Antimony roaster project Oman

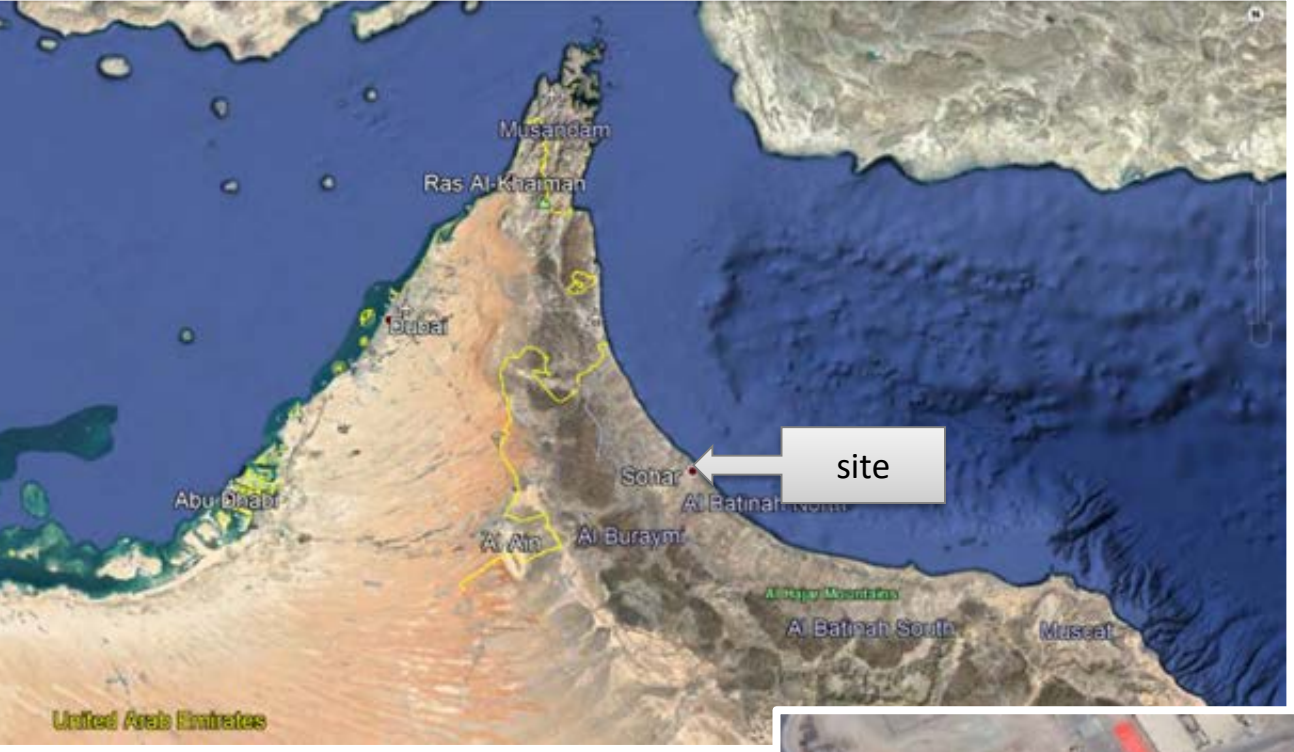
Flue Gas Desulphurisation Plant
Project Summary

Project Overview

Client	Confidential Customer
Site location	Sohar, Oman
Project	Antimony and Gold Refinery
ERG project	Flue gas gas cleaning (desulphurisation) and gypsum production

Project Overview – ERG design development

- ERG was initially contacted by one of our client's investors in 2014 to discuss a new opportunity to process antimony ores – the investor needed assistance to sort out the product recovery and gas treatment
- ERG then produced some initial process scoping and costing under a FEED (Front End Engineering Design) in 2015
- This was further developed in a subsequent FEED in 2016 for the partnership operating company – this is the confidential customer who procured, constructed and operates the antimony processing facility
- Worley Parsons were engaged by the customer in 2016 as managing designers and main contractor
- ERG produced subsequent FEED and preliminary engineering under design contracts
- In August 2016, the customer awarded ERG the £5.5M contract to manufacture, deliver and supervise the installation and commissioning of the gas cleaning plant



ERG Air Pollution Control

Google Earth images

Project Overview – The Client's Process

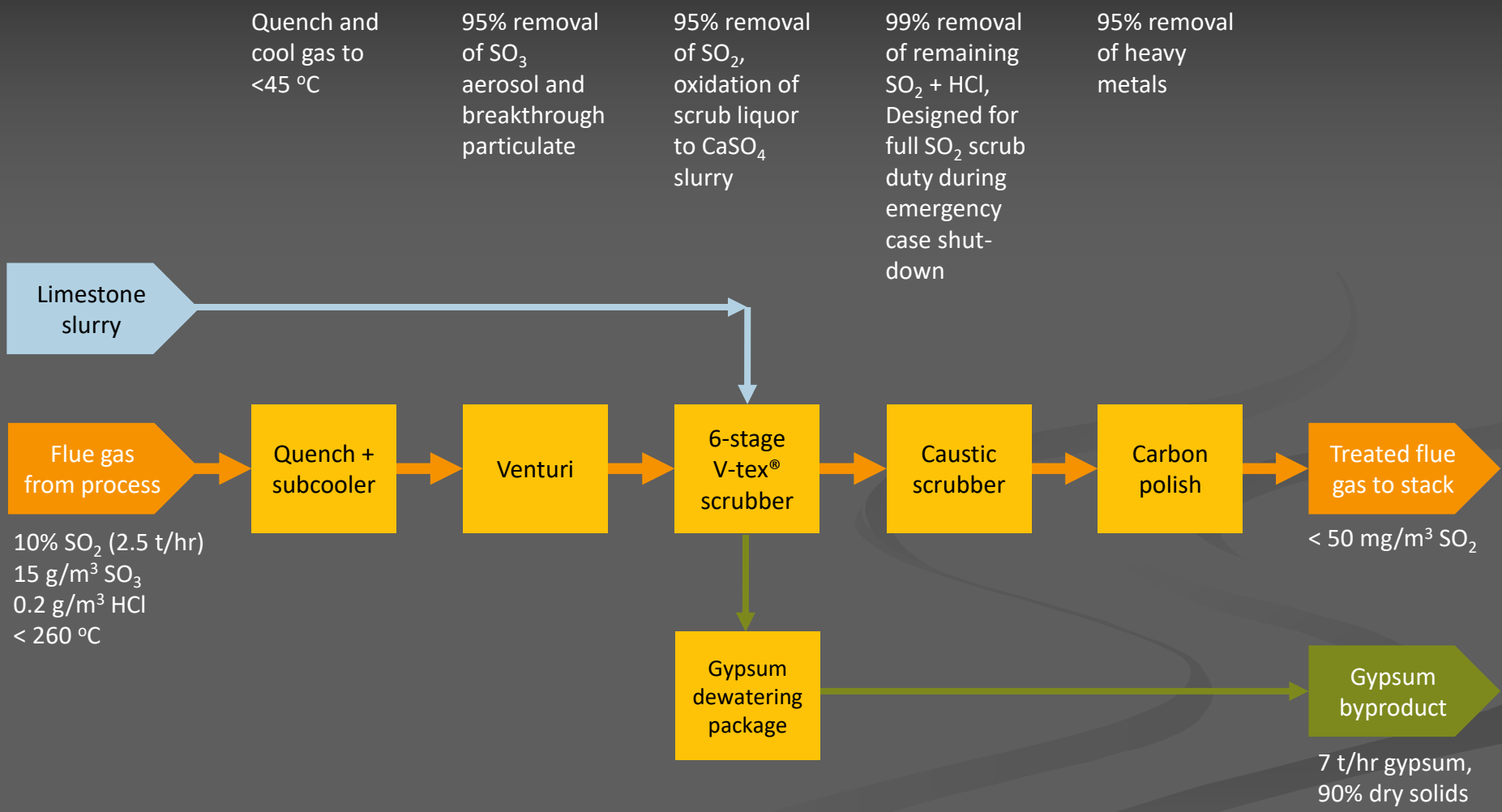
- ERG's customer buys stibnite ore (antimony sulphide)
- This arrives in containers into Sohar port and is delivered by road to the plant
- After quality checks and blending, the ore is fed into the Roaster where it is heated and oxidised with air to form antimony oxide vapour. Sulphur dioxide (SO_2) is a byproduct
- The flue gas from the roaster is then cooled. As the antimony oxide vapour cools, it forms crystals which are collected in cyclones and bag filters – this is the main product from the plant.
- The flue gas is then further cooled to about 200^{o}C and fed to ERG's package.

- Antimony oxide uses include flame retardant additive for plastics and catalyst for plastic manufacture
- The stibnite ore also contains a small but commercially significant amount of precious metals which will also be recovered at the Sohar plant

Project Overview – ERG's Process

- The flue gas at 200°C contains 10% by vol SO_2 plus some SO_3, a small amount of HCl, some residual heavy metals, and potentially some dust if the upstream bag filter has a problem
- ERG's package is designed to remove all of this contamination, and produce gypsum (calcium sulphate) as a by-product which the customer sells to other companies in Sohar
- ERG's package comprises:
- Quench, sub-cooler, venturi, 6-stage V-tex® scrubbing using limestone, caustic scrubber, carbon polish, fans, reaction tank and gypsum dewatering
- ERG partnered with Sirius (Finland) for the limestone slurry and gypsum dewatering
- The V-tex® vessels and several pump skid assemblies were fabricated at ERG's sister company, ERG PF
- Other equipment items were procured from Europe and UAE.

Project Overview – ERG's Process



Project timeline and status

- Design and procurement in 2016
- Site works began in 2017, with the large V-tex® sump tank constructed on site – this was the first equipment to arrive at site
- The rest of ERG's equipment was delivered in summer and autumn 2017
- ERG provided site supervision for installation during late 2017 and early 2018
- Mechanically and electrically installed by early summer 2018
- Commissioning during summer and early autumn 2018 – ERG package performance proving completed November 2018
- Process optimisation and production snagging during winter 2018/19 and spring 2019

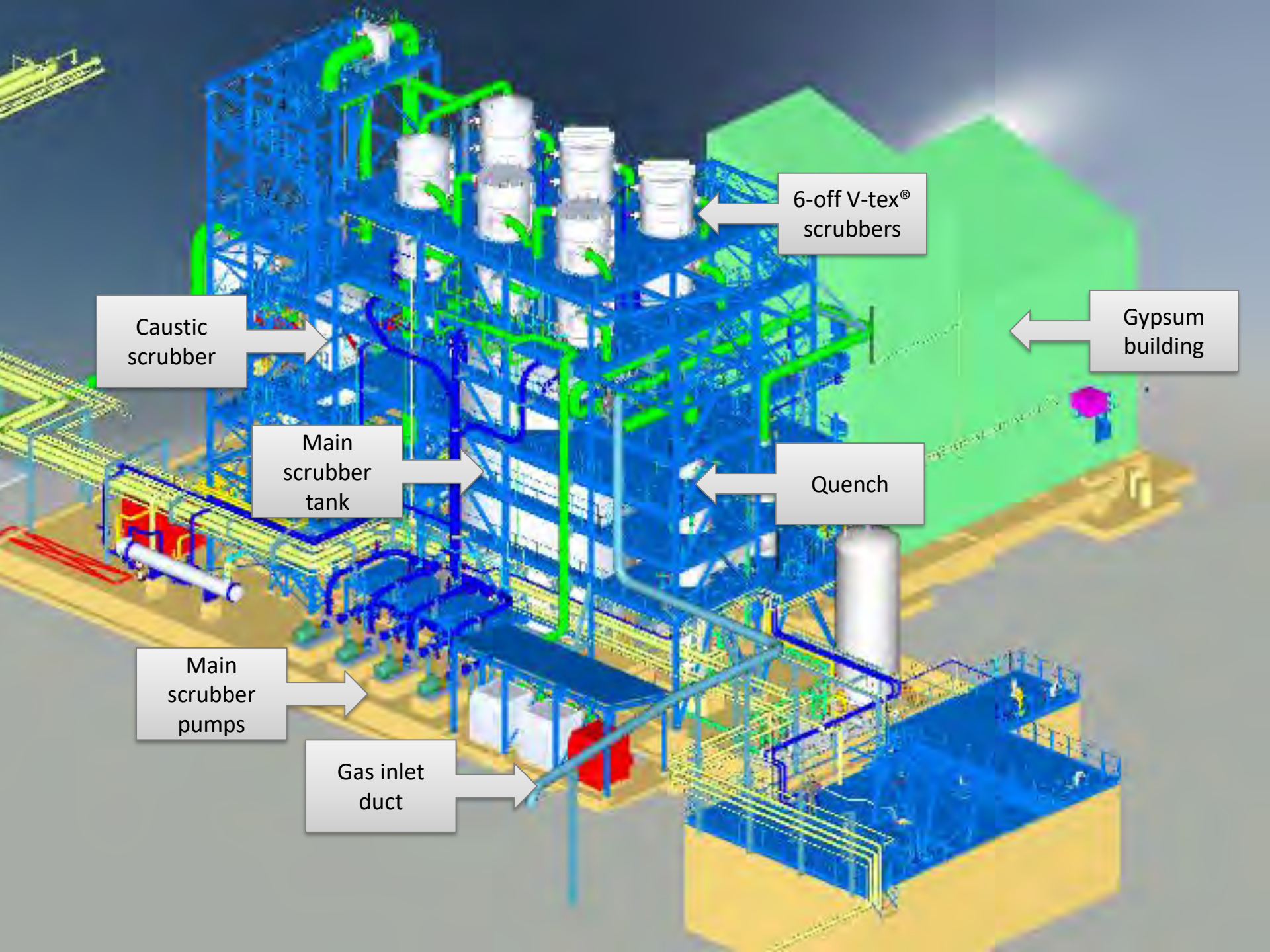
Why did the customer use ERG for this project?

