Eden,

To note in 2014 we replaced our fleet of fire engines and ladder trucks. Prior to this project, our old fleet was not manufactured before the new EDA guidelines for diesel truck emissions was introduced. Our current fleet has the latest emissions technology, which meets these requirements, thus reducing the amount of diesel emissions into the environment. Below is an outline of the system, and attached is a diagram of the technology installed in our fleet.

Diesel Exhaust Fluid (DEF), is a solution made from 67.5% purified water and 32.5 percent automotive-grade urea that serves as a carrying agent for the ammonia needed to reduce nitrogen oxide (NOx) emissions from diesel engines. When DEF is injected into the engine exhaust gas, downstream of the DPF, it will be rapidly hydrolyzed producing the oxidizing ammonia needed by the SCR catalyst to complete NOx emissions reductions. DEF begins to freeze at 12 degrees Fahrenheit (-11 degrees Celsius), manufacturers are incorporating a heating system to prevent this.

Unlike other solutions used to control NOx, a DEF system allows the diesel engine to run at its optimum range in terms of fuel mixture – some systems require the engine to run richer, which can be harmful to diesel engines, to control the NOx.

Selective Catalytic Reduction (SCR), is a general term for aftertreatment equipment which promotes a chemical reaction by using a catalyst for eliminating or detoxifying particular chemical ingredients. To meet the EPA2010 regulation, the vehicle out NOx level will be extremely close to zero (0.2 Grams per brake horsepower). By mixing the NOx with the ammonia contained in urea, it will be separated into harmless water and nitrogen. It is an extremely effective, dependable, efficient and economical selection. SCR has already been adopted in Europe and Japan for truck and mobile vehicle applications, so it only makes sense to be used as a solution for EPA 2010. Almost every U.S. diesel engine manufacturer plans to adopt SCR technology, further proving its reliability.
How it works

The first step in cleaning the diesel exhaust occurs when the exhaust stream enters the Diesel Oxidation Catalyst (DOC). The role of the DOC is twofold. First, it converts and oxidizes hydrocarbons – at about 250 degrees Celsius – into water and carbon dioxide. Second, it is used to provide and promote heat, using specific engine management strategies, into the exhaust system. Through appropriate thermal management, this heat increases the conversion efficiency of the downstream subsystem(s) in reducing emissions.

The second step in the process is known as Selective Catalytic Reduction (SCR). In this process, the NOx in the exhaust stream is converted into water and inert nitrogen, which is present in the atmosphere and harmless. Before the exhaust gas enters the SCR chamber, it is dosed with Exhaust Fluid (DEF), also known as urea, an aqueous solution that is approximately 67.5 percent water and 32.5 percent pure urea. When heated, the DEF splits into ammonia and carbon dioxide. These molecules are atomized, broken up and vaporized, then enter a mixer that resembles a corkscrew. This twist mixer evenly distributes the ammonia within the exhaust flow. The ammonia enters the SCR module, which contains a catalyzed substrate, and through chemical reactions combines and converts the NOx and ammonia into the harmless inert nitrogen and water. Dosing typically occurs between 200 and 500 degrees Celsius.

The final step of the cleansing system for the diesel exhaust gas involves the Particulate Filter (DPF). DPF traps any remaining soot, which is then periodically burned away, known as regenerating, when sensors detect the trap is full. The regeneration process sees temperatures in excess of 600 degrees Celsius to burn away soot.