



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



Google Earth images

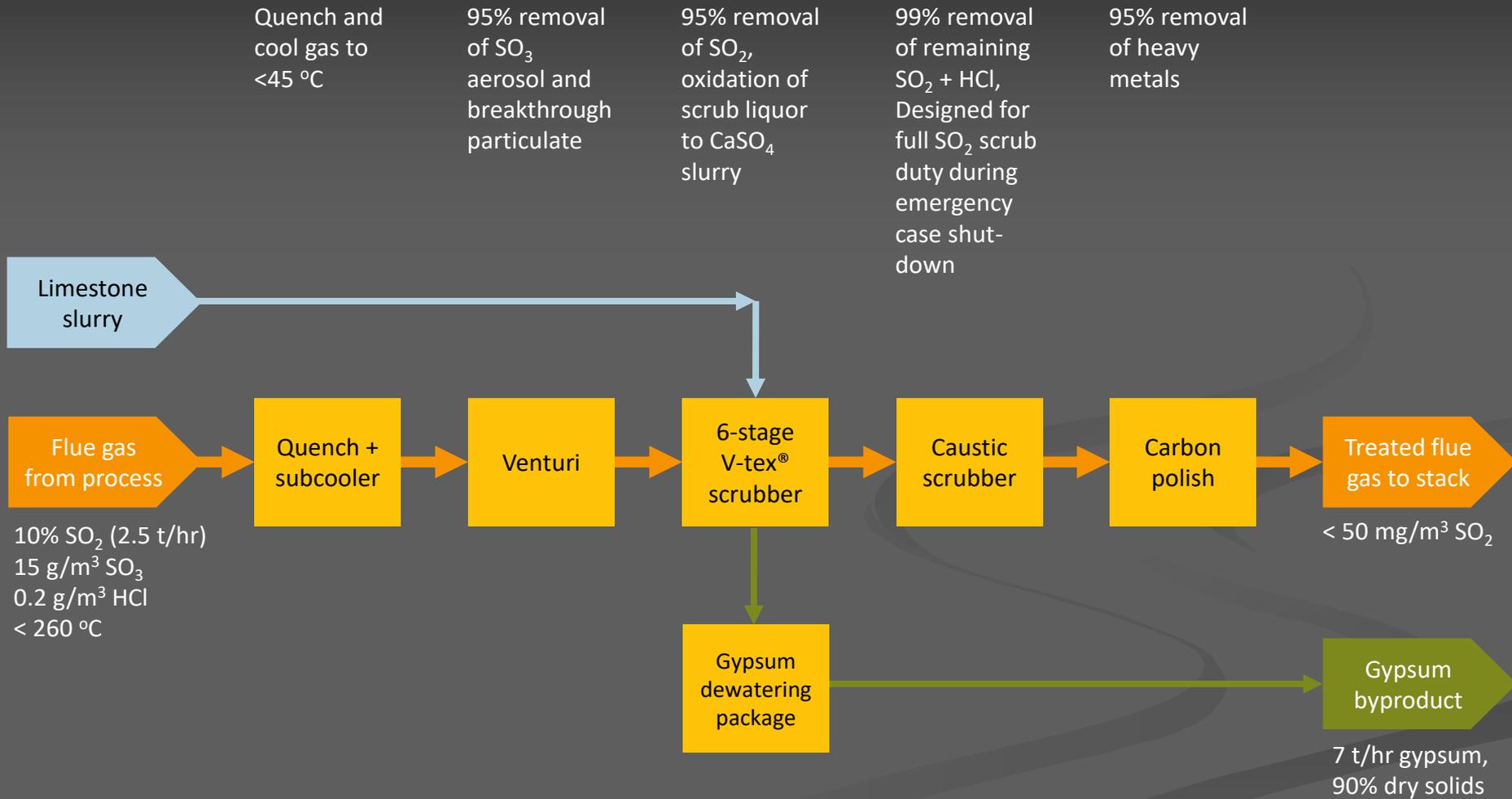
Project Overview – The Client's Process

- 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 (SO₂) 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°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 SO₂ plus some SO₃, 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