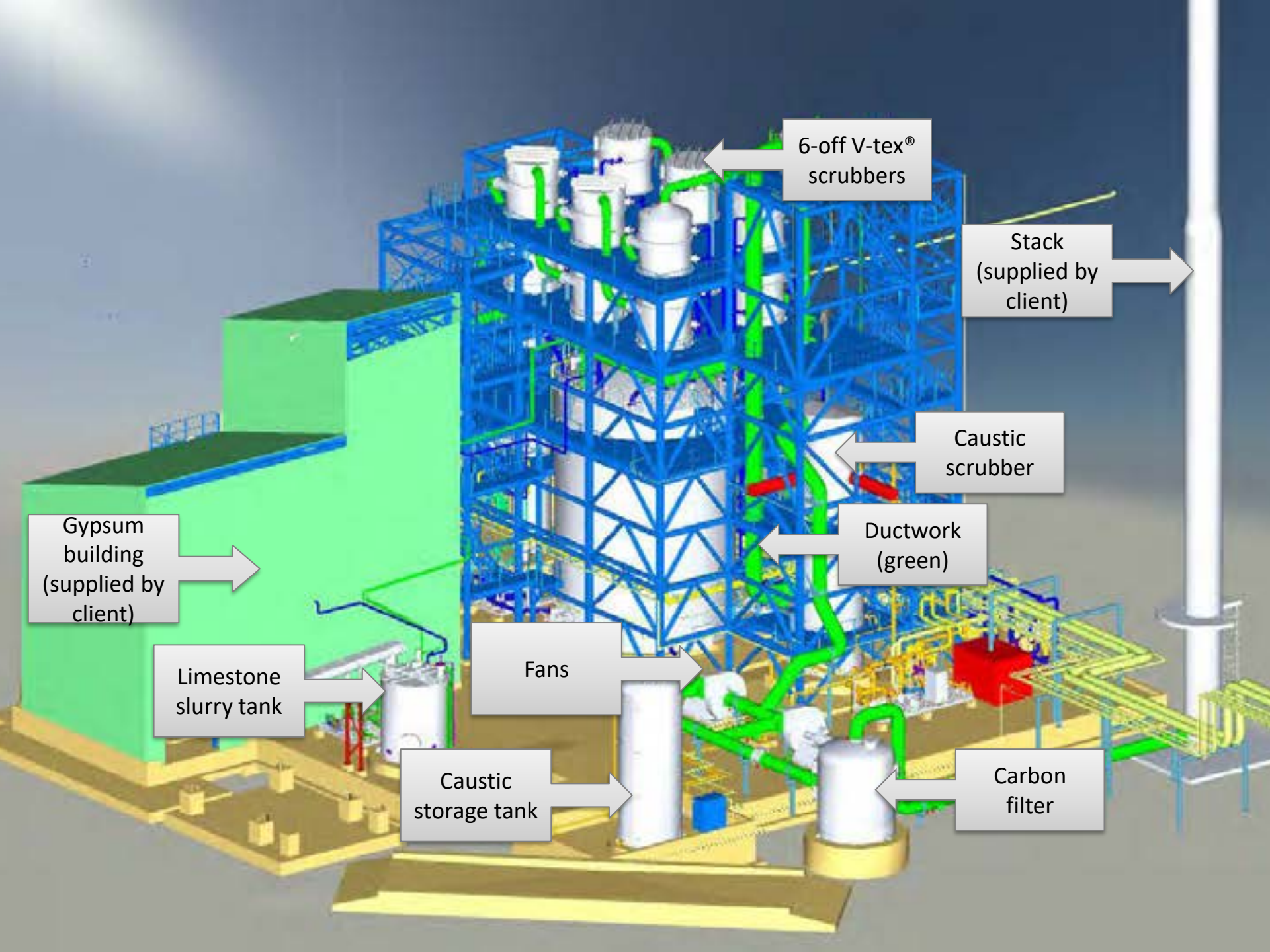
- ERG is a specialist gas cleaning process contractor able to design and manage a project of this size and complexity and we employ highly experienced process, mechanical and electrical engineers, 3D CAD designers, project managers and site/commissioning managers → throughout the FEED and EPC parts of the project, ERG was organised, responsive, proactive and brought solutions to the many pitfalls hidden in delivering this type of integrated system effectively
- ERG's unique, patented V-tex® scrubber can operate with up to 20% suspended solids → it is the most suitable scrubbing technology selection for this application, minimising equipment size, offering superior SO_2 removal efficiency – see www.ergapc.co.uk/how-it-works/
- ERG's sister company ERG PF fabricates high quality plastic GRP process vessels and skid packages → ERG can offer high quality vessels to the tightest specifications at attractive prices – see www.ergpf.co.uk/
- ERG's Middle East business has a well-establish supply chain and expediting experience → ERG offered excellent value for money and programme management by utilising local suppliers

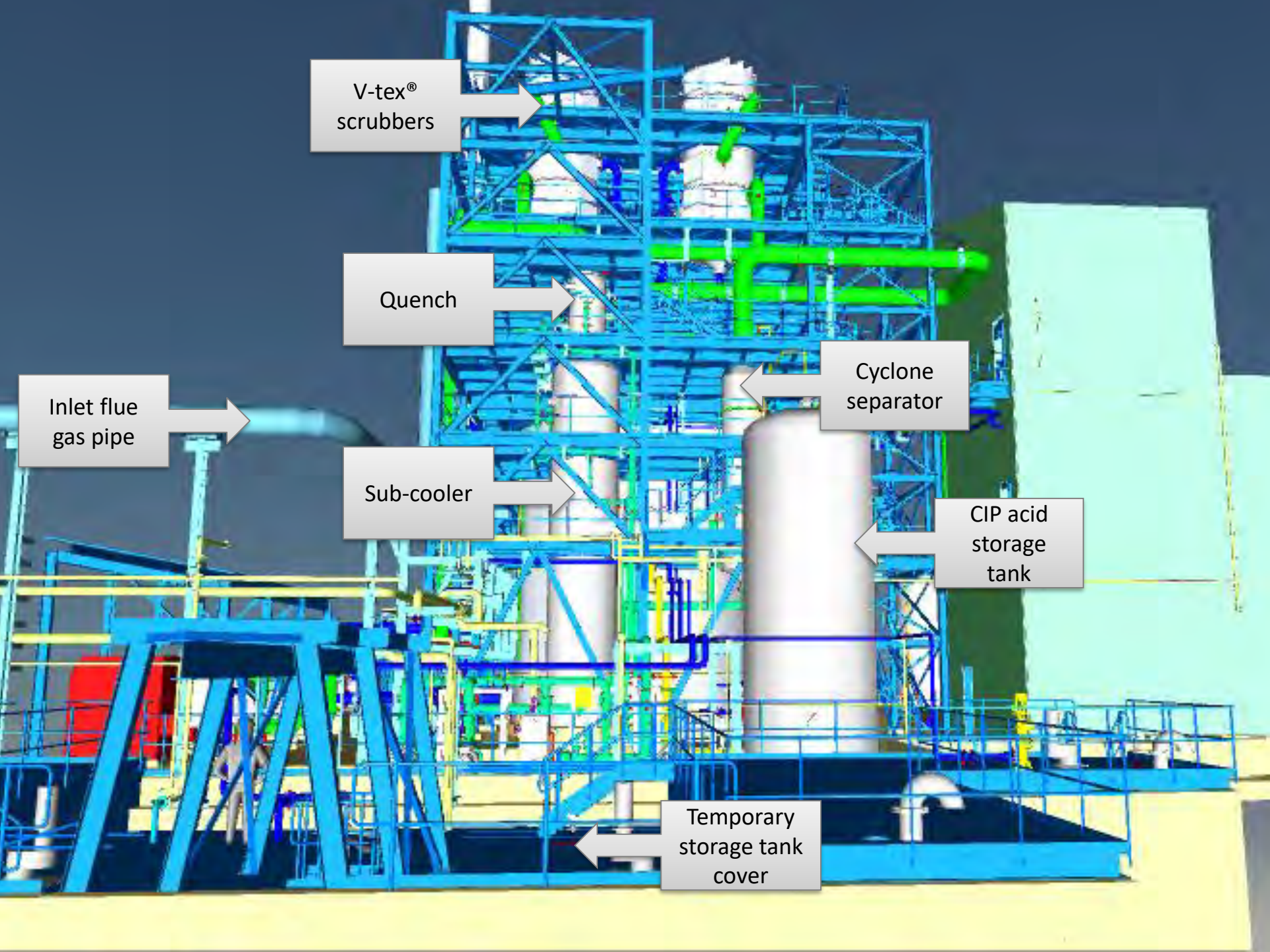
Site model and photos

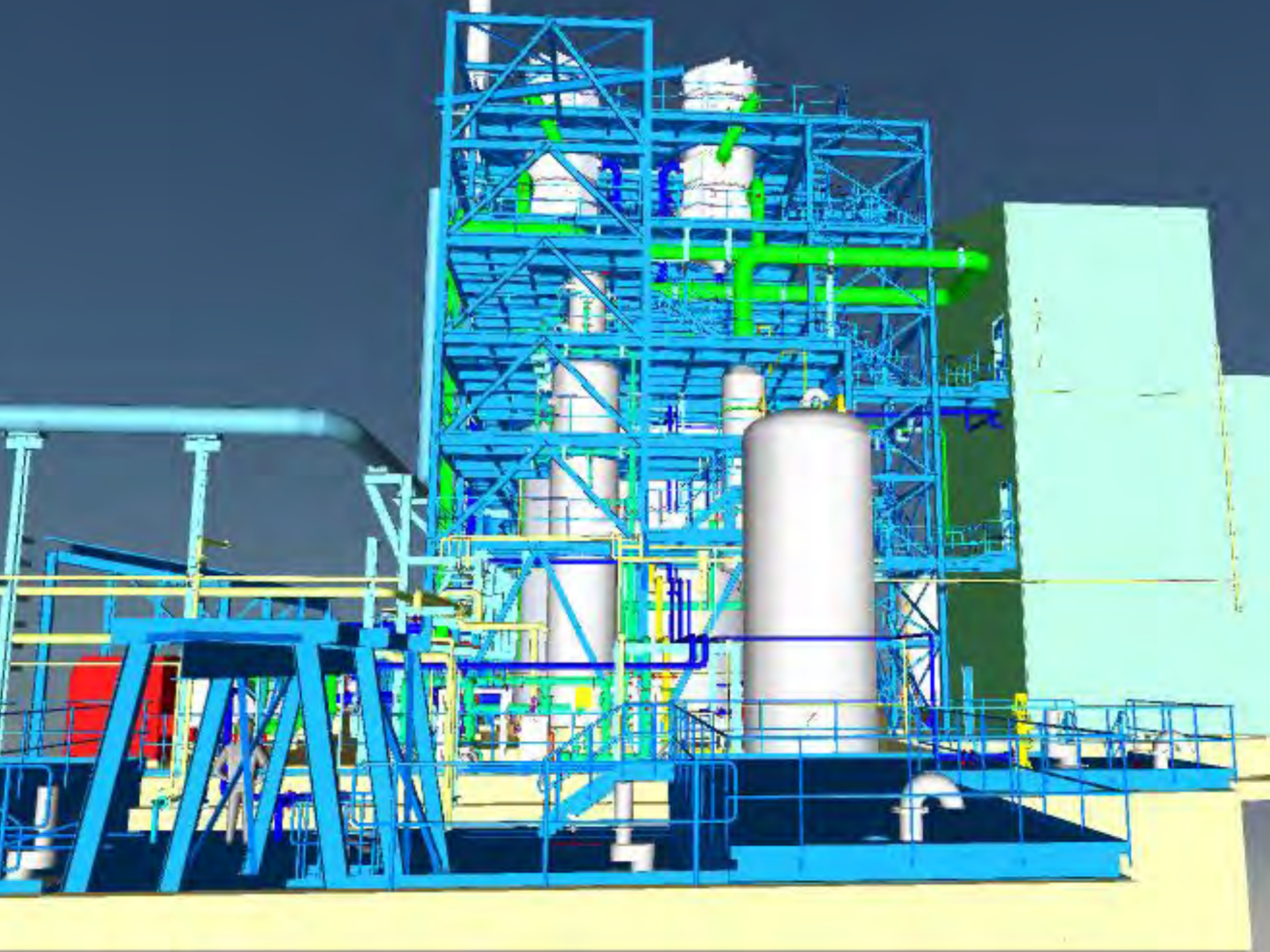
- The next slides show views from the 3D model ERG produced – and matching photos of the equipment as it looked in June 2018
- All of the process equipment, interconnecting ductwork and process pipework and instruments were supplied by ERG
- The steel structure, the building for the gypsum dewatering, the stack and all utility pipework was supplied by ERG's customer
- The labelling tells you what the main items are…

