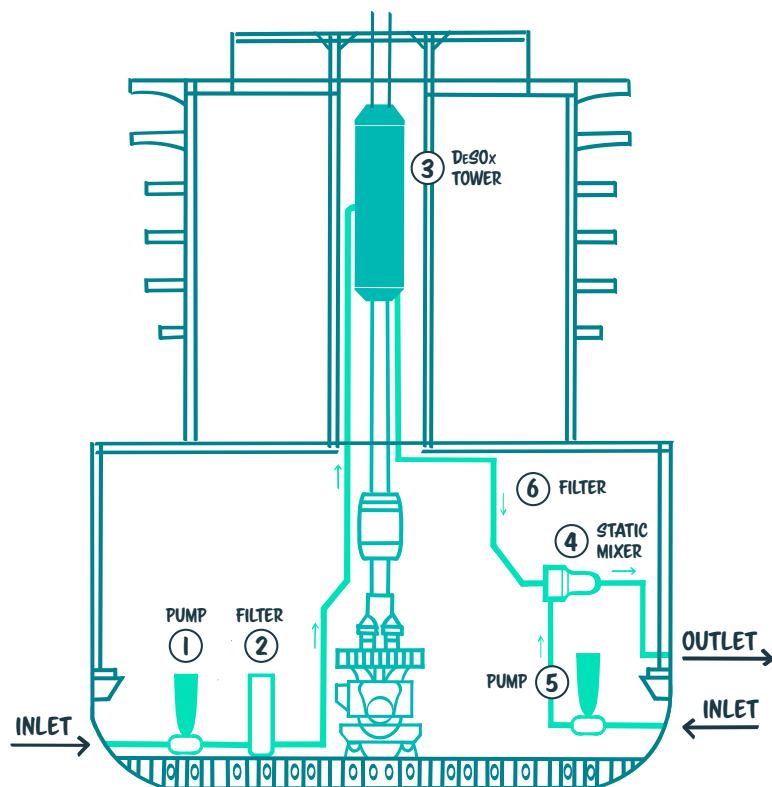


# ADVANCED AIR QUALITY SYSTEMS



The diagram shows the system components.  
More information can be found at [www.carnivalaaqs.com](http://www.carnivalaaqs.com).

## HOW THEY WORK

Advanced Air Quality Systems (AAQS), also known as scrubbers, can be either open loop, closed loop, or hybrid. An open loop AAQS brings in seawater for “scrubbing” the engine exhaust prior to it leaving the ship’s funnel. The seawater is filtered and then returned to the sea in a safe and effective way, meeting all applicable water quality standards. We saw the open-loop AAQS as the practical choice because the system avoids the risks and difficulties of storing and handling large amounts of chemicals on board as required for closed-loop and hybrid systems. For in-port operations, the seawater in the open-loop system is passed through an additional filtration process to ensure even higher water quality.

**275 AAQS**  
systems across  
our brands

Removes  
**99%**  
of sulfur  
dioxide

Removes  
**60–90%**  
of particulate matter

Reduces  
**10%**  
of nitrogen  
oxides

## DID YOU KNOW?

Ships operating with Advanced Air Quality Systems have the benefit of removing sulfur from fuel - keeping it from being released into the air - and returning it to the sea, which is the world’s primary natural reservoir for sulfur. Marine fuel also requires less refining than marine diesel, which means less greenhouse gas created during production. Marine fuel also has a lower combustion temperature than marine diesel, resulting in less nitrous oxides (NO<sub>x</sub>) production at sea.

Additionally, we released an independent two-year scientific wash water study in 2018 that collected 281 wash water samples from Carnival ships. The study demonstrated that the AAQS wash water samples were well below the limits set by several major national and international land-based water quality standards up to and including the World Health Organization (WHO) standards for drinking water.