A Comparison of Shorepower and Scrubbers

Overview

- **Shorepower reduces more air pollution than scrubbers**
- **Shorepower and scrubbers are a good combination**
- **Scrubbers contribute to water pollution**
- **Monitors do not negate need for shorepower**
- **Shorepower cost is realistic**

Air Pollutants

Shorepower is a proven way to reduce air pollution from ships, and would deliver *more reductions* for Charleston than Carnival's scrubber proposal. The best combination would be shorepower *and* scrubbers.

Nitrogen Oxides

The problem: When nitrogen oxides and volatile organic compounds heat in the sun, they form ground level ozone, a toxic gas. Separately, when nitric oxide hits the air, nitrogen dioxide is formed, which then contributes to the formation of ozone, particulate matter, haze, and acid rain. Breathing air with ozone reduces lung function and increases respiratory symptoms thereby increasing susceptibility to respiratory infections, medication use by asthmatics, doctor visits, and ER department visits and hospital admissions for individuals with respiratory disease. Ozone also contributes to premature death. High ozone harms vegetation.

Shorepower: A study commissioned specifically for Charleston concluded that shore power will reduce nitrogen oxides from a cruise ship based here by 98% in 2015 and by 99% in 2019, compared to that ship simply burning the cleanest required fuel.

Scrubbers: This technology cannot reduce nitrogen oxides.

Carbon Oxides

The problem: Carbon monoxide is a gas emitted from mobile combustion sources, and can cause harmful health effects by reducing oxygen delivery to the body's organs and tissues. At high levels it can cause death. Carbon dioxide is a greenhouse gas.

Shorepower: A study commissioned specifically for Charleston concluded that shore power will reduce carbon monoxide emissions by 92% in 2015 and by 97% in 2019, compared to that ship simply burning the cleanest required fuel. The same study concluded that shore power will reduce carbon dioxide emissions by 26% in 2015 and by 36% in 2019, compared to that ship simply burning the cleanest required fuel.

Scrubbers: Scrubbers cannot address these pollutants.

Particulate Matter

The problem: Particulate matter is the mixture of solid pollution particles and liquid droplets in the air. There are two standards for particulate matter: PM10 and PM2.5. Particulate matter from diesel exhaust is now classified as a carcinogen (cancer-causing). With its increase, even in small amounts, it causes elevated risk of cardiovascular events and deaths, lung cancer deaths, respiratory deaths in infants, and general deaths overall. Conversely, reduction of this deadly pollutant means longer life expectancy rates and less demand for acute asthma care. Proximity elevates the danger of these pollutants. Hundreds of studies have proven that the closer a person is to a source of diesel exhaust, the more hazardous that pollutant becomes.

Shorepower: A study commissioned specifically for Charleston concluded that shorepower would reduce large particulates (PM10) by 19% in 2015 and 58% in 2019, compared to that ship simply burning the cleanest required fuel. Shorepower would reduce small particulates (PM2.5) by 34% in 2015 and 71% in 2019, compared to that ship simply burning the cleanest required fuel.

Scrubbers: The EPA anticipates that scrubbers will reduce particulate matter more than simply burning the cleanest required fuel. Those numbers are expected to be better understood when trials begin. One industry source claims the reductions could be 60-80%, but it is unclear what that reduction is compared to.

Sulfur Dioxide

The problem: Sulfur dioxide is part of smog and acid rain. Exposure to this pollutant is linked to multiple serious adverse respiratory effects.

Shorepower and scrubbers both reduce sulfur dioxide. A study conducted specifically for Charleston determined that shorepower would reduce sulfur dioxide emissions by 30% in 2019, compared to that ship simply burning the cleanest required fuel. The EPA expects the use of scrubbers to have the same or better reductions of sulfur dioxide as would have occurred with simply burning the cleanest required fuel.

Water Pollutants

Tests of scrubbers show possible increases in high concentrations of a number of harmful compounds in the water body around the ships.

The use of scrubbers adds to water pollution from cruise ships. Studying the washwater left over from scrubbing, the EPA has pointed out that "use of scrubbers to clean the exhaust from marine engines using high sulfur residual oil and diesel fuels may lead to high concentrations of a number of harmful compounds in the

water body around the ships." These harmful compounds include polycyclic aromatic hydrocarbons (PAHs), the largest known group of cancer-causing substances. PAHs also change the genetic materials of mammals, and bioaccumulate in edible shellfish consumed by humans.

The washwater also contains dangerous metals, such as arsenic, copper, lead, nickel, and selenium. Impacts from exposure to these metals include impaired organ function and reproduction, birth defects, and if at a high enough exposure, acute mortality.

In tests of scrubbers on cruise ships, the EPA determined that the amount of PAHs and metals disposed of could pose a risk to humans and other affected mammals and shellfish, and could also exceed water quality standards on a localized scale. Limits recommended by the International Maritime Organization "may not be sufficiently protective."

Air Quality Monitoring

The SPA says there will be monitoring performed at Union Pier, but does not specify the types of monitors and how data will be assessed. Monitoring pollution is a good idea, but is not a reason to avoid shorepower.

Cost

Shorepower: The infrastructure has cost other ports between $5-7 million for landside, and $1 million for shipside. Industry data suggests motor maintenance costs fall sharply when shore power is used.

Scrubbers: Carnival is investing more than $180 million to install scrubbers on 32 of its ships. That averages out to $5.6 million per ship. Industry data points to increased maintenance cost with scrubbers, since water and dissolved pollutants can form highly corrosive acid solutions, as well as increased operating cost, because ships equipped with scrubbers have additional fuel needs due to increase of their weight and need of high pressure drop for treating the exhaust.

Sources

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