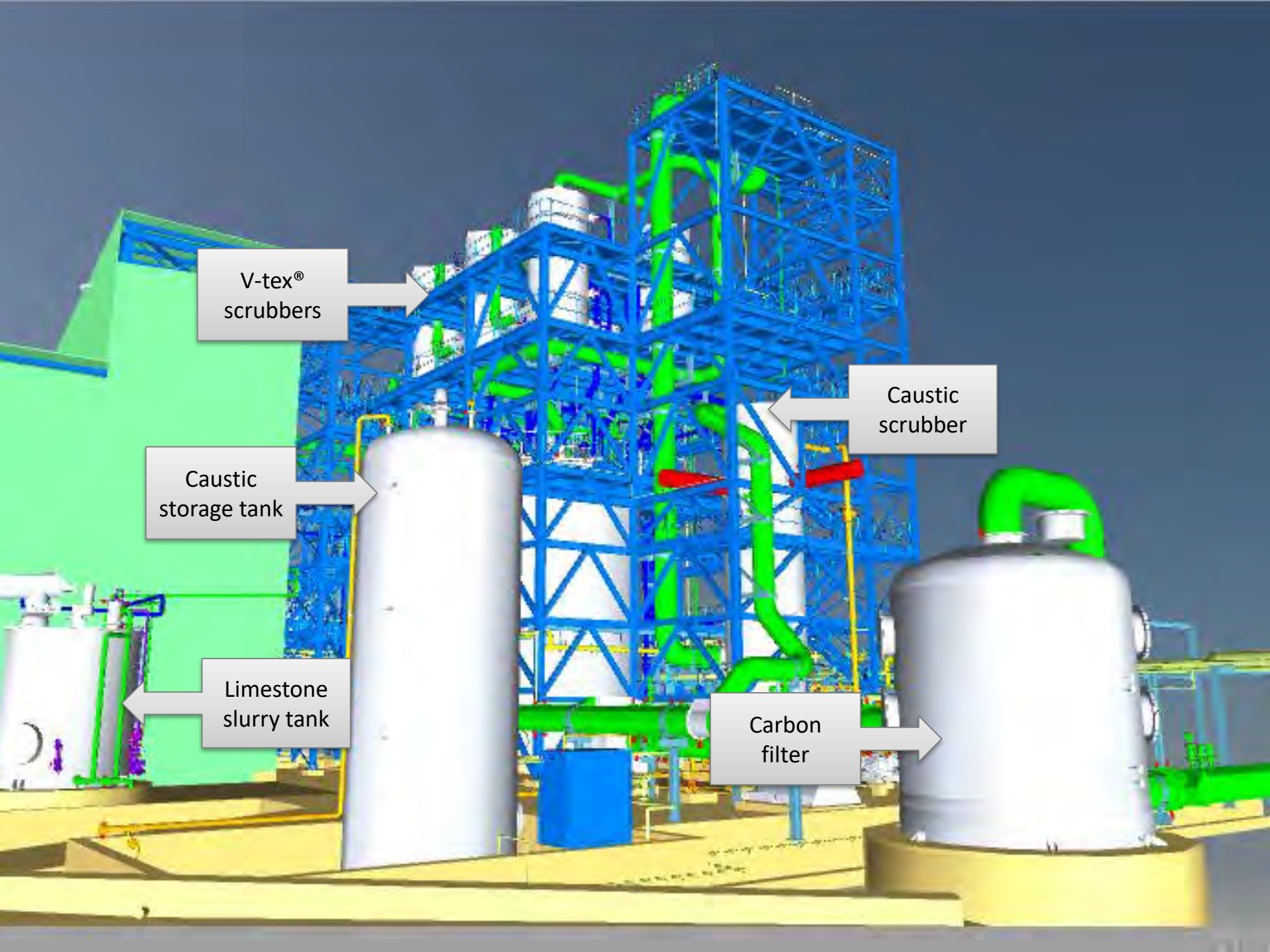

ERG’s flue gas desulphurisation plant
with gypsum production facility

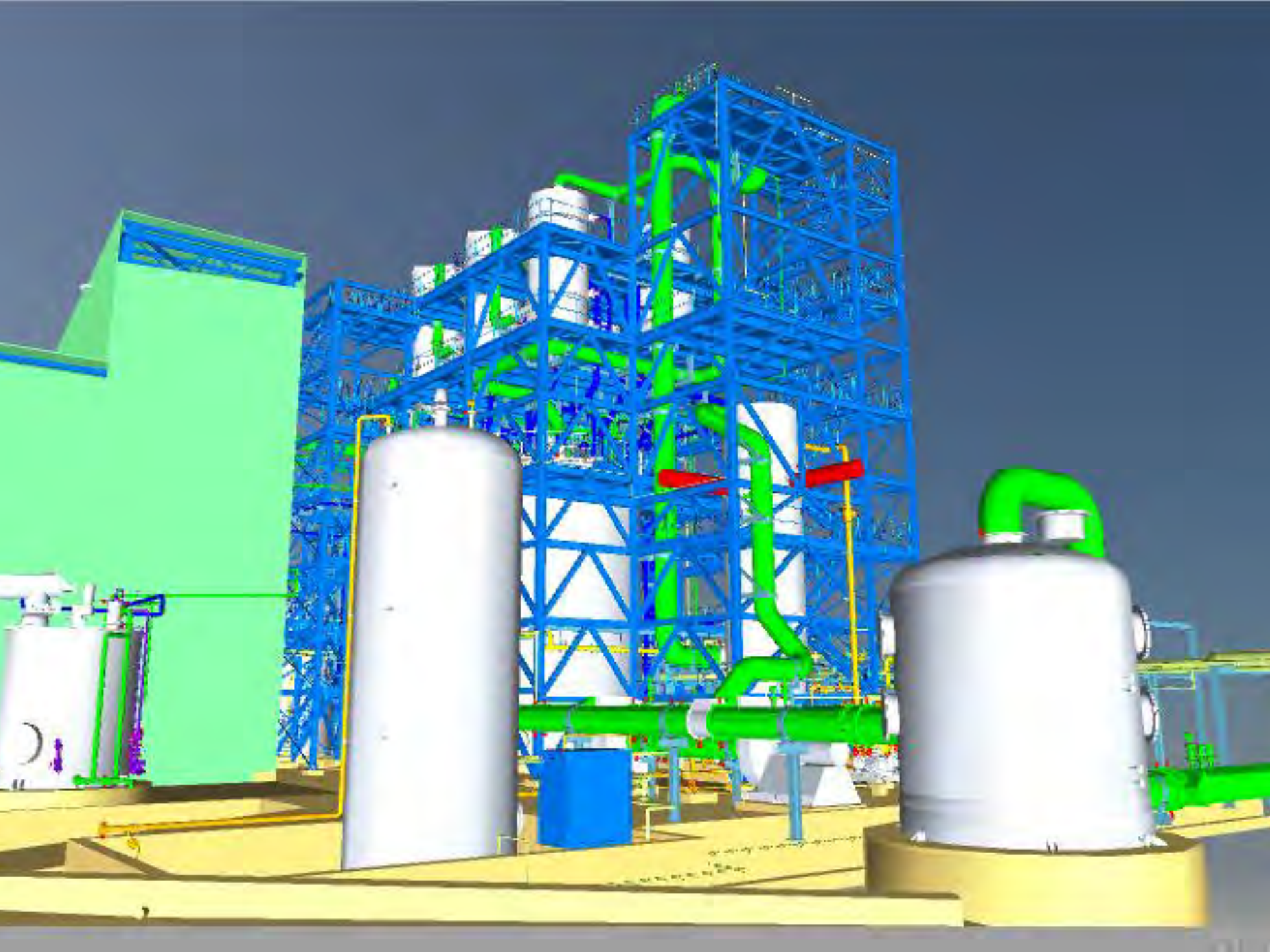

6-off V-tex® scrubbers
Caustic scrubber
Gypsum building
Main scrubber tank
Quench
Main scrubber pumps
Gas inlet duct

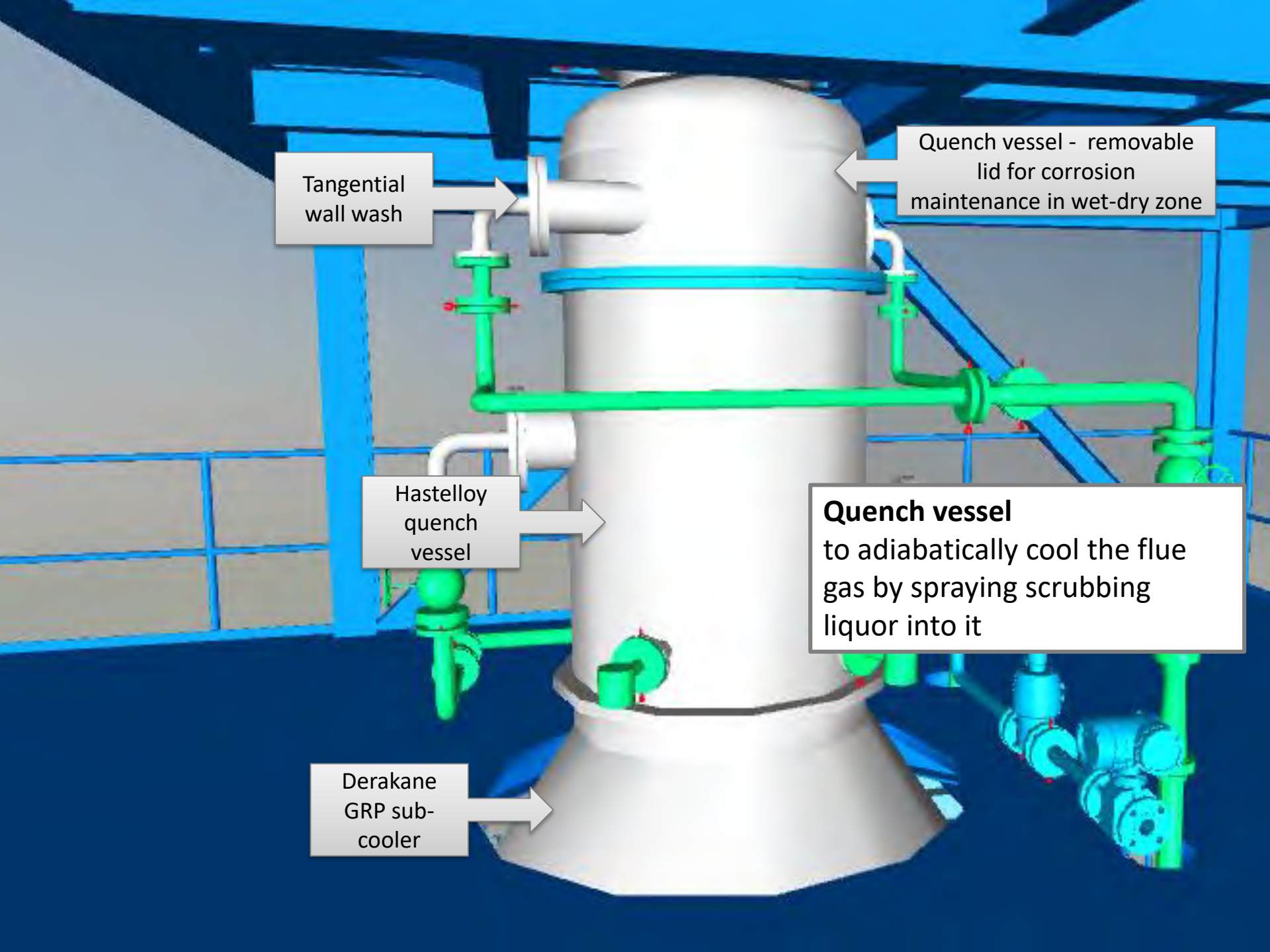

6-off V-tex® scrubbers
Stack (supplied by client)
Caustic scrubber
Ductwork (green)
Gypsum building (supplied by client)
Fans
Limestone slurry tank
Caustic storage tank
Carbon filter

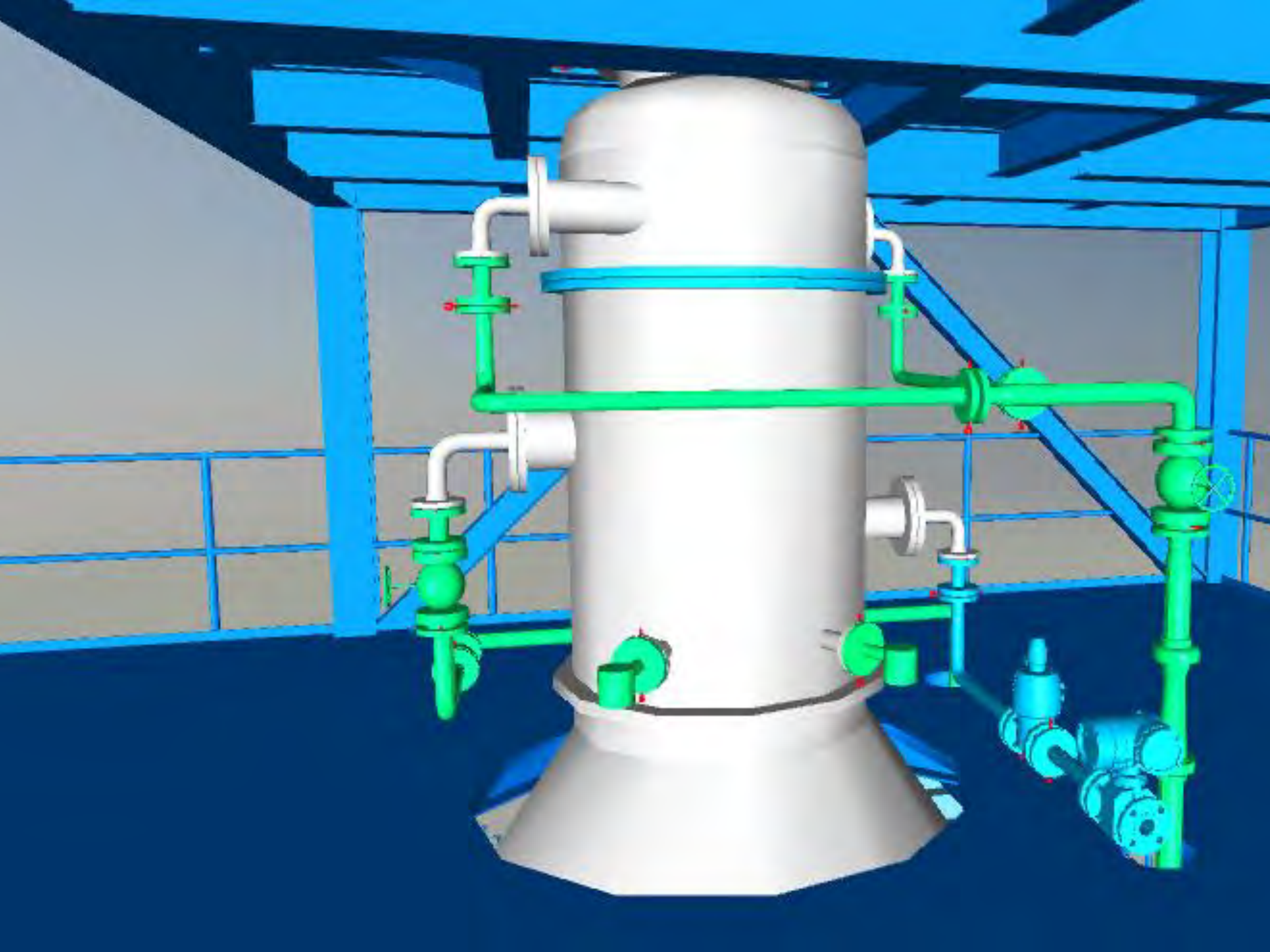

V-tex®
scrubbers
Quench
Inlet flue
gas pipe
Cyclone
separator
Sub-cooler
CIP acid
storage
tank
Temporary
storage tank
cover

