SAFETY ASPECTS OF OPERATING MARINE SCRUBBER SYSTEMS ON PASSENGER SHIPS

Miroslav Vukičević, Marija Čukić

University of Montenegro, Faculty of Maritime Studies Kotor, Put I Bokeljske brigade 44, 85330 Dobrota, Kotor, Montenegro, miroslav.v@ucg.ac.me, marijac@gmail.com

ABSTRACT

Marine scrubber systems (Exhaust Gas Cleaning Systems – EGCS) have become a critical compliance technology in modern maritime transport, enabling ships to meet IMO MARPOL Annex VI sulphur oxide emission limits. Passenger vessels are particularly dependent on these systems due to their high fuel consumption and continuous operation. However, while scrubbers effectively reduce air pollution, their operation introduces substantial technical, chemical, and safety risks that require systematic analysis.

This paper examines the safety aspects of operating hybrid marine scrubber systems aboard passenger ships, combining regulatory analysis with direct operational experience gained aboard Mein Schiff 3, equipped with a Wärtsilä hybrid EGCS. The research draws on original Wärtsilä technical manuals, onboard safety procedures, maintenance documentation, and practical engineering observations.

Key findings show that corrosion of pipelines, washwater systems, and overboard discharge areas represents the most significant long-term operational risk. Chemical handling of sodium hydroxide (NaOH) used in closed-loop and hybrid modes demands strict safety protocols and specialized crew training. Maintenance procedures — including scrubber tower cleaning and catalyst maintenance — are physically demanding and performed under hazardous engine room conditions. Continuous monitoring of exhaust gas parameters, pH values, and washwater quality proved essential for both environmental compliance and operational safety.

The findings confirm that safe scrubber operation depends on the combination of advanced technology, preventive maintenance, and experienced, well-trained engineering crews. Clearly defined crew responsibilities and shift-based monitoring protocols — from the Chief Engineer's overall accountability to the night duty engineer's hourly parameter checks — emerge as key organizational factors alongside technical systems in ensuring reliable and environmentally compliant scrubber operation aboard modern passenger ships.

Keywords: marine scrubber, passenger ships, maritime safety, environmental protection, exhaust gas cleaning systems.