SAFE S.p.A. designs, manufactures and assembles CNG, Oil and Gas, and Biogas stations with a manufacturing and supply capacity of more than 500 compressors per year. Using Intergraph® CADWorx® and CAESAR II®, SAFE has realised a 70% time savings in calculation model generation; a less error-prone model building due to accuracy of CAESAR II; and the easy management of wide and complex piping systems from design and calculation point of view.

Overcoming Challenges
While working on the project, the engineers at SAFE quickly noticed that fatigue failures of main piping and small-bore attachments as well as piping supports degradation were common problems associated with compression skids. This is due to high vibration levels, caused by pulsation-induced forces. This kind of pulsation can cause excessive vibrations and cyclic stresses for the skids. Therefore, SAFE quickly realised that a mechanical response analysis of the system was necessary to keep the vibration and cyclic stress levels within tolerable levels in order to avoid fatigue failures during the early stage of the design process.

Realising Results
SAFE chose Intergraph® CAESAR II® to perform mechanical response analysis according to API 618 standard to avoid the challenges mentioned above. CAESAR II was chosen due to its modal and harmonic analysis, and it has proven to be an efficient tool to evaluate the natural frequencies of the system (MNFs) as well as the vibration and cyclic stress levels caused by dynamic forces induced by pulsation.

SAFE used CADWorx® Plant Professional to easily create a compression skid 3D models, including piping lines, steel structures and equipment.

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Originally an AutoCAD® Plant 3D user, SAFE also decided to adopt Intergraph CADWorx Plant Design Suite for its ease of use, flexibility, and interconnectivity with analysis programs. The compatibility between CADWorx and CAESAR II positively affected the project outcome and provided SAFE with:

- A 70% time savings in calculation model generation due to the automatic generation of the CAESAR II model from the 3D CADWorx model.
- Less error-prone model building due to accuracy of CAESAR II.
- Easy management of wide and complex piping systems from design and calculation points of view.
- The ability to perform both conventional piping stress and pulsation analysis with a unique and integrated software package.
- The possibility to easily research new solutions to deal with the problems induced by high pressure pulsations.

The combination of Intergraph CADWorx and CAESAR II allowed SAFE to consider all the factors affecting the MNFs of the piping systems, such as flexibility of structures of pipe supports, nozzle flexibilities and support stiffness.

Moving Forward
Currently SAFE is working with Intergraph staff to further improve CAESAR II capabilities for pulsation studies according to API 618 standard to make the software even more user-friendly and to satisfy SAFE’s remaining complex and specific needs. SAFE plans to use Intergraph analysis solutions in all of its future compressor projects for oil and gas industries.

For more information about Intergraph® CADWorx® & Analysis solutions, visit ppm.intergraph.com.