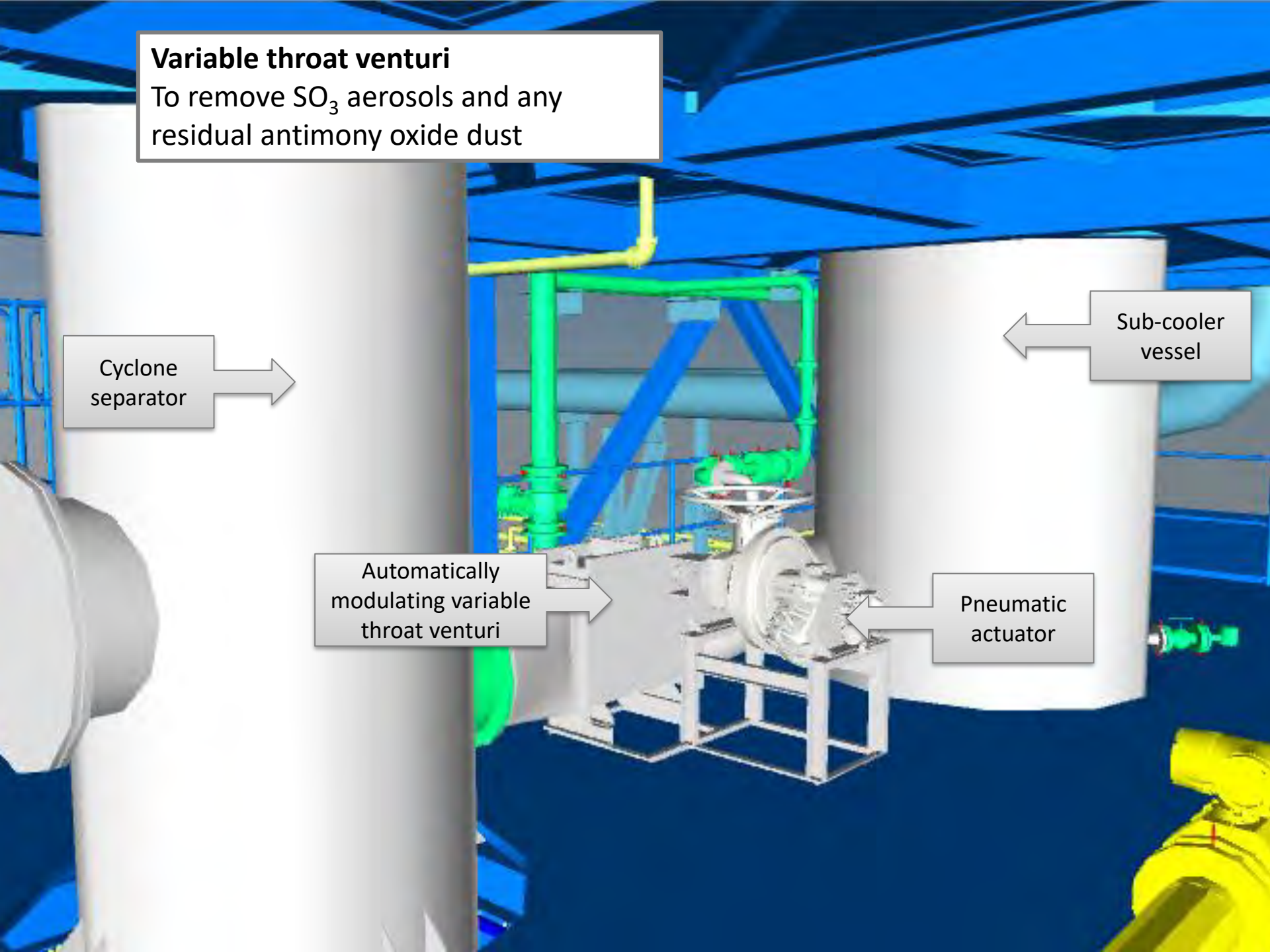


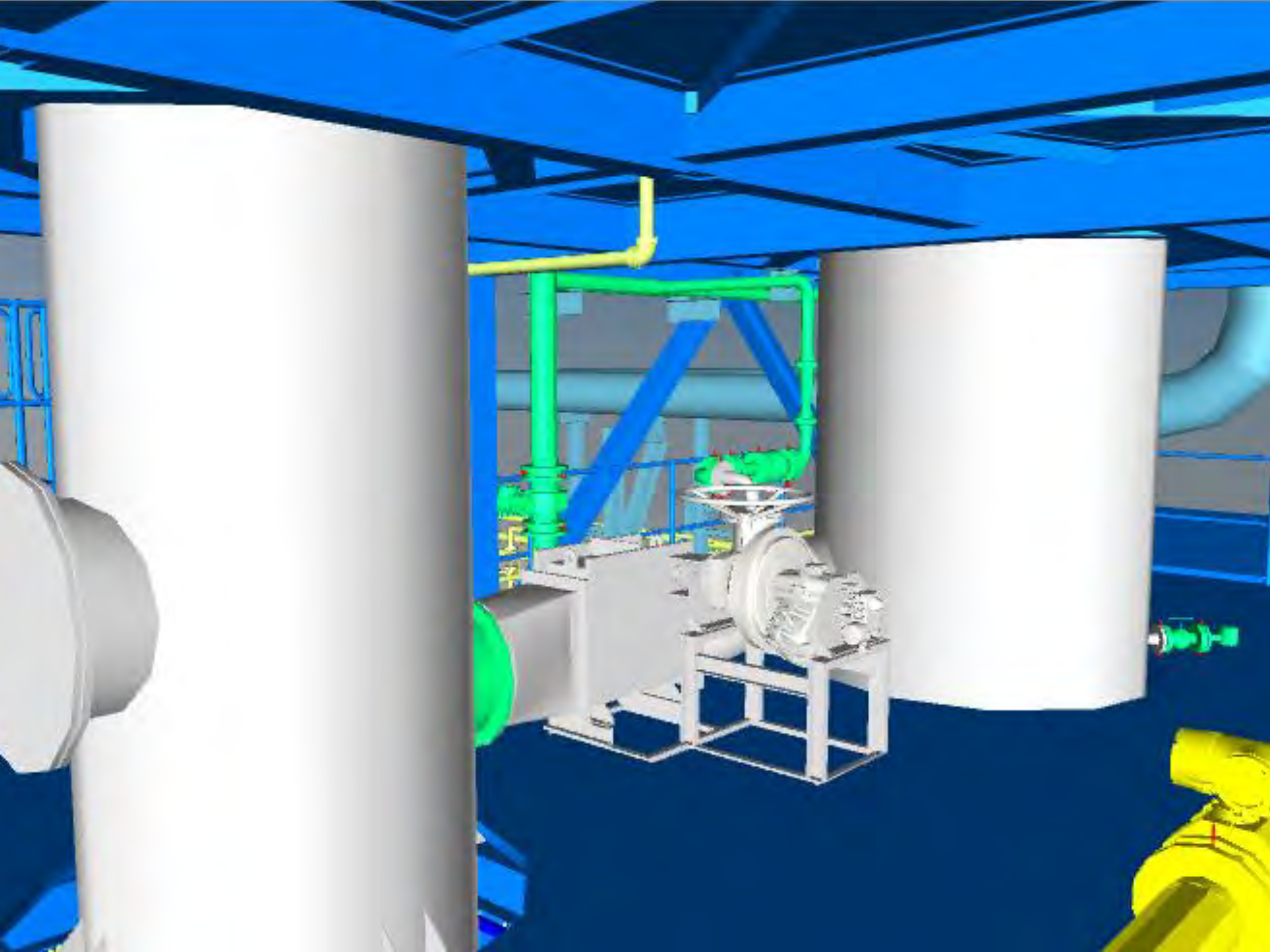

V-tex®
scrubbers
Caustic
scrubber
Caustic
storage tank
Limestone
slurry tank
Carbon
filter



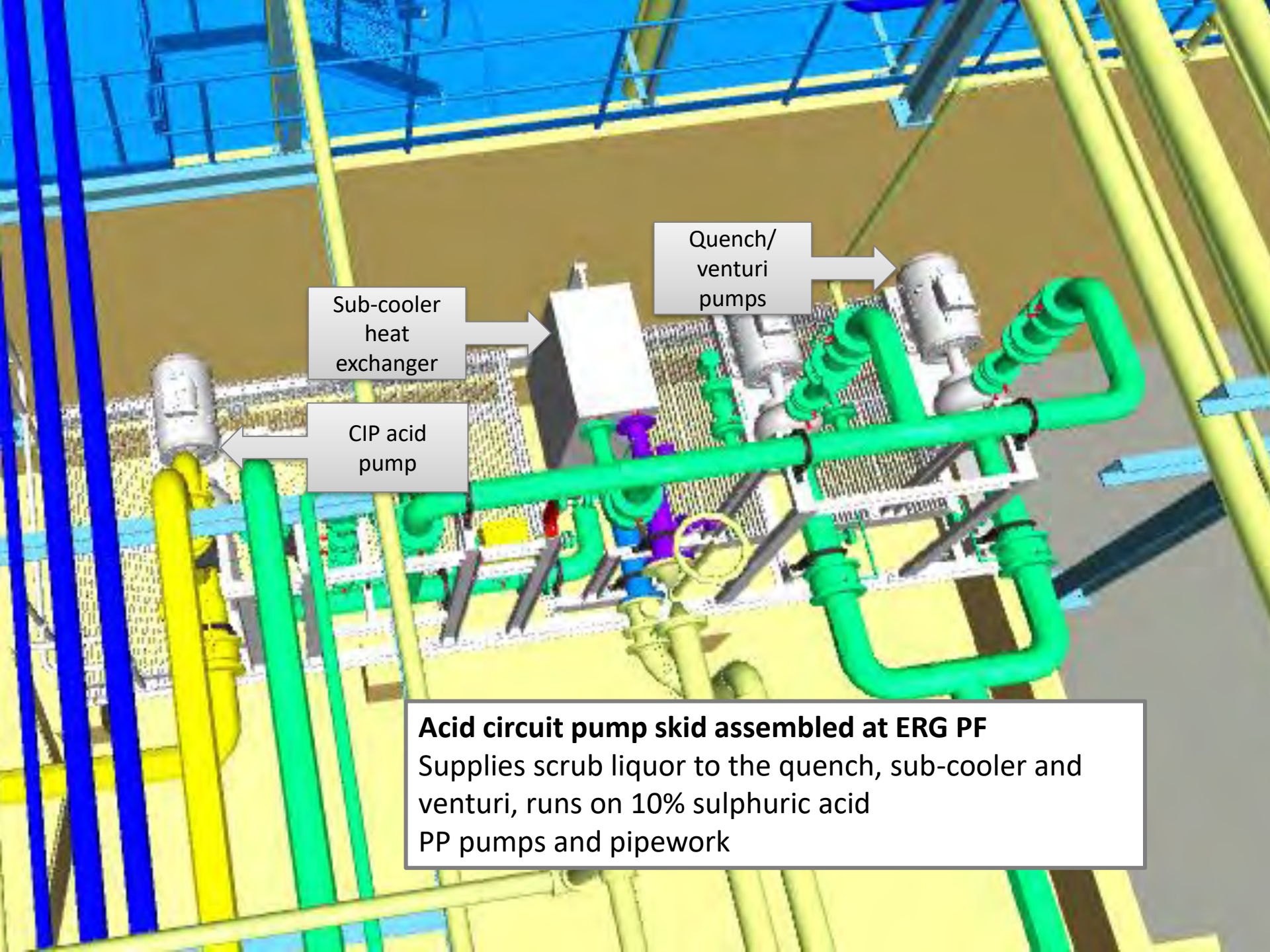

Tangential wall wash
Quench vessel - removable lid for corrosion maintenance in wet-dry zone
Hastelloy quench vessel
Quench vessel
to adiabatically cool the flue gas by spraying scrubbing liquor into it
Derakane GRP sub-cooler




Variable throat venturi
To remove SO_3 aerosols and any residual antimony oxide dust
Cyclone separator
Sub-cooler vessel
Automatically modulating variable throat venturi
Pneumatic actuator



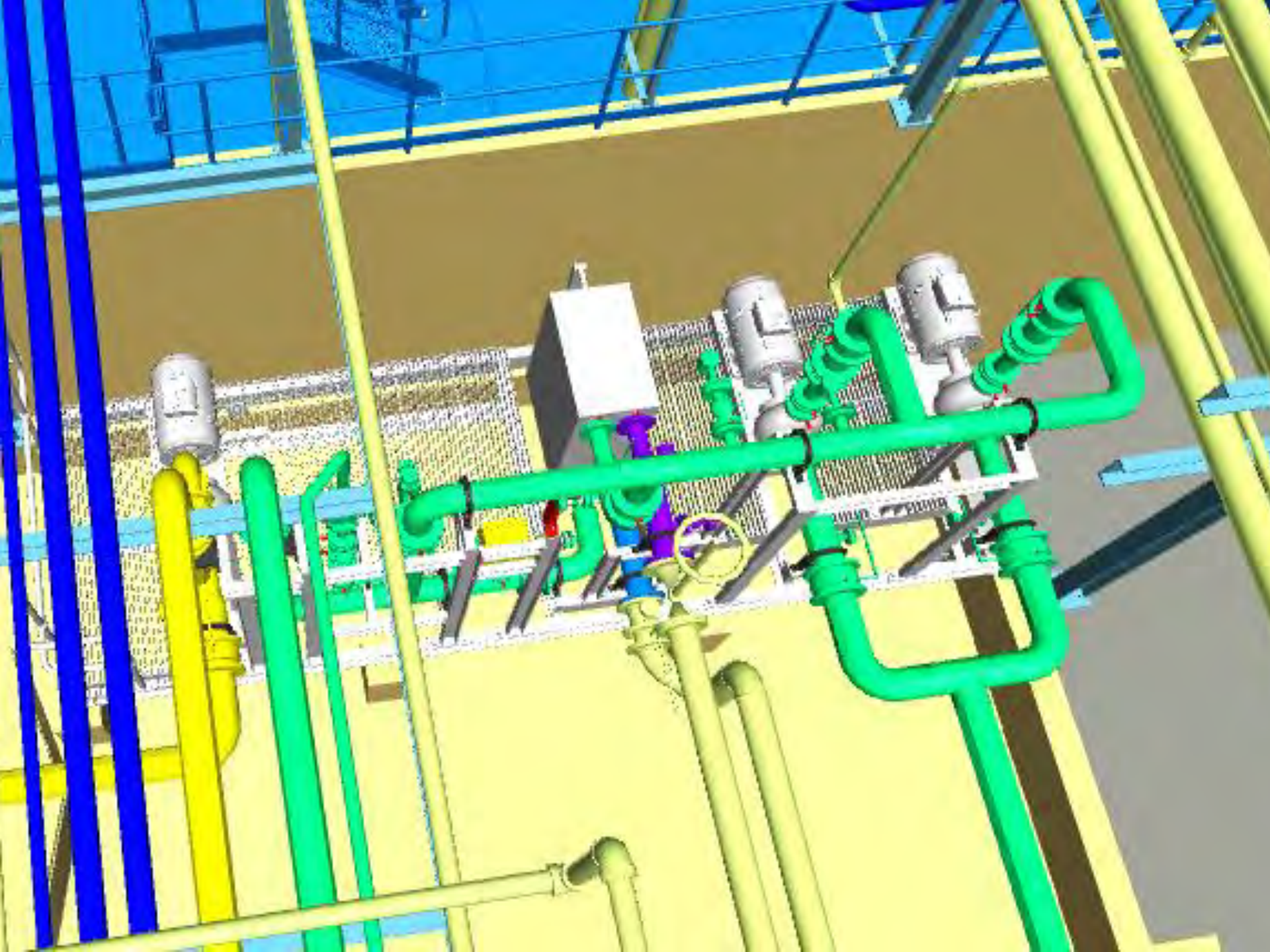

MADE IN UAE

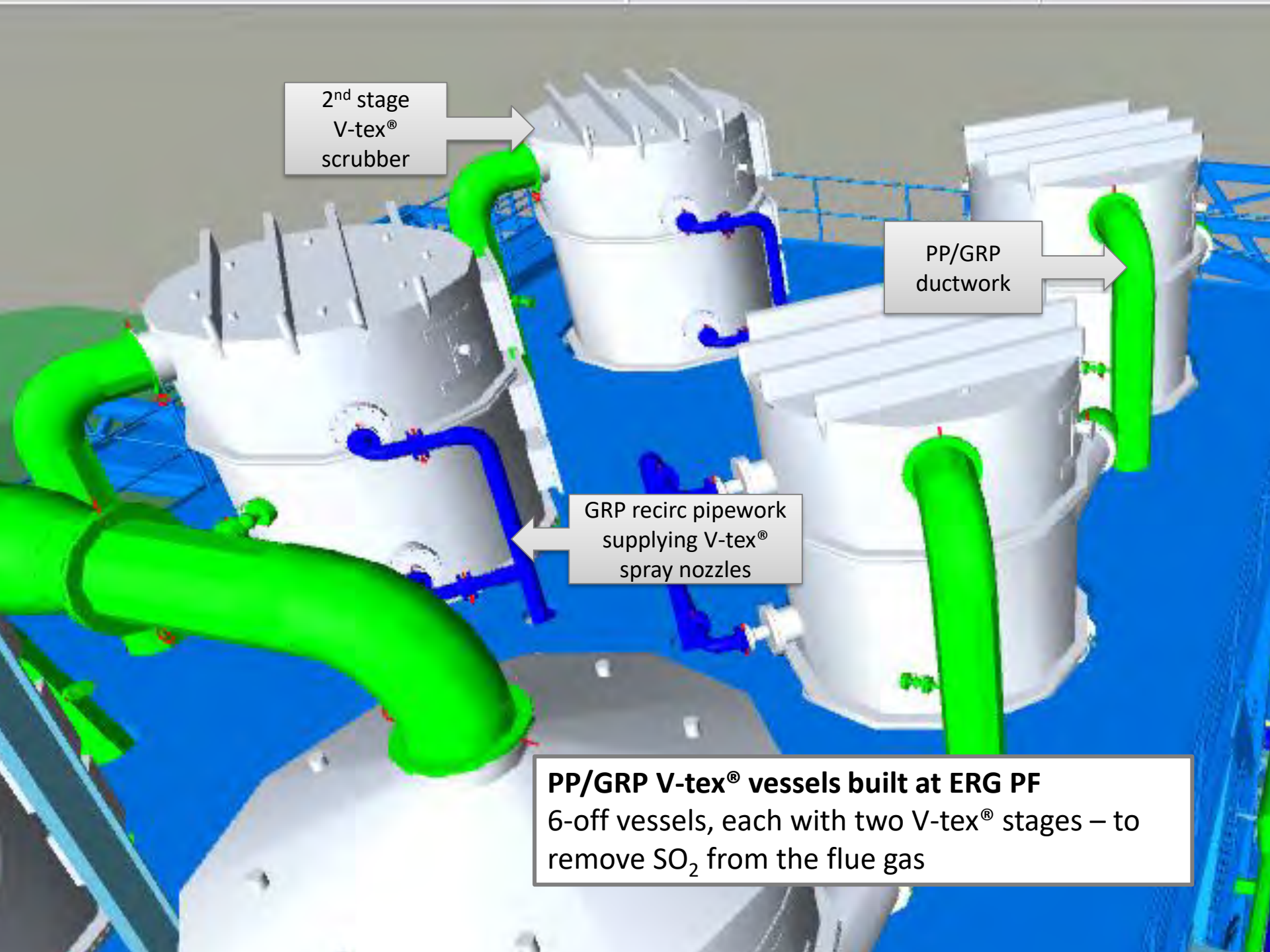


Acid circuit pump skid assembled at ERG PF

Supplies scrub liquor to the quench, sub-cooler and venturi, runs on 10% sulphuric acid