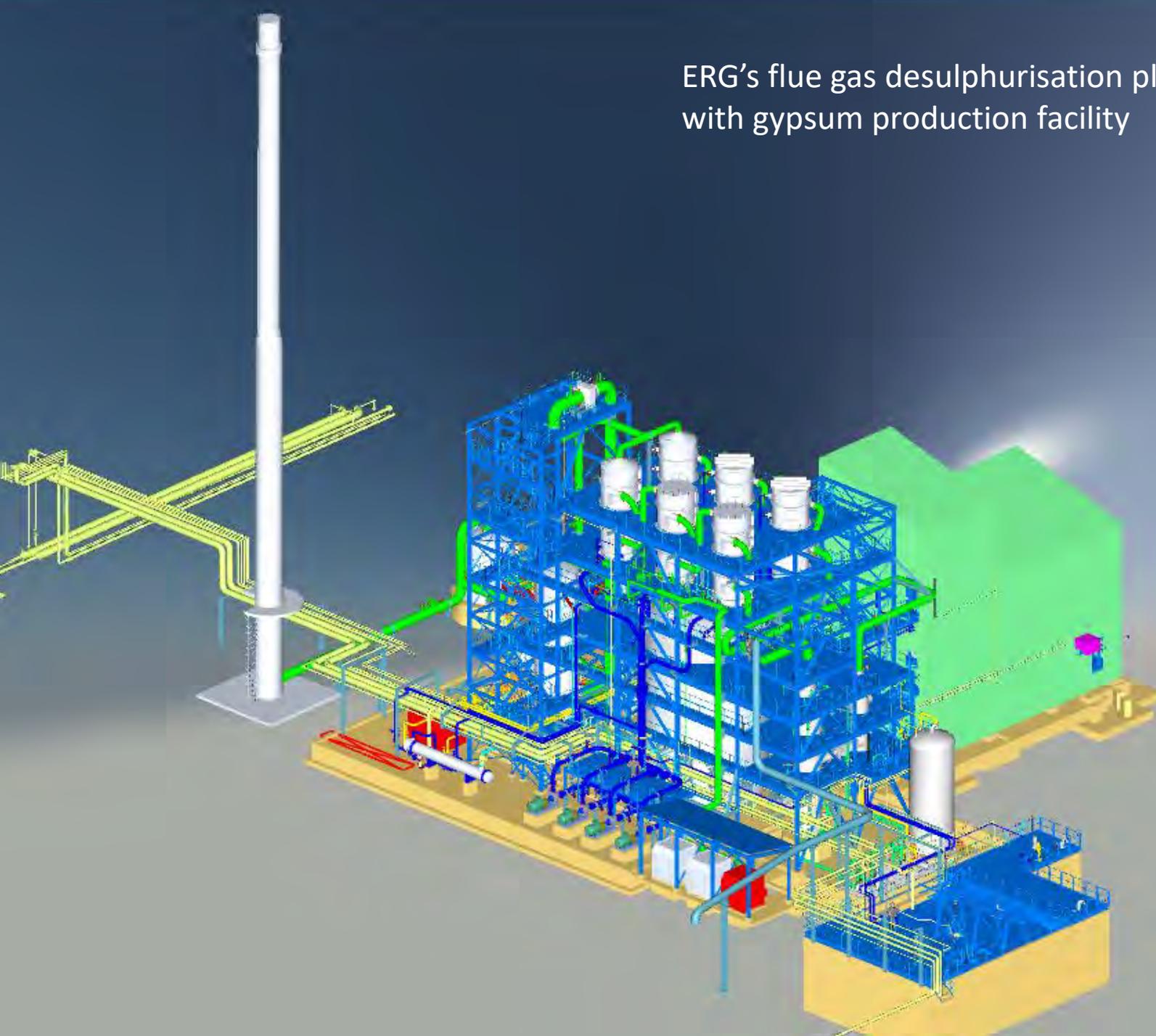
Why did the customer use ERG for this project?

