin presence during testing.

Preliminary testing using the ETV test protocol was conducted in the fall of 2014 and spring 2015 and it was decided to start the official USCG TA program during the summer 2015.

Table 2. Test data from the USCG marine water testing

Date	14.08	23.09	7.10	14.10	22.10
> 50 µm org.	1,2	<1	<1	<1	<1
>10-50 µm org. CMFDA	<1	4	3	4	<1
UVT %	69.5	65	70.6	74	87

The land based testing for all three salinities was completed by the beginning of June 2016. The limiting factor is based on UVI is set to 600 w/m² with corresponding UVT between 60 to 70%.

The ship board testing was conducted aboard Saga Future (Figure 1) a bulk carrier that trades worldwide. It has proven to be a challenge finding the required life for valid test. The first test was completed successfully in beginning of November 2015 and the final and 5th test was completed last week of May 2016. There were 3 attempts with insufficient levels of organisms in the uptake water. The environmental testing was completed in May 2016.

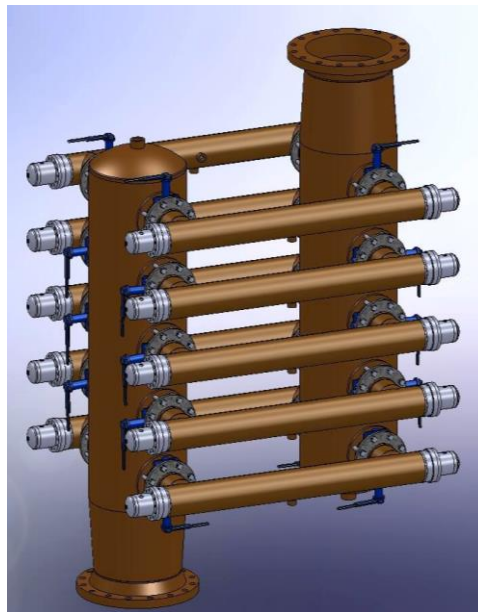
Figure 1. Saga Future



4. Scaling

The OBS is designed with one UV reactor for 167 m³/h and when higher flows are required the UV chambers are installed on a manifold where the inlet and outlet is on opposite sides and the flow is distributed equally to the individual chambers. This enables perfect scaling and the limiting UVI will always be the same for any total flow. See Figure 2.

Figure 2. UV manifold



5. Conclusion

The USCG test program was completed the first week of June 2016 and DNV-GL finalized the TA documentation during the summer and early fall. The TA application was submitted to the USCG on September 22nd, 2106. There was some clarification required in a questions and answer period and the final USCG TA was issued December 2nd, 2016.

The test program for USCG TA has proven that UV technology can meet the stricter dead criteria set forward by USCG and EPA in the ETV test protocol. Optimarin has been working with the same system designed in 2006/2007 and customers will be able to receive USCG TA Certificates retroactively.