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EPA Requirements for Diesel Generator Systems in Data Centers

Information Sheet # 47

1.0 Introduction:

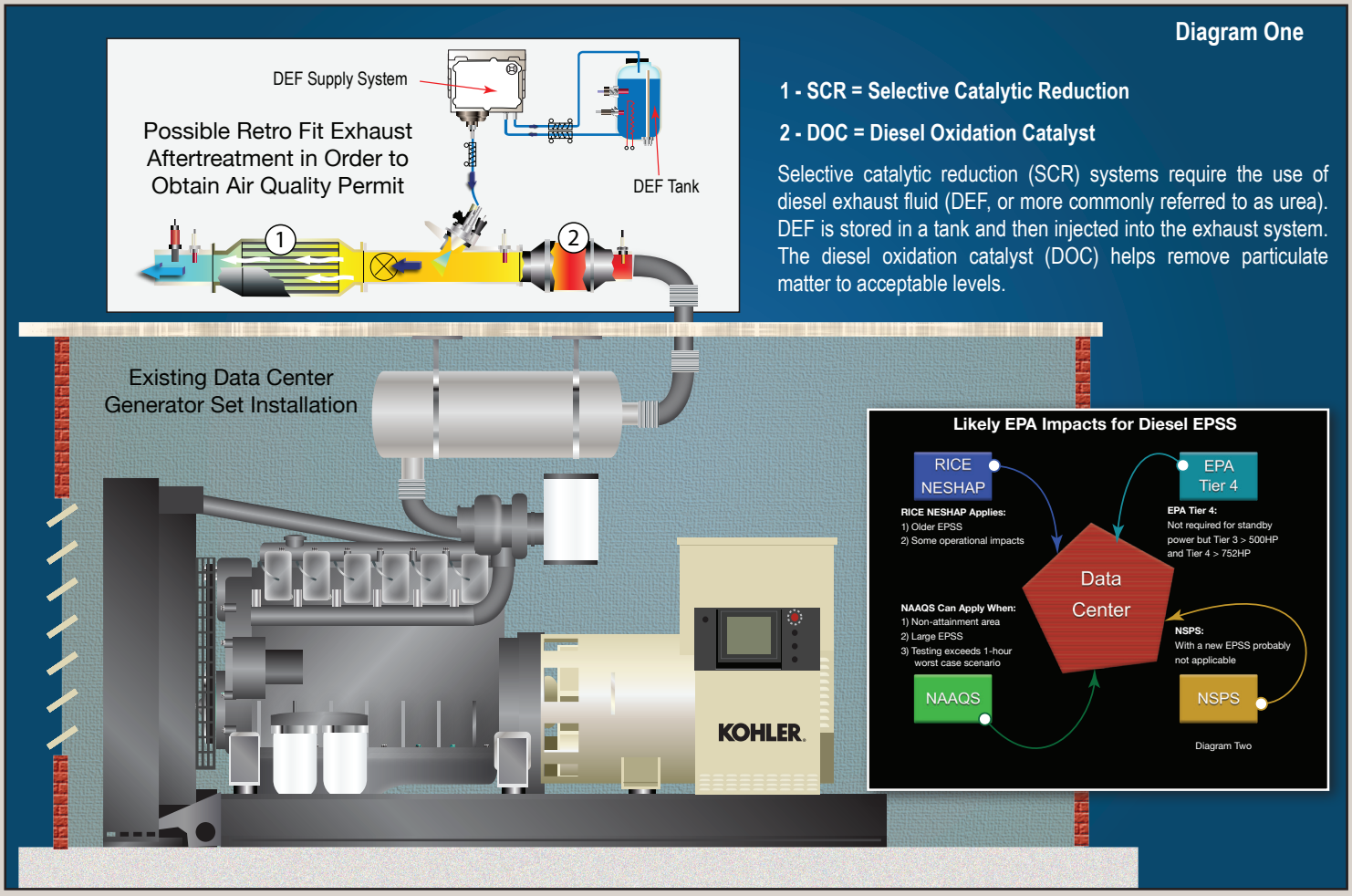
A modern society relies on uninterrupted access to data in all areas of commerce, infrastructure, and services. Loss of access to data due to failure of the primary power supply can result in life and economic critical situations. As such, major data centers are fitted with a standby power system. Large data centers require generator sizes from several hundred kilowatts to a few megawatts of power. Also, power requirements grow as the data center expands. Data center system designers must comply with emission standards set by the Environmental Protection Agency (EPA) and local authorities who are mandated by law to improve air quality.

This Information Sheet discusses EPA requirements for generators with engines above 500hp in emergency power generator installations for data centers which can be considered a "critical power" application, and how systems can remain EPA compliant as they expand.

2.0 Air Emission Permits:

Under the Clean Air Act, the EPA is mandated to maintain a National Ambient Air Quality Standard (NAAQS). The US is divided into several areas and the EPA measures the emissions in each area. Areas that do not meet NAAQS air quality standards are designated as "non-attainment" areas. States that have non-attainment areas must prepare a

Diagram One



1 - SCR = Selective Catalytic Reduction

2 - DOC = Diesel Oxidation Catalyst

Selective catalytic reduction (SCR) systems require the use of diesel exhaust fluid (DEF, or more commonly referred to as urea). DEF is stored in a tank and then injected into the exhaust system. The diesel oxidation catalyst (DOC) helps remove particulate matter to acceptable levels.

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State Implementation Plan (SIP) for bringing their air-quality within NAAQS. One example of non-attainment is from Maine to Northern Virginia which the EPA refers to as the Ozone Transport Region (OTR). Ordinarily a data center's generator system emission permit would have to comply with EPA Tiers set for NAAQS, but for an installation within a non-attainment area the user air quality permit would be looking at more stringent emission standards.