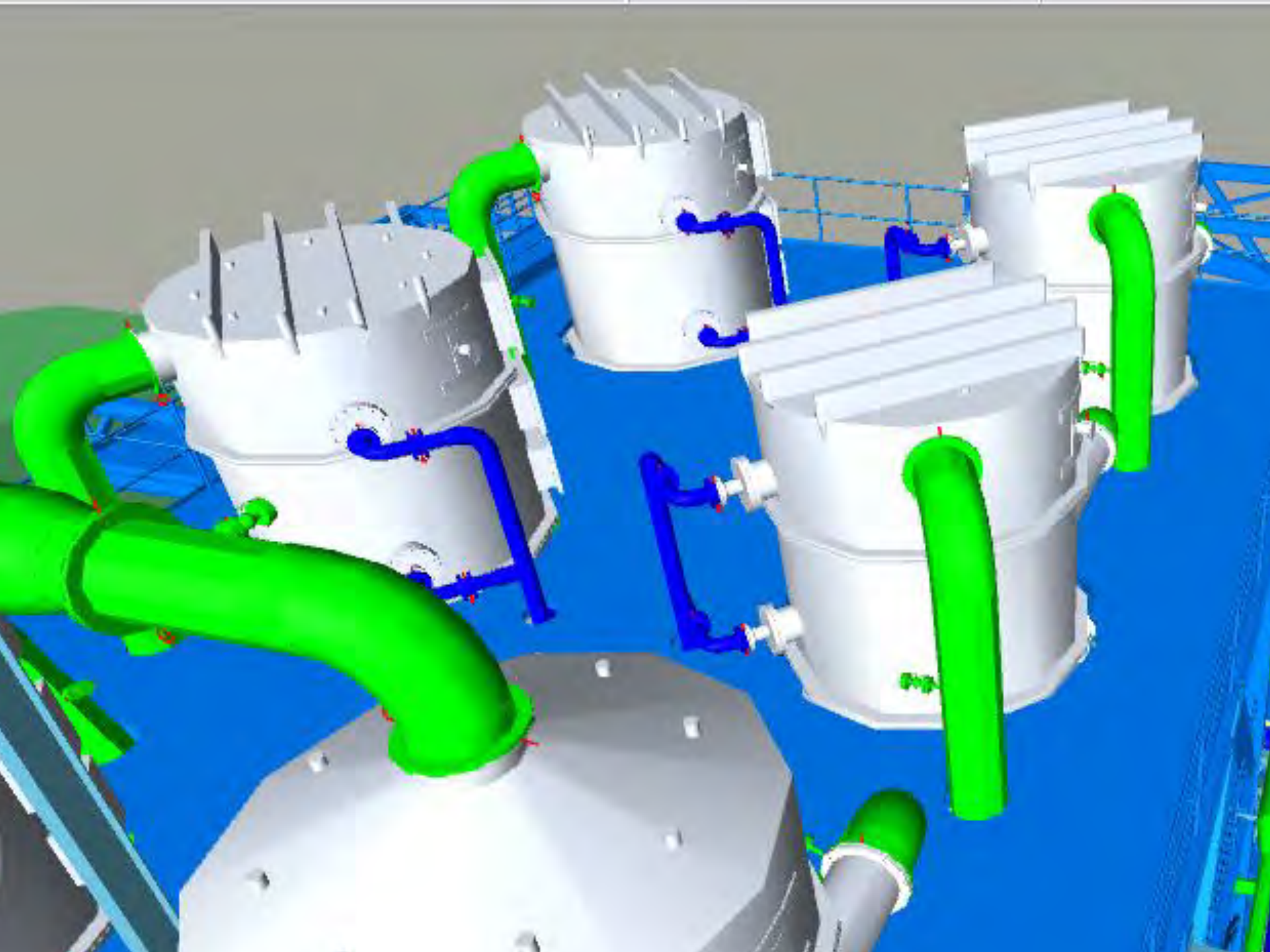
PP pumps and pipework

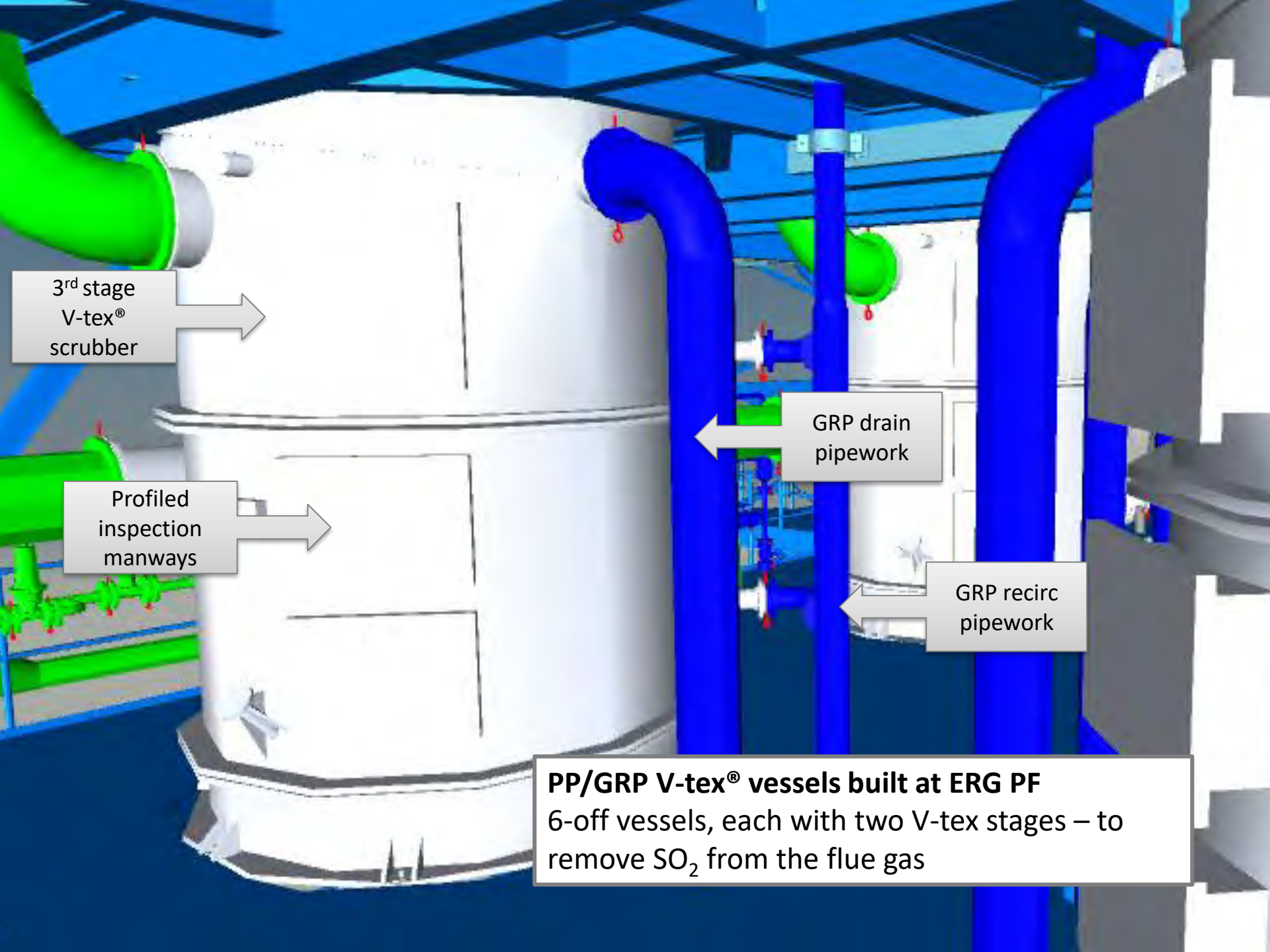




PP/GRP V-tex® vessels built at ERG PF

6-off vessels, each with two V-tex® stages – to remove SO_2 from the flue gas