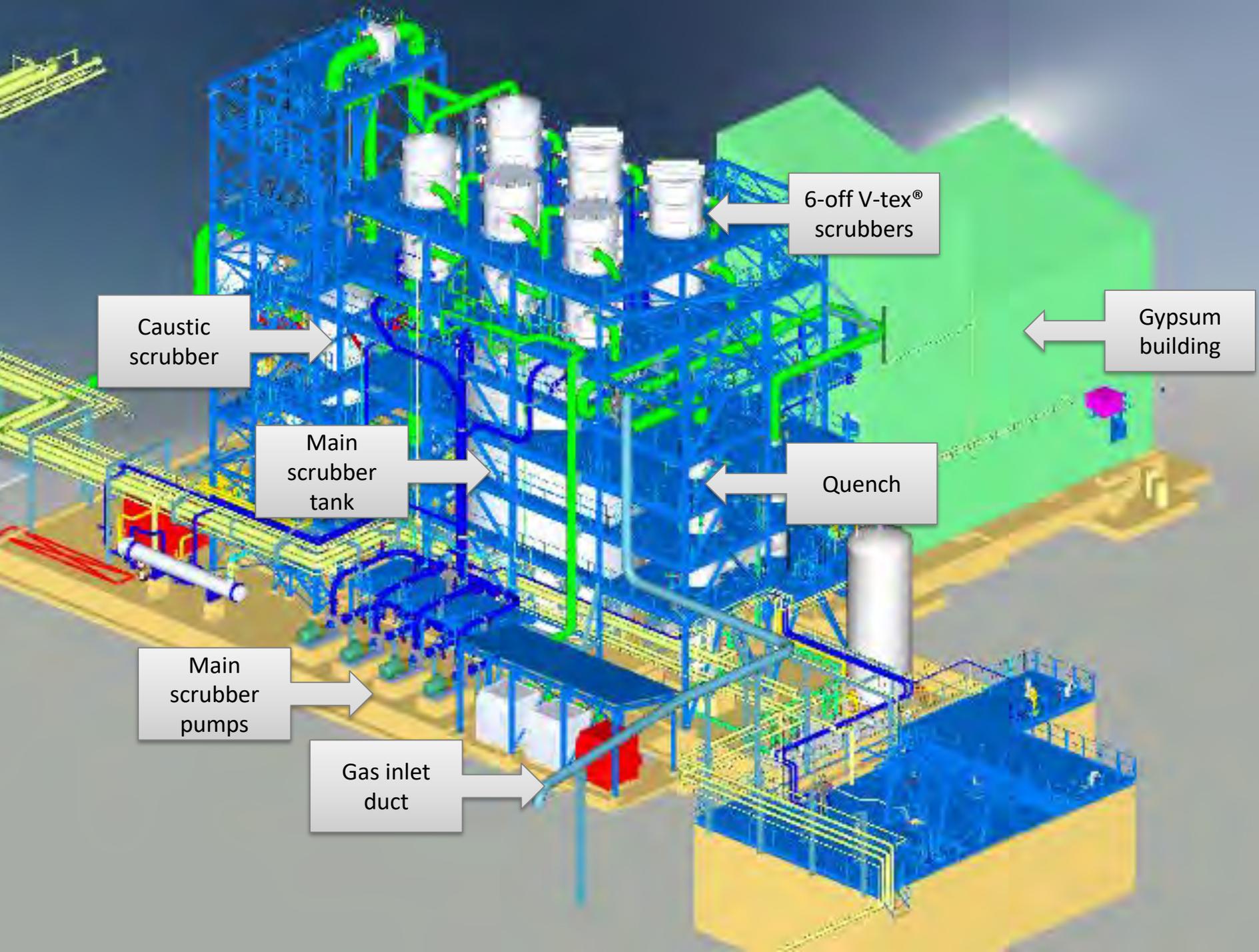
- ERG is a specialist gas cleaning process contractor able to design and manage a project of this size and complexity and we employ highly experienced process, mechanical and electrical engineers, 3D CAD designers, project managers and site/commissioning managers → throughout the FEED and EPC parts of 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 SO₂ 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-established 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