3.0 Emission Components Regulated for NAAQS:

Of the designated 6 components contributing to poor air quality, diesel engines, through their exhaust, emit 4 of them. Through a series of tier standards restricting diesel exhaust emissions, each subsequent tier more stringent that its predecessor, the EPA has greatly reduced exhaust emissions to achieve the healthy air quality objectives of NAAQS.

The following are the four diesel engine exhaust components being regulated:

- **Nitrogen Dioxide NO_2 –** When applying for an air permit for a new diesel Emergency Power Standby System (EPSS) any issues usually relate to NO_2. While the diesel may emit NO_2 within its designated emission tier, the background air quality and NO_2 within a non-attainment area is already so high that a large data center EPSS (over 500hp) running on a full load test, pushes overall background NO_2 levels over acceptable limits. The term NOx means the total concentration of NO and NO_2.
- **Particulate Matter (PM) & Hydro Carbons (HC) –** PM/HC (soot) in the engine exhaust is due to the incomplete combustion of fuel.
- **Carbon Monoxide –** Modern diesel engine combustion technology nearly eliminates CO and is within EPA levels.

4.0 On-site Emission Testing of Data Base Facilities:

When a state has submitted a SIP for reducing NO_2 within a non-attainment area for a large data center facility, an ambient air quality check must be made before a user air quality permit is issued. On-site testing of the ambient air quality usually adopts the EPA's Atmospheric Dispersion Modeling (AERMOD) system. AERMOD modeling takes account of the site's topography, major emission sources, such as the generator running on full load, prevailing winds, and any other parameters that could, in a worse-case condition, elevate air pollutants above the limits set in a SIP.

AERMOD is a mathematical simulation of how pollutants will disperse into the atmosphere.

5.0 Various Regulations Effecting Larger Diesel EPSS (500hp plus) in Data Centers:

While the EPA mandates diesel exhaust emissions to comply with NAAQS through various tiers, applications using larger diesel engines to obtain local air quality permits must take into account the following additional regulations, particularly if the installation is within a non-attainment area. (See Diagram Two)

- **RICE (Reciprocating Internal Combustion Engine) –** Existing stationary generator systems could require exhaust after-treament to ensure the total facility emissions comply with NESHAP (National Emissions Standards for Hazardous Air Pollutants).
- **RICE NESHAP –** Applies to existing and new large stationary diesel generator systems.
- **NSPS (New Source Performance Standards) –** An EPSS >500hp must be tier 3 and >752hp must be tier 2 compliant.
- **NFPA 110 (National Fire Protection Association) –** Systems such as data centers, that are classified as critical power systems, must be tested in compliance with NFPA 110 level 1. A level 1 EPSS must be tested for at least 4-hours at least once every 36-months. Generators with diesel engines 500hp and above can produce exhaust emissions that exceed background air quality limits when a permit is being sought in a non-attainment area.

6.0 Actions and Research a Data Center Site Developer Must Take in Selecting a Compliant EPSS:

The critical power engineer having responsibility for selecting a large engine (>500hp) EPSS will have to consider the following and take required actions to ensure the system is compliant and can receive an air-quality permit:

- **Location –** Is the facility within an EPA defined non-attainment area?
    1. If the answer is NO - NAAQS applies and the generator engine must be the EPA tier for the year of installation and commissioning. Standby generator engines that run less than 100 hours a year are tier 2 or 3. Mobile and prime power sets will be tier 4 final.
    2. If the answer is YES - Emissions exhaust levels may have to be much lower to avoid decreasing the overall local air quality with diesel exhaust pollutants before a user air quality permit can be obtained.
- **New or Existing EPSS –** If the location is new, and not within an EPA defined non-attainment area, the EPSS should follow New Source Performance Standards (NSPS) that is the EPA applicable to new stationary EPSS engines. Tier 3 > 500hp and tier 2 > 752hp. However, if the data center facility is within a defined non-attainment area the following should be referred to for both existing and any proposed new EPSS.
    1. For New and Existing EPSS Within a Non-Attainment Area - Engines will be subject to RICE NESHAP. This will require new EPSS engines to be in line with NSPS (current EPA tier) and existing EPSS will have to be upgraded to meet local air permits and the operator must follow requirements for fuel use, maintenance, and reporting.
    2. If Deemed a Life Critical EPSS - The EPSS must be fully load tested in accordance with NFPA 110 Level 1. A local air permit test will measure the effect full load exhaust emissions have on overall surrounding air quality under worse case conditions. Even if EPSS engine is new and to current EPA tier, exhaust after-treatment may be required.

7.0 How to Address EPSS Requiring Additional Exhaust Treatment to Obtain Air Quality Permit:

The data base facility critical power engineer has several options to reduce exhaust emissions for an air quality permit. It will depend on whether the EPSS is existing or a planned new EPSS, but RICE NESHAP applies to new and existing stationary engines.

- **Older Pre-Tier Emission Technology EPSS –** To reduce exhaust emissions 3 technologies are applied. Various companies manufacture retro-fit packages for installing above existing EPSS (See Diagram One)
    1. DOC (Diesel Oxidation Catalyst) to reduce CO and unburnt HC (Hydrocarbons)
    2. DPF (Diesel Particulate Filter) to reduce PM (Particulate Matter)
    3. SCR (Selective Catalytic Reduction) to attain lower NOx levels
- **New Current Tier EPSS –** Current tier 2 (engines above 725hp) and tier 3 (engines above 500hp) all adopt more advanced combustion technology (i.e. high pressure fuel injection), and the exhaust after-treatment listed above. Any additional exhaust treatment must address the exhaust component that is pushing surrounding air quality above limits.

An authorized distributor of a generator manufacturer will have the staff to advise a data center power manager on the equipment to meet local air quality requirements.