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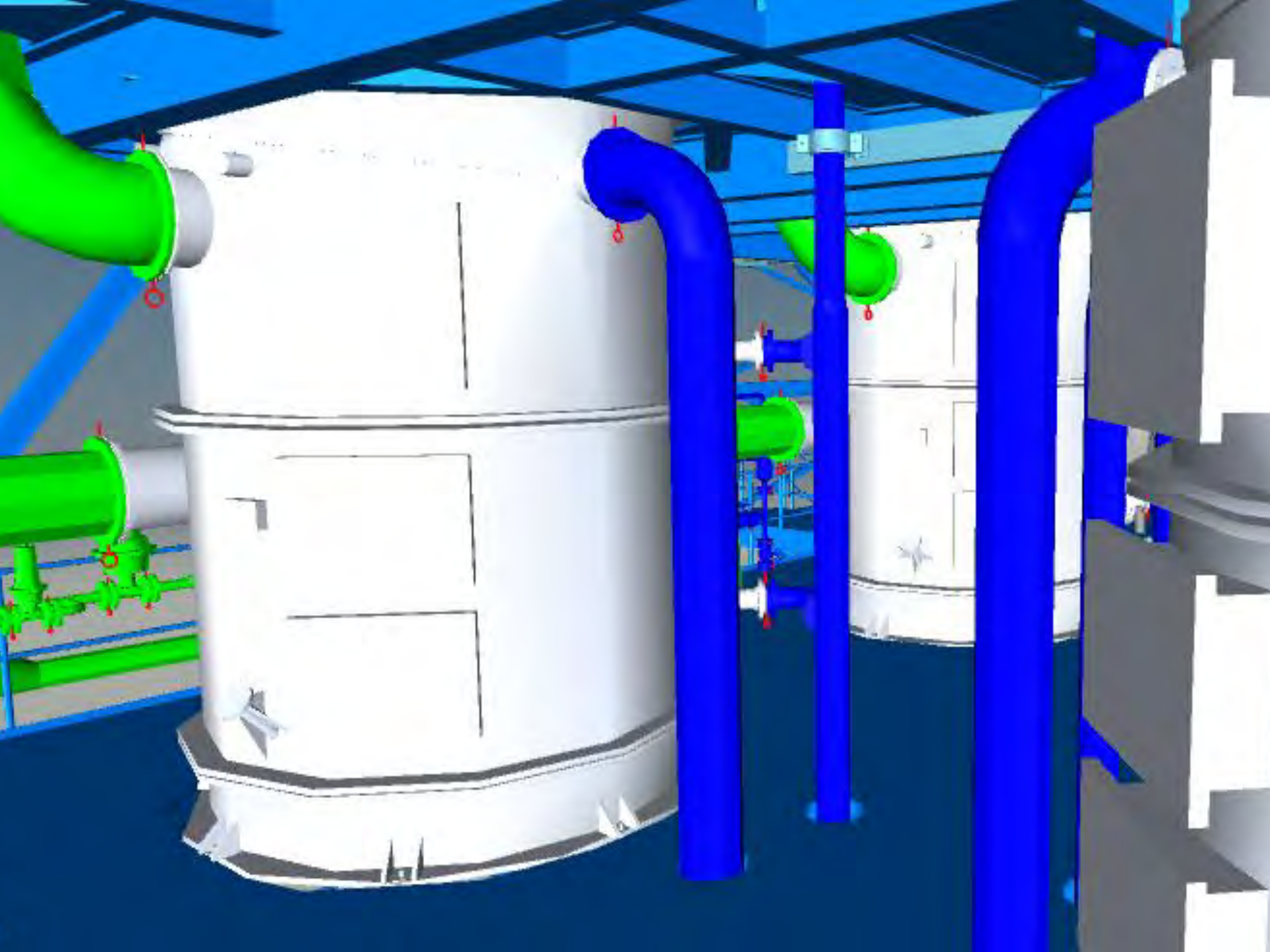
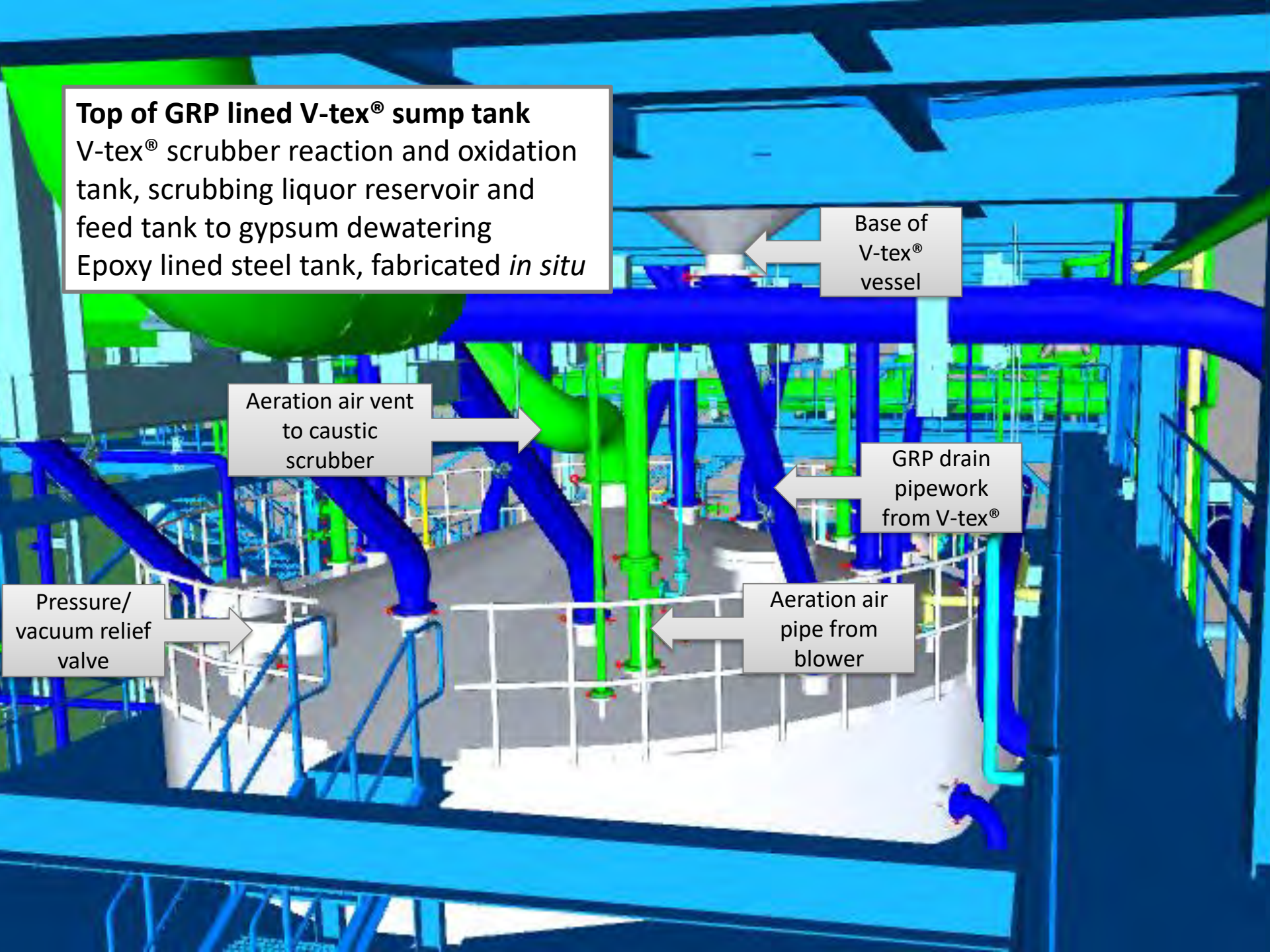
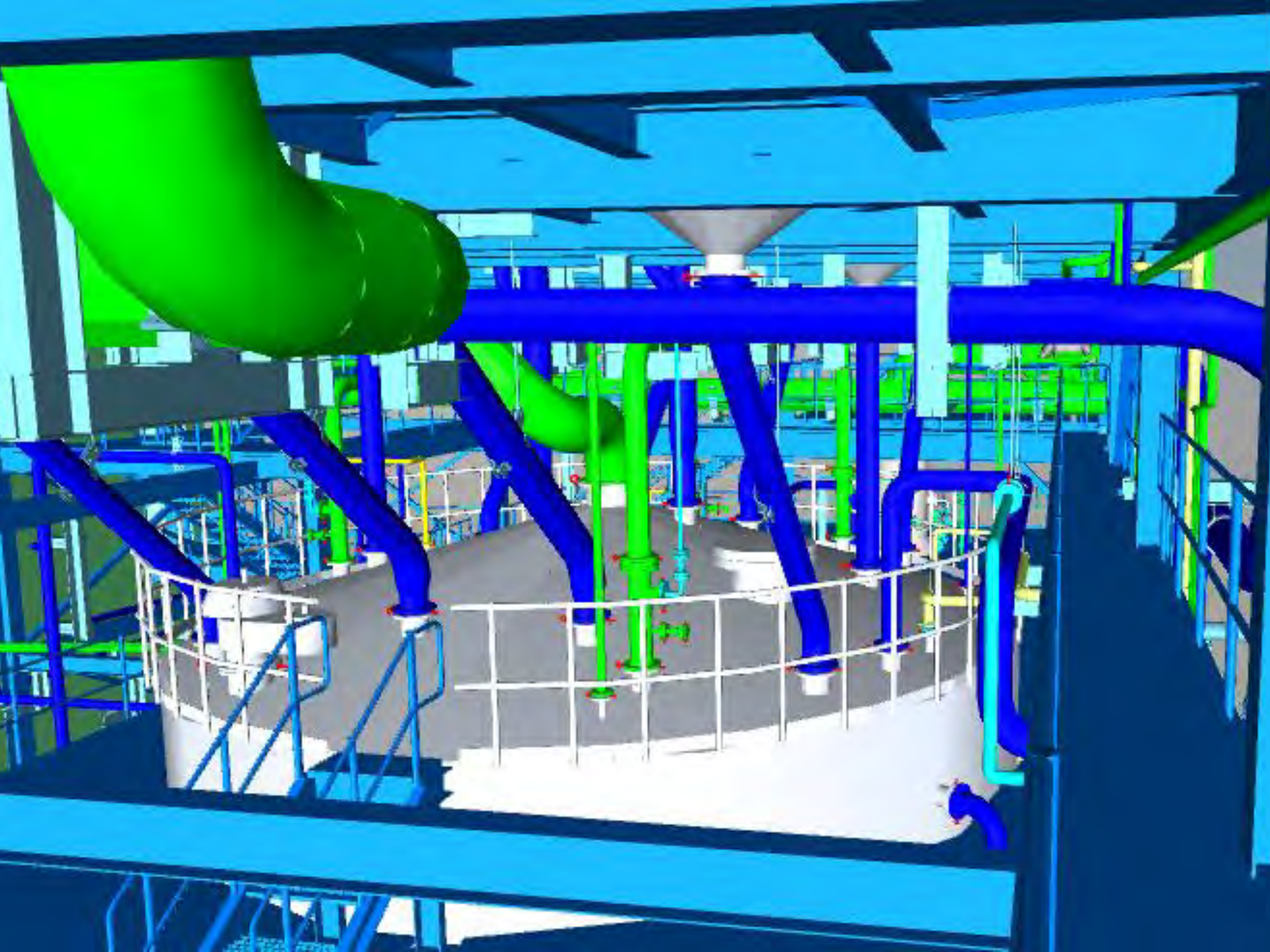
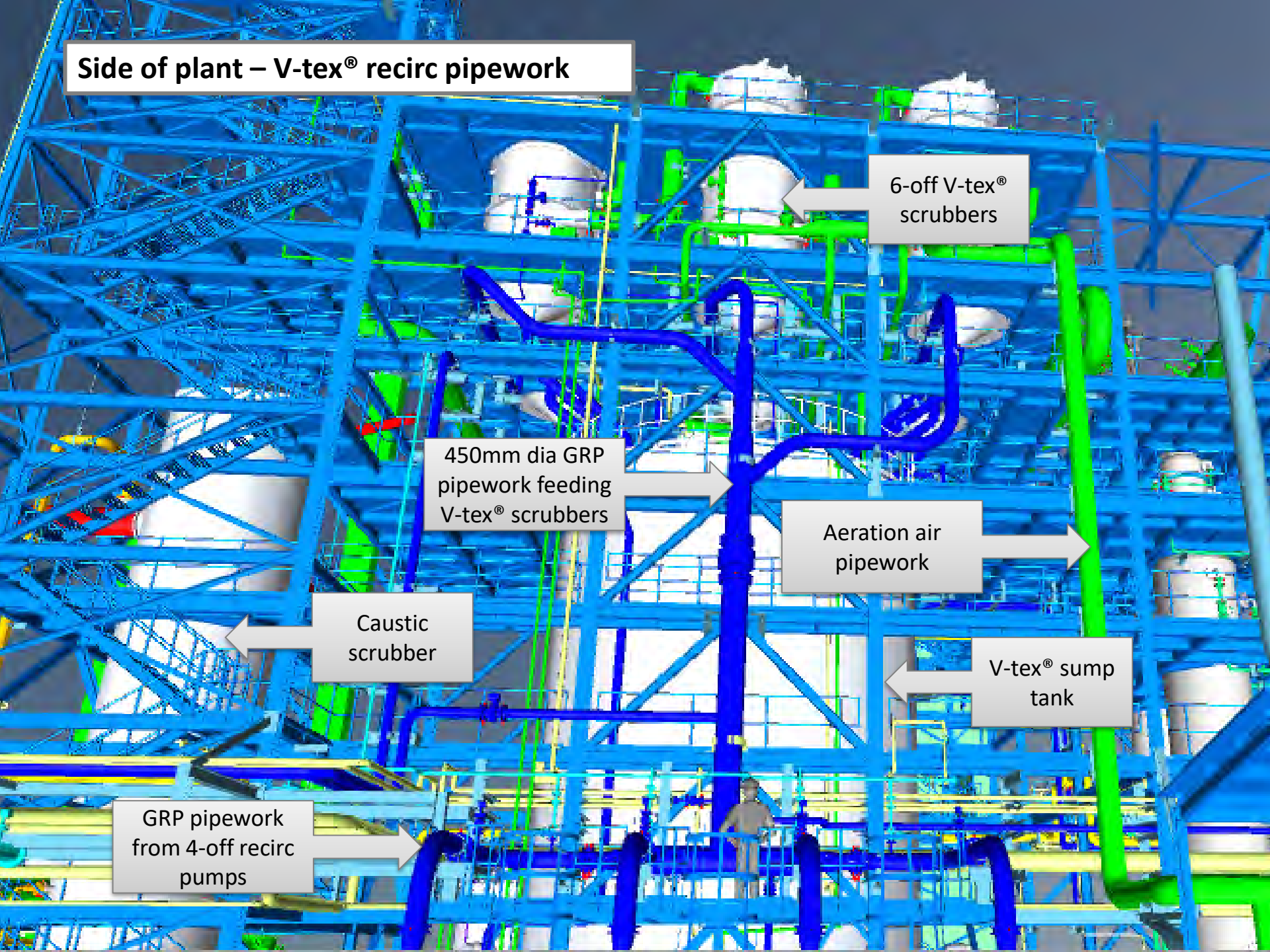
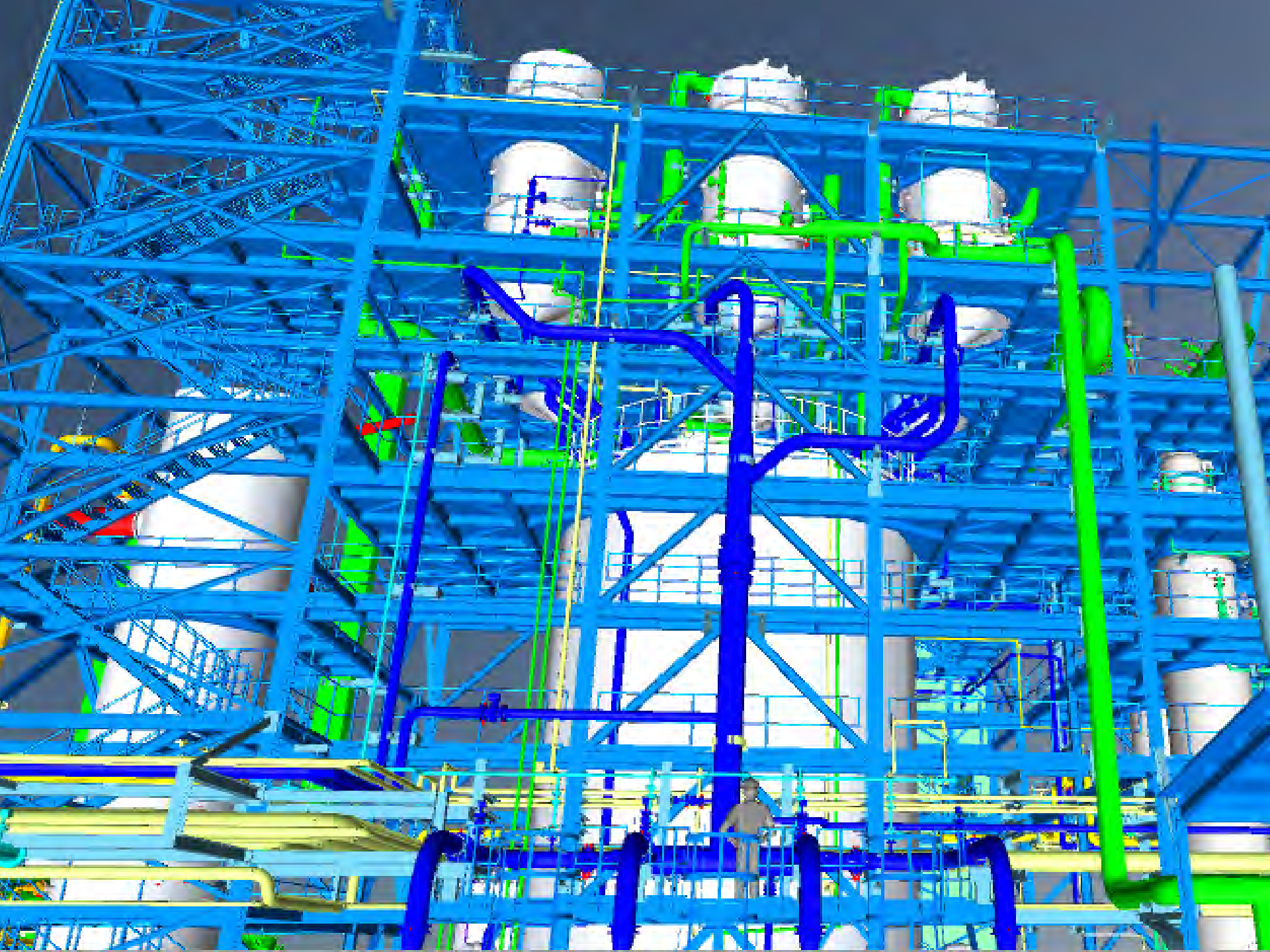
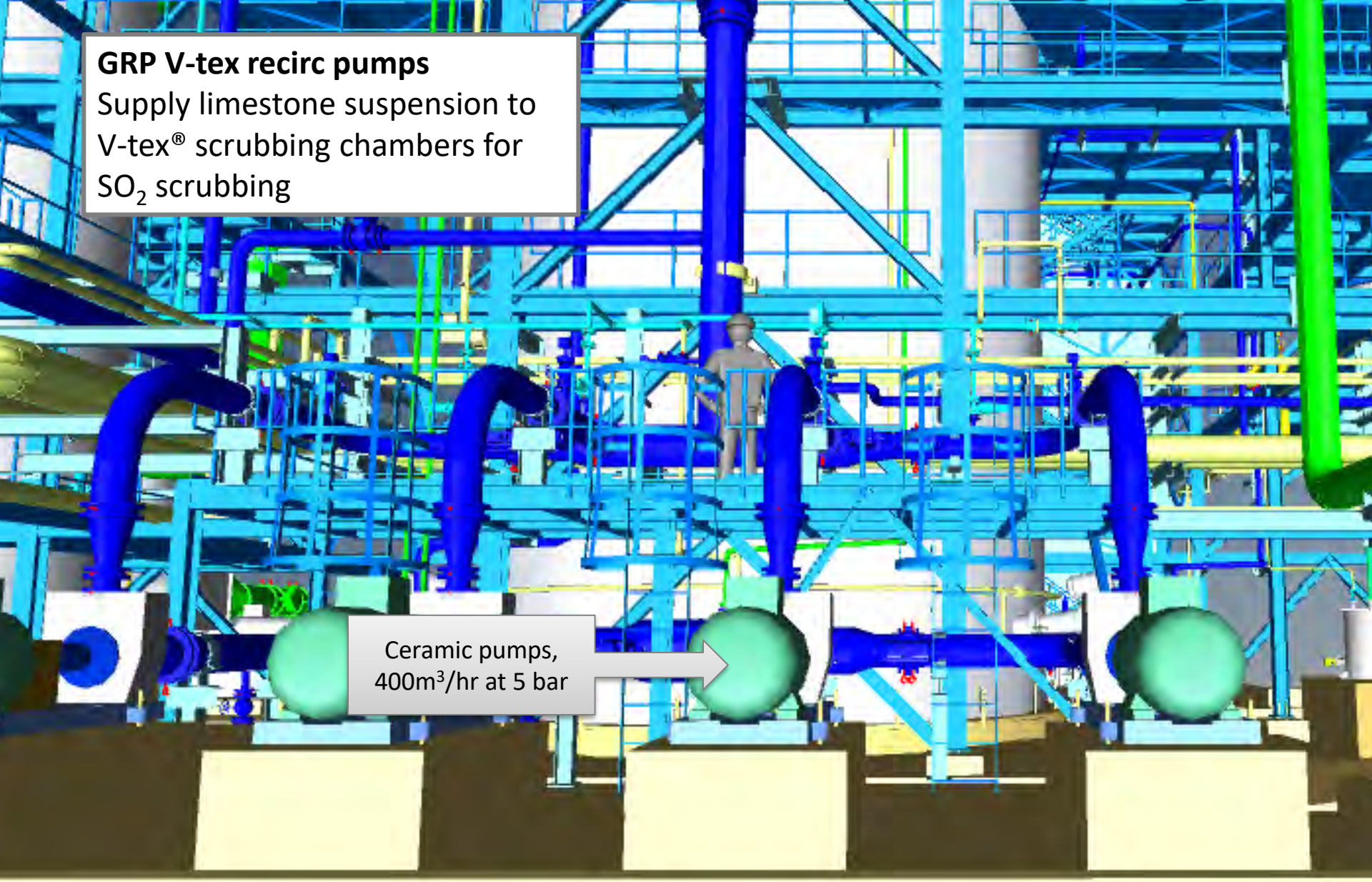


