CONTROLLING DIESEL PARTICULATE MATTER FROM ON-ROAD DIESEL ENGINES

More effective

Less effective

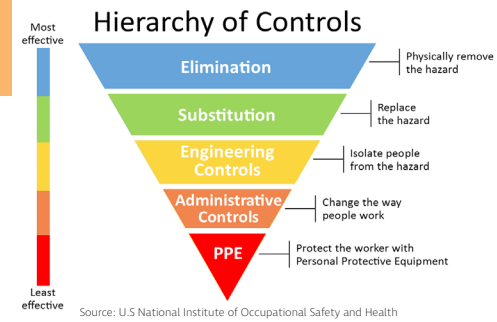
ELIMINATION/ SUBSTITUTION	ENGINEERING CONTROLS	ADMINISTRATIVE CONTROLS	PPE
PROACTIVE CONTROLS Reduce or eliminate emissions before they enter the workplace air			
Alternative Energy Switch from diesel-fueled engines to alternate energy vehicles with lower emissions, such as electric or hybrid.	**Local exhaust ventilation** Use LEV, such as tailpipe exhaust extraction systems, when diesel engines must be operated in enclosed or indoor spaces such as loading docks, garages, and vehicle bays. Attach LEV prior to turning on vehicle, or immediately upon entering the enclosed or indoor space.	**Maintenance** Perform regular servicing and maintenance on diesel engines (including any filters or aftertreatment systems). Poorly maintained engines can produce significantly more emissions than engines in good condition.	
Replacing or repowering Replace older diesel engines or equipment with newer models. Newer engines must meet much stricter emissions regulations and emit lower levels of diesel particulate matter.	**Aftertreatment systems** Add aftertreatment systems such as diesel particulate filters (DPFs). Aftertreatment systems reduce the particulate matter and/or gases emitted by diesel engines. Emissions reductions depend on the type of filter chosen, as well as the engine and load.	**Idling** Avoid idling, especially in confined or indoor spaces (e.g. garages, loading docks, and EMS waiting areas). Start vehicles in the working areas only when required. Turn off vehicles immediately after entering the working area. Avoid prolonged warm up and cool down periods. Idling increases both emissions and engine wear.	
	General ventilation Increase ventilation when diesel engines must be operated in enclosed or indoor spaces: open doors and windows, allowing sufficient time for exhaust to clear before closing; install or increase the number of exhaust vents to filter the air; use window-mounted air conditioners or fans to bring in fresh outside air; or increase the number of air changes per hour. Install HEPA or MERV 16 filters into the ventilation systems. Keep work and living spaces near to operating diesel engine under positive pressure, and work areas where diesel engines are operating under negative pressure.	**Housekeeping** Wash uniforms or work clothing regularly; provide on-site laundry where possible. Opt for surface materials that are easy to wipe clean; avoid fabric-covered seats. Clean walls, surfaces and equipment regularly.	**Respirators** PPE should be used as a last resort, and is not a replacement for other controls. Respirators should be fit-tested, and training should be provided to wearers. Respirators and filters should be appropriate for the hazards present in the environment.
	Isolation Install isolation barriers in garages, loading docks, and vehicle bays to prevent the movement of diesel particulate matter. Provide rest areas, residences, or shelters for workers that are protected from diesel exhaust (e.g. separated, properly ventilated). Isolate the operation of diesel equipment to specific areas in the workplace.	**Work practices** Prohibit workers from waiting in areas where diesel engines are operating or in vehicles without closed cabs. Encourage workers to avoid entereing diesel work areas until necessary/required. Reduce and limit the number of vehicles being operated in enclosed or indoor spaces wherever practical.	
	Enclosed cabs Where possible, use enclosed cabs provided with positive-pressure filtered clean air. Air intake and recirculation systems should be fitted with HEPA or MERV 16 filters. Maintain cab integrity, monitor filter condition, prohibit smoking in cabs, keep doors and windows closed, and provide climate control within cabs.	**Operator training** Training can include many aspects, such as driving skills, how to recognize maintenance issues, diesel policies and procedures, proper use of diesel control technologies, and information on the risk of diesel exhaust exposure.	

Proactive controls — More effective

Reactive controls — Less effective

Reactive controls
Remove emissions from the workplace air, or reduce the likelihood that workers will inhale emissions

Occupational Cancer Research Centre



Source: U.S National Institute of Occupational Safety and Health