A KCH ENGINEERED SYSTEMS
NOx EXHAUST/SCRUBBER CASE STUDY

A large metal finishing company specializing in the Plating of automobile parts had such large production capacity that it was inevitable that there would be a significant amount of product that was not up to this company's usual standard of perfection. These parts would have to be chemically stripped and re-plated.

The chemical stripping process required the installation of a large parts stripping system consisting of **a large tank containing a bath 60% concentration of a 42 degree Baume nitric acid.** This acid bath also must be kept fresh and replenished with new nitric acid on a weekly basis.
The rate of evolution from the tank surface area from the tank surface area of this large stripping tank during the parts stripping process was a severe concentration of nitric acid, white acid fog, and brown orange gas (Nitrogen Dioxide),. **In fact, the rate of evolution from the process was so great and concentrated that it was questioned that an exhaust system and a scrubber system could *even be successfully designed* and built to keep the employee's safe.**
Also at stake was compliance with air toxic permissible exposure limits, and also meeting the strict state and federal emission standards for acid emissions and opacity.

Knowing the severity of these conditions, this company asked KCH Engineered Systems to design/build and install an Exhaust/Fume Scrubber System, including all of the corrosion resistant engineered components, i.e., properly designed exhaust hoods and correct duct work components, and, a very unique PUSH/PULL exhaust system; ALL designed in accordance with the American Conference of Governmental Industrial Hygienists.
This system also had to include the design/build and installation of a **special NOx Packed Bed Scrubber to ensure the highest possible efficiency, allowing no visible emission of the extremely high concentration of NOx, and also no visible emission of white ACID FOG that is created during this process.**

The design parameters for this packed bed scrubber must be custom and were critical, and required engineering expertise. If any visible acid emissions were present, the company would be shut down by state air management. This scrubber was custom designed and was required to be very large in diameter and approximately 40 feet tall. The gas absorption, (mass transfer), and acid fog elimination capabilities could leave nothing to chance. The scrubber system must achieve maximum mass transfer, absorption of a high volume of gas, must create the chemical de-oxidation of NOx, and must contain the visibility of acid fog. The capacity of the scrubber would be 20,000 ACFM.

A complex scrubber control panel was also designed and supplied to include all necessary instrumentation, enabling all system functions, and all chemical reactions inside the scrubber to occur.

The entire system was manufactured from Type II Grade I PVC, utilizing White, UV Resistant PVC for construction of the scrubber, exhaust fan, and all of the equipment that was located outside.

When the process tanks were being filled with fresh nitric acid, the fumes evolving from the tank were very heavy even before parts stripping began. White nitric acid vapors were severe, and also a very visible concentration of Nitrogen Dioxide (brown/orange gas) NOx, was already present

When the first racks of parts to be stripped were dipped into this aggressive solution, the tank fuming increased to an extreme opacity.
As production proceeded the severity of white nitric acid fumes and the brown orange plume of NOx fumes coming from the tank continued to increase.
Only because the exhaust system was conservatively and expertly designed, was the system evacuating these aggressive fumes with excellent efficiency.

Upon commissioning of the system, orange emission from the stack head as the NOx, (Nitrogen Di-oxide) was being abated.

There was also no visible emission of the white acid fog from the scrubber stack, due to the scrubber being designed with additional multiple stage mist eliminators to collect wet particulate down to an incredible one micron.

This exhaust/scrubber system's performance was so successful under these most extreme conditions was because of KCH Engineered Systems expertise in engineering the exhaust system to capture the maximum evolution of toxic acid from the process, and KCH Engineered Systems focus on also creating the maximum efficiency packed bed scrubber design, with emphasis on all of the fine detail, to ensure no visible emission of any kind or color was present at the stack.

This is another example of the KCH unique approach to design, engineering, manufacture, and installation of a critical project.

This design/build/installed system is just another example of the versatility of the KCH Engineered Systems' Team.