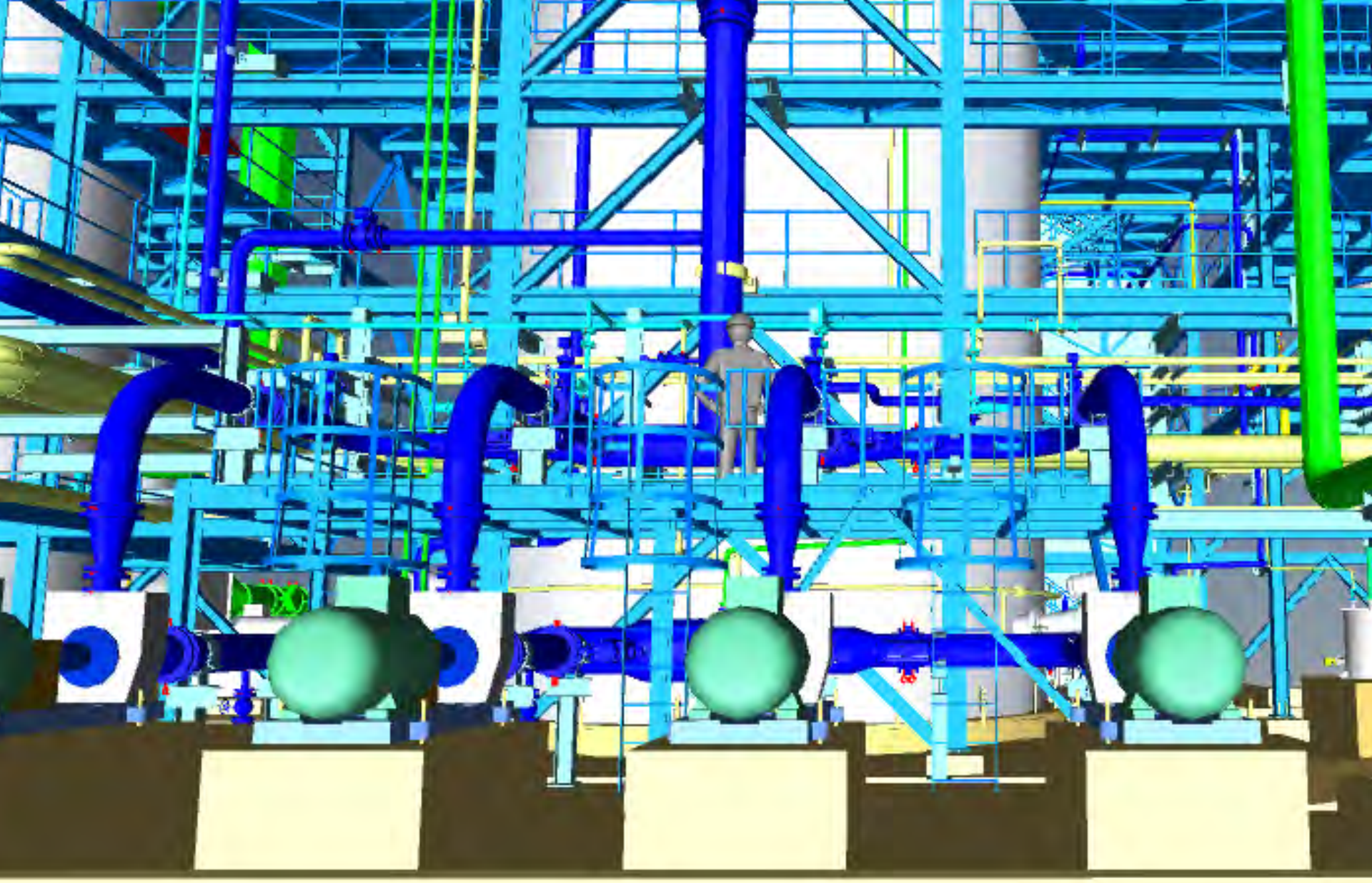

Top of GRP lined V-tex® sump tank
V-tex® scrubber reaction and oxidation tank, scrubbing liquor reservoir and feed tank to gypsum dewatering
Epoxy lined steel tank, fabricated *in situ*
Base of V-tex® vessel
Aeration air vent to caustic scrubber
GRP drain pipework from V-tex®
Pressure/ vacuum relief valve
Aeration air pipe from blower

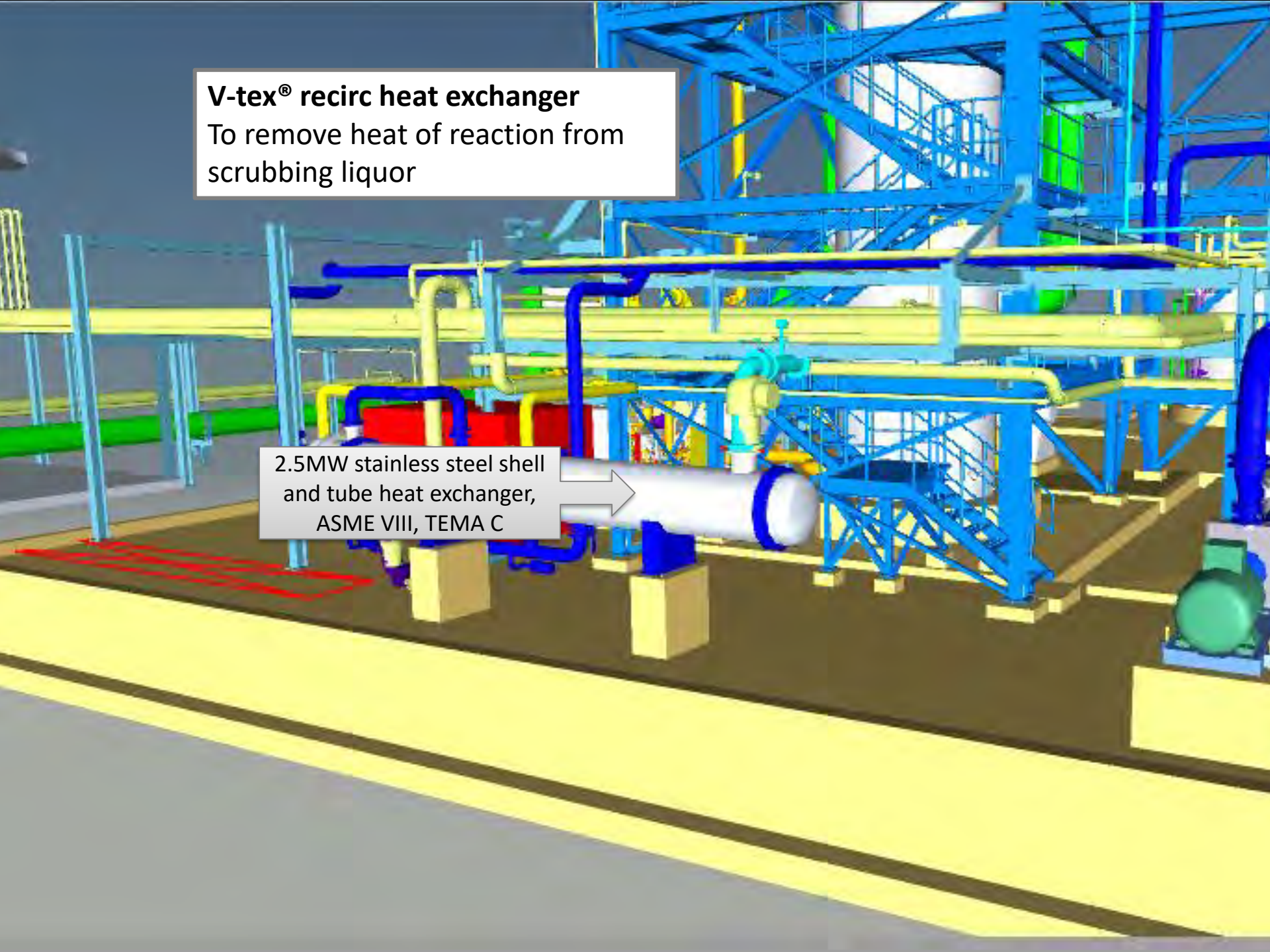


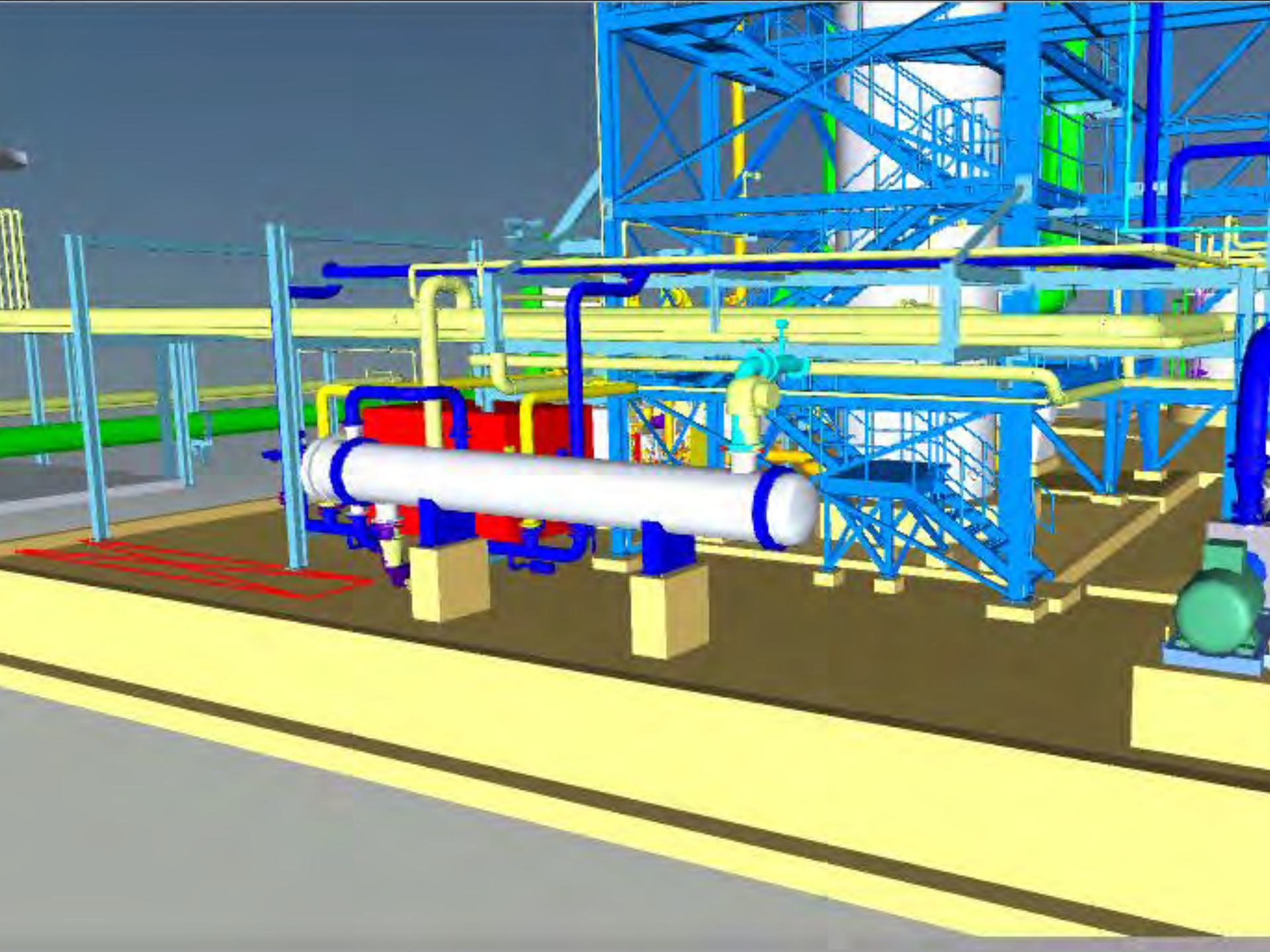

Side of plant – V-tex® recirc pipework
6-off V-tex® scrubbers
450mm dia GRP pipework feeding V-tex® scrubbers
Aeration air pipework
Caustic scrubber
V-tex® sump tank
GRP pipework from 4-off recirc pumps

