THE WORLD LEADER IN CLEAN AIR SOLUTIONS

Helipad Applications
Gas-Phase Filtration

SAAF™ TECHNOTE

Helicopter Emissions

Helicopter emissions from EMS helicopters may include a variety of gases and particulates. Gas emissions include carbon monoxide, hydrocarbons, nitrogen oxides, and sulfur oxides from the combustion of jet fuel. Carbon monoxide is the dominant by-product, but is odorless and has a relatively high exposure limit. Therefore, the other by-products are of higher concern in order to prevent odors and irritation for building occupants.

Helicopter engines produce varying amounts of these contaminants, depending on the operation mode: approach, climb, idle, and takeoff. As shown below, one operation mode produces more hydrocarbons, while another produces more nitrogen oxides, with sulfur oxides being the lowest overall emission. At a minimum, these contaminant groups should be targeted in a helipad application.

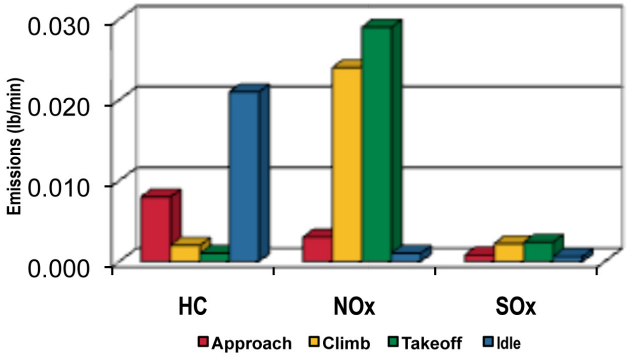
Estimated Emissions from a Bell 206 Helicopter[1]

Operation Mode		Emission (lb/min)		
	CO	HC	NOx	SOx
Approach	0.069	0.008	0.003	0.0008
Climb	0.037	0.002	0.024	0.0022
Takeoff	0.035	0.001	0.029	0.0024
Idle	0.101	0.021	0.001	0.0006

CO = carbon monoxide
HC = hydrocarbons
NOx = nitrogen oxides
SOx = sulfur oxides

[1] Final Environmental Impact Report Lampoc Wind Project, 2008. County of Santa Barbara, CA.

Estimated Emissions of Odorous / Irritant Gases



Information on Emitted Gases

Emitted Gas	EPA Cont.	Description	EPA NAAQS
CO	CO	colorless, odorless, tasteless	35 ppm – 1 hr 9 ppm – 8 hr
NOx	NO_2	irritant	0.053 ppm – annual
SOx	SO_2	suffocating odor	0.14 ppm – 24 hr
HC	n/a	odorous or irritant	n/a

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Helipad Applications Gas-Phase Filtration

Media Selection

Combining proper location of building outdoor air intakes with helicopter operating instructions and gas-phase filtration is one solution to minimizing the irritation and odor from helicopter exhaust. After measures have been taken to minimize the amount of helicopter exhaust entrained into the building's ventilation air, applying appropriate filtration will minimize odor or irritant events from helicopter emissions. The filtration system should include particulate filtration to capture particulates first, then gas-phase media to address hydrocarbons, reactive organics, and inorganics. In cases where significant amounts of combustion generated particulates are entrained into the filtration system, higher efficiency prefilters are necessary (MERV 11–14).

Virgin activated carbon has the ability to adsorb many hydrocarbons with good capacity. For the inorganic compounds that are more reactive, a media with the ability to oxidize contaminants can achieve higher capacities than virgin carbon (SO_2, NO). The oxidant media also oxidizes reactive organics produced by helicopter engine combustion, with a higher capacity than virgin carbon (formaldehyde). AAF Flanders recommends utilizing both types of media to effectively address these contaminants (See chart for respective media capacities).

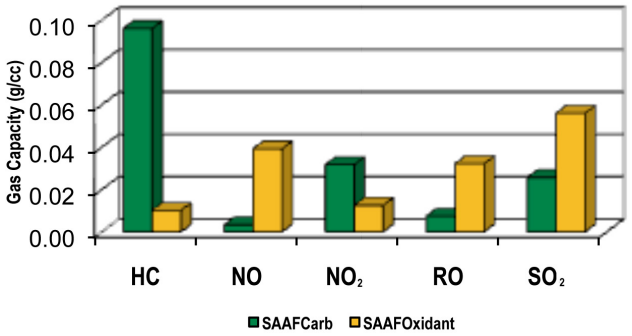
AAF Flanders provides SAAFCarb™ (virgin activated carbon) and SAAFOxidant™ (oxidant media) for use in gas-phase filtration systems to meet this need. These media can be applied in separate passes for optimum performance and media life. They may also be blended together as SAAFBlend™ GP for applications using one pass of gas-phase filtration media.

Heavy Airborne Particulate

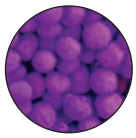
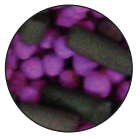
For applications with a high presence of exhaust particulates, a MERV 11 to MERV 14 air filter is recommended upstream of the media for its protection.

Note: *Every application requires evaluation to determine specific requirements. The solution recommendations detailed here are typical, and may not be appropriate for each application of this nature.*

Typical Capacities for Contaminants from Helicopters



HC = hydrocarbons (as toluene)
NO = nitric oxide (a component of NOx)
NO_2 = nitrogen dioxide (a component of NOx)
RO = reactive organics (as formaldehyde)
SO_2 = sulfur dioxide (a component of SOx)

Media	Media Description	Gases Targeted
	**SAAFCarb™** SAAFCarb media is pelletized activated carbon that removes toxic and impure gases from the environment. The activated carbon is composed of bituminous coal substrate. It is UL Classified.	chlorine, hydrocarbons, nitrogen dioxide, and Volatile Organic Compounds (VOCs)
	**SAAFOxidant™** SAAFOxidant media is composed of spherical and porous pellets, that are a combination of activated alumina and other binders. Potassium permanganate is impregnated to this media combination, in order to provide optimum adsorption, absorption, and oxidation of various gaseous contaminants. It is UL Classified.	formaldehyde, lower molecular weight aldehydes and organic acids, nitric oxide, and sulfur dioxide
	**SAAFBlend™ GP** SAAFBlend GP is manufactured from an equal volumetric mix of SAAFCarb and SAAFOxidant media. It is UL Classified.	chlorine, formaldehyde, hydrocarbons, hydrogen sulfide, lower molecular weight aldehydes and organic acids, nitric oxide, nitrogen dioxide, sulfur dioxide, and VOCs

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