Road traffic is one of the main sources of air pollution in the European Union; the European Commission has defined and legislated the levels of emission in Euro standards. Until now the standards has not controlled the emissions of particles, but with the sixth edition the manufactures’ of heavy vehicles will be forced to develop new methods of keeping the levels and ways to control the functionally of the cleaning system up to 700 000 kilometers.

Since 1992, 5 different Euro standards has been launched and legislated, by the 31:st of December 2013 a new Euro 6 will be applied. The latest version not only tightens the levels of emissions, the standards also set new limits to the period of time where the vehicles will have to ensure the levels. The old version, the Euro 5, says that a vehicle should be able to be controlled any time during its lifecycle up to 500'000 kilometers or seven years; the Euro 6 will increase the lifecycle up to 700'000 kilometers or 7 years.

To ensure the functionality of the vehicles, the Portable Emission Measurement System has been introduces, known as PEMS, that is able to measure the level of different constituents of the tail pipe exhaust. The purpose of the equipment is to perform the measurements while driving the vehicles on road and at the same time sampling data from the On Board Diagnostic system (OBD) of the vehicle.

The new emission standards are very demanding and the whole vehicle industry has got involved with redesigning and redeveloping of the engines and exhaust after treatment systems. The cost for this adaption is enormous, but compared to the result of not fulfilling the standard it is affordable. To not fulfill the standards could in the end result of losing the license of producing, distributing and selling vehicles in the European Union, as this was not enough, the European Union often is seen as a pioneer in these matters.

To guarantee the functionality of the vehicle, the emission’s system and not risk a bullwhip effect of thousands of recalled units, the manufacturers’ will have to develop method for in-house functionality controls at the production sites. The difficulty in controlling the systems comes with the fact that every engine and muffler is unique and forms a pair that has to be tested and adapted together.

The after treatment systems functionality are dependent on a high working temperature and
together with an urea fluid called Ad Blue it reacts and reduce the exhaust emissions. The fact that the temperature of the system must be sufficient for reliable functionality are a time requirement, demanding the vehicle to be driven for a longer time or with a sufficient pay-load to be shorten.

**Purpose of the project**
The project focus has been on how Scania can be able to perform real environment test such as the PEMS in a standardized approach aligned to the production flow. Scania’s aim is to perform PEMS validation on sample of approximately 100 vehicles per year, covering all types of engine setups concerned by the Euro 6 regulations. These vehicles are to be tested with an emission analyze equipment throughout a 150 km test drive on public roads to ensure the functionality.

**Research methods**
Research that has been conducted clarifies the opportunities for further improvements of the initial methods used at Scania for PEMS-measurements. Evaluation of the actual approach concerned mainly the level of process orientation and the efficiency of the ingoing activities involved in the process. With the aim to find a feasible positioning for the measurements in one of the already established processes a clear structure of the overall flow at the assembly facility was conducted.

This resulted in a focus on the last parts of the assembly line where the functionality of the vehicles is tested before delivery to the customer. These two areas or processes are known as Functional Area 6 (FA6) and Vehicle Audit. This is the only two sections where the trucks are performing an on road test drive. These processes where well established and contributed with a good foundation for a future possible match for the PEMS performed at another division.

To clarify the information and visionary gaps of how the enterprise divisions identified its vision for the future usage of PEMS were performed by reviews of the current situation with the use of several focus groups. The result of gathering this useful information about the preferred outcome was supportive when constructing a process description for the present situation. This process, commonly known as an “As-Is” became the foundation for further evaluation and process improvement to determine and remove unvalued adding activities for the present PEMS process.

The owner of the PEMS and the performance of the vehicles emissions is a sub division of Power Train called NMET. The “As-Is”-process for the present structure clarified a large gap in process orientation compared to the two feasible processes mentioned as FA6 and Vehicle Audit. Conducting the process mapping together with NMET and process evaluation according by use of the Process Maturity Modell brought an insight in valuable topics to be improved such as documentation and structure for the PEMS.

**Conceptual Solution**
A result of these analyses became the objective for further improvement both in terms of efficiency improvements and as
technical requirements for an improved conceptual method for handling of the present measurement equipment. The main improvements have been to reduce the complexity, safety and time consumption.

Aligning the information between the division’s concerning the activities correlated to the PEMS process and strategically visualizing the benefits of an improved solution supported the empowerment for a common goal for a future usage.

Together with NMET four different concepts for an improved solution for handling of the PEMS equipment on tests was evaluated through the House of Quality. The criteria for this evaluation where based on the previously mentioned requirements an areas of improvements that could be performed.

This resulted in a new and improved procedure supported by a trailer based PEMS-solution that fulfills the requirements for a feasible industrialized process. This improved process can be aligned into an existing flow for internal audits performed at all manufacturing facilities that are producing the Euro 6 vehicles worldwide.

**Deliverables of the project**
Throughout the time the masters project was performed the first Euro 6 vehicles was produced and taken into PEMS test. These on road tests were performed in combination with a stationary vehicle test done in laboratory environment and with the PEMS equipment mounted inside the cabin according to the past solution. This test clearly showed that there was a need for a new improved and at most a correlated approach for future more beneficial usage. The result from the process improvement and alignment of a vision together with the trailer solution was presented to the divisions involved with a framework supporting the change improvement according to eight steps presented in figure 3.

This framework systematically helps the process owner to easily visualize the status for the project and beneficial for gathering the right resources for taking the net step of the project.

![PEMS based on a trailer solution](image)