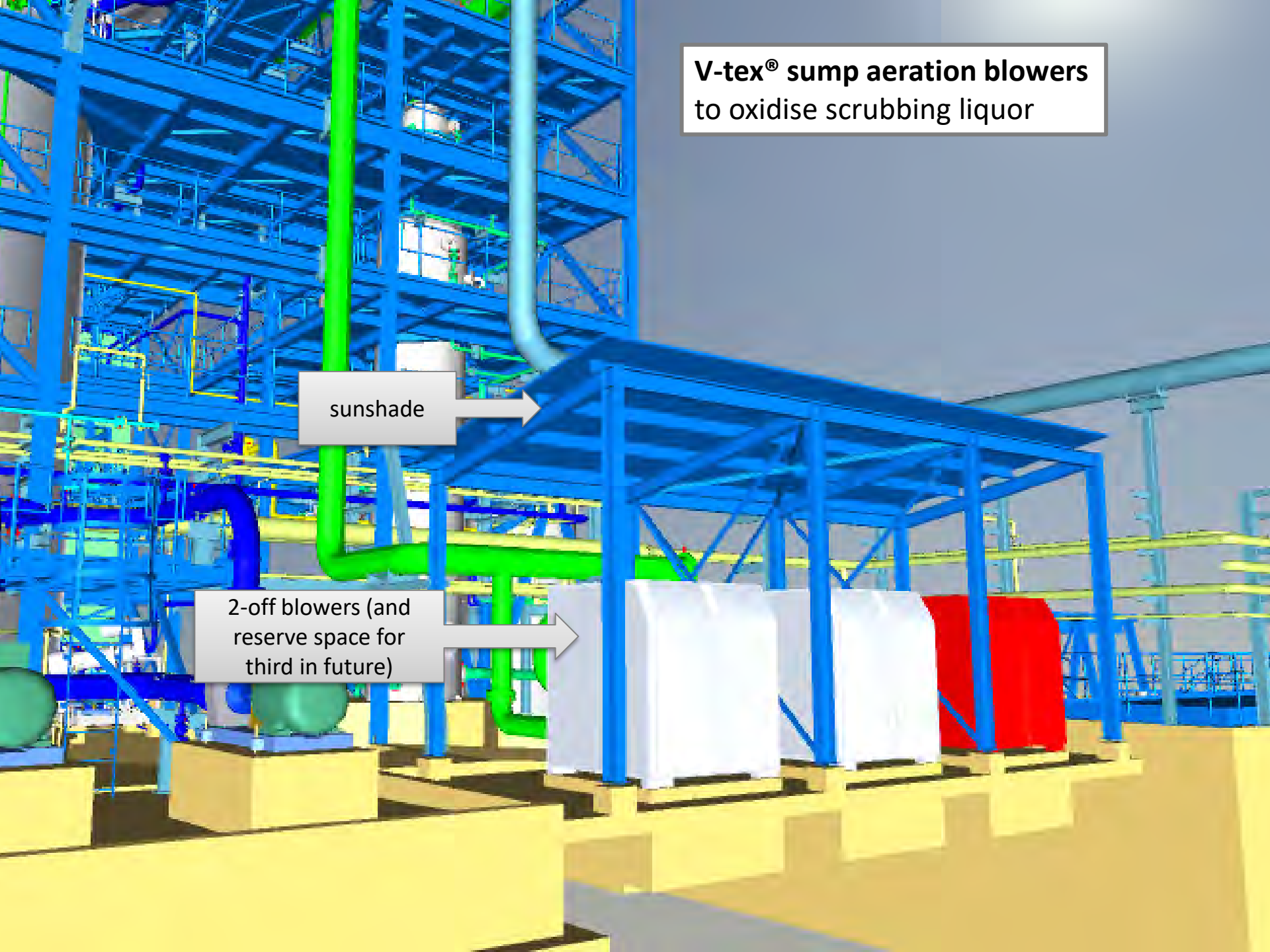


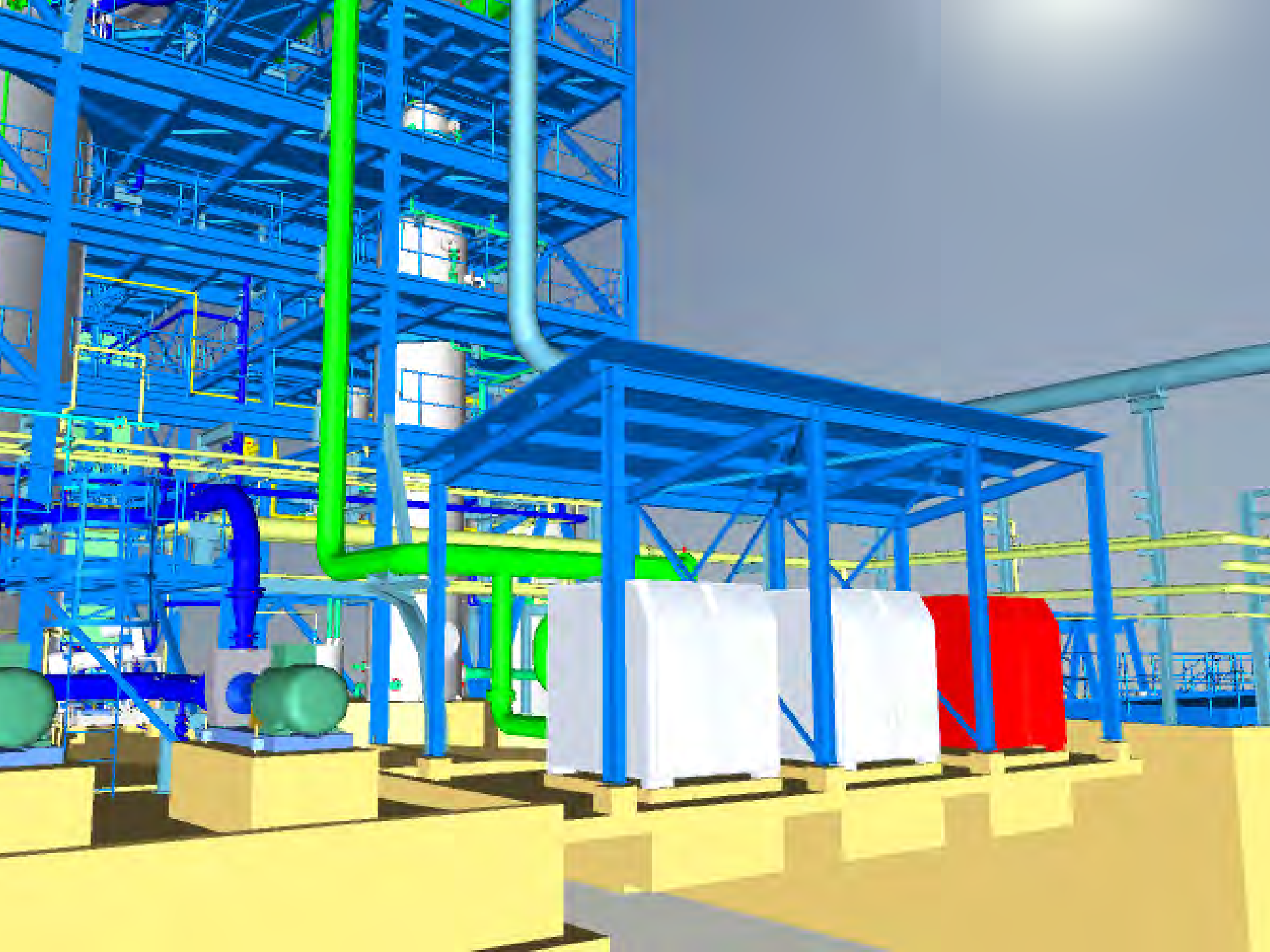

GRP V-tex recirc pumps
Supply limestone suspension to V-tex® scrubbing chambers for SO_2 scrubbing
Ceramic pumps, 400m³/hr at 5 bar

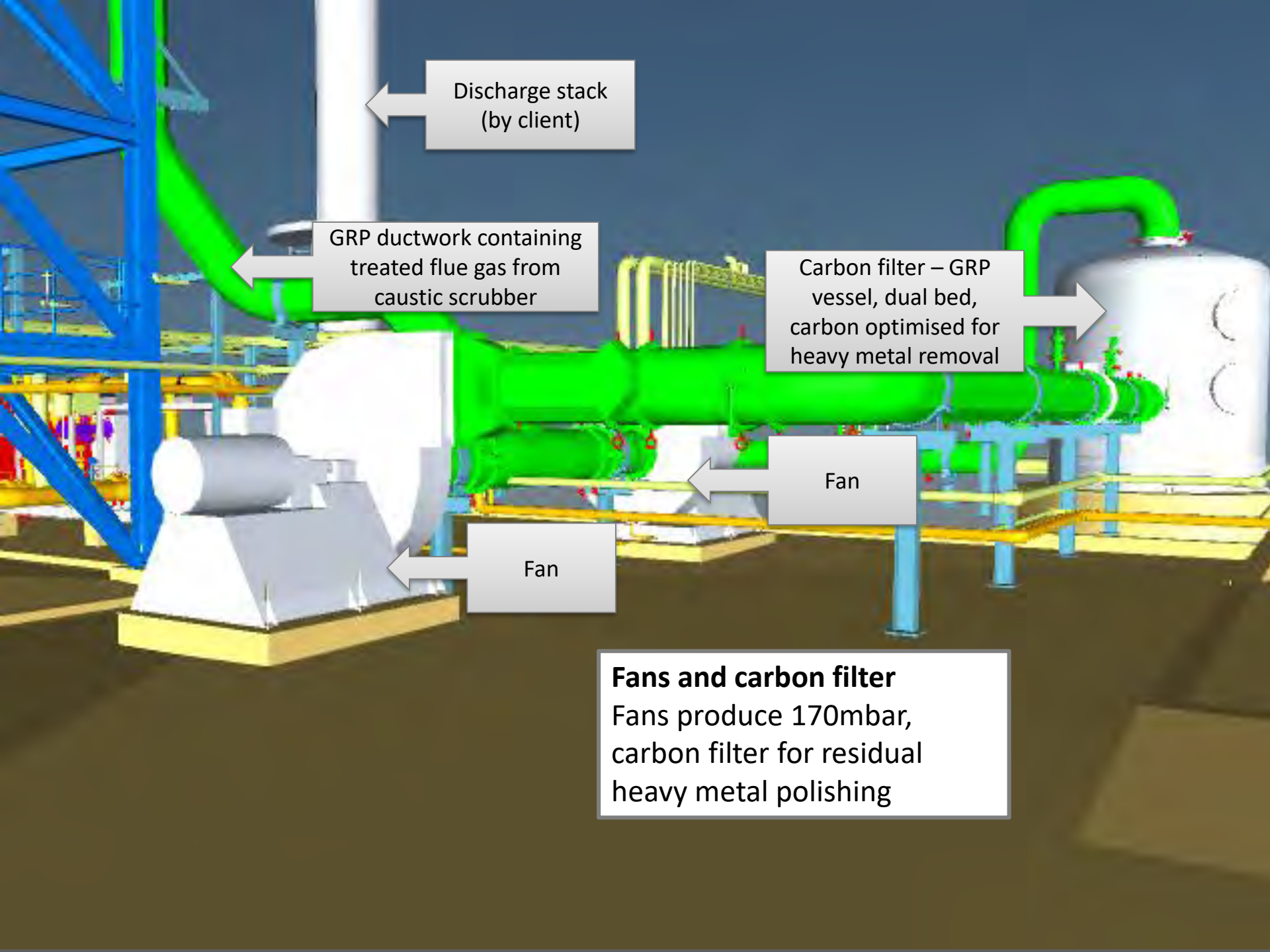



V-tex® recirc heat exchanger
To remove heat of reaction from scrubbing liquor
2.5MW stainless steel shell and tube heat exchanger, ASME VIII, TEMA C

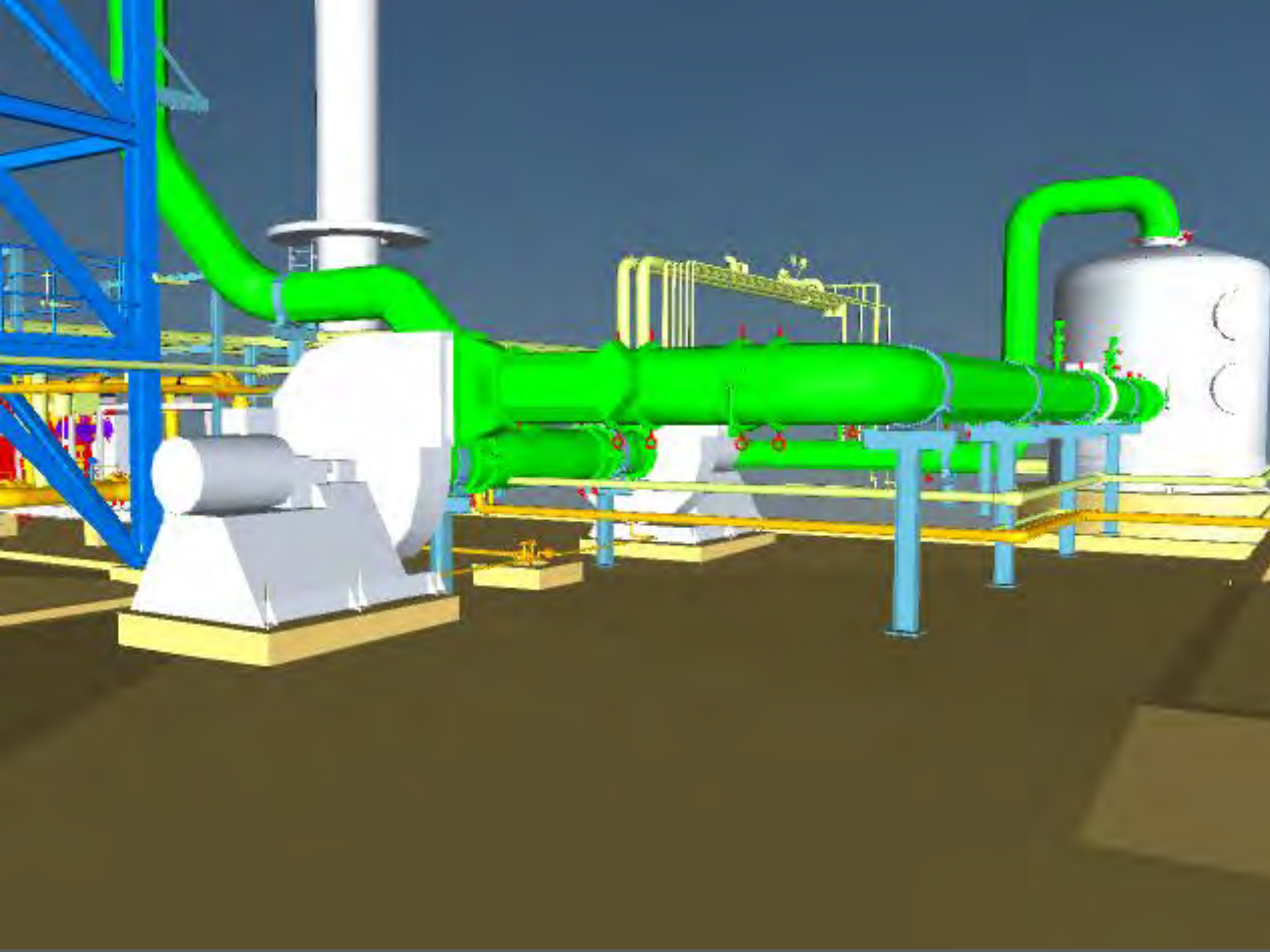


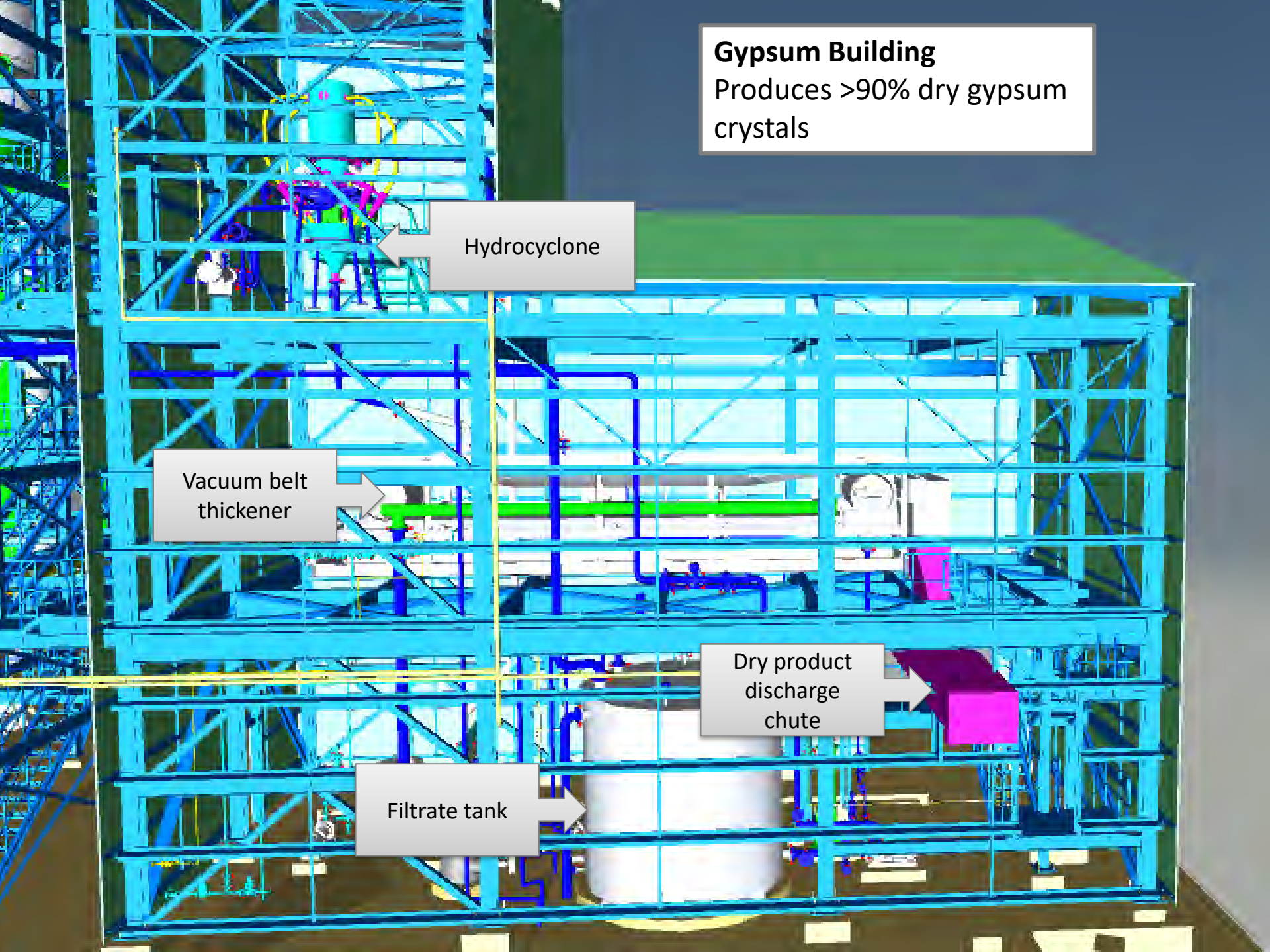

V-tex® sump aeration blowers
to oxidise scrubbing liquor
sunshade
2-off blowers (and reserve space for third in future)





Fans and carbon filter
Fans produce 170mbar, carbon filter for residual heavy metal polishing




Gypsum Building
Produces >90% dry gypsum crystals
Hydrocyclone
Vacuum belt thickener
Dry product discharge chute
Filtrate tank

For more information or to discuss your specific industrial gas cleaning application, please contact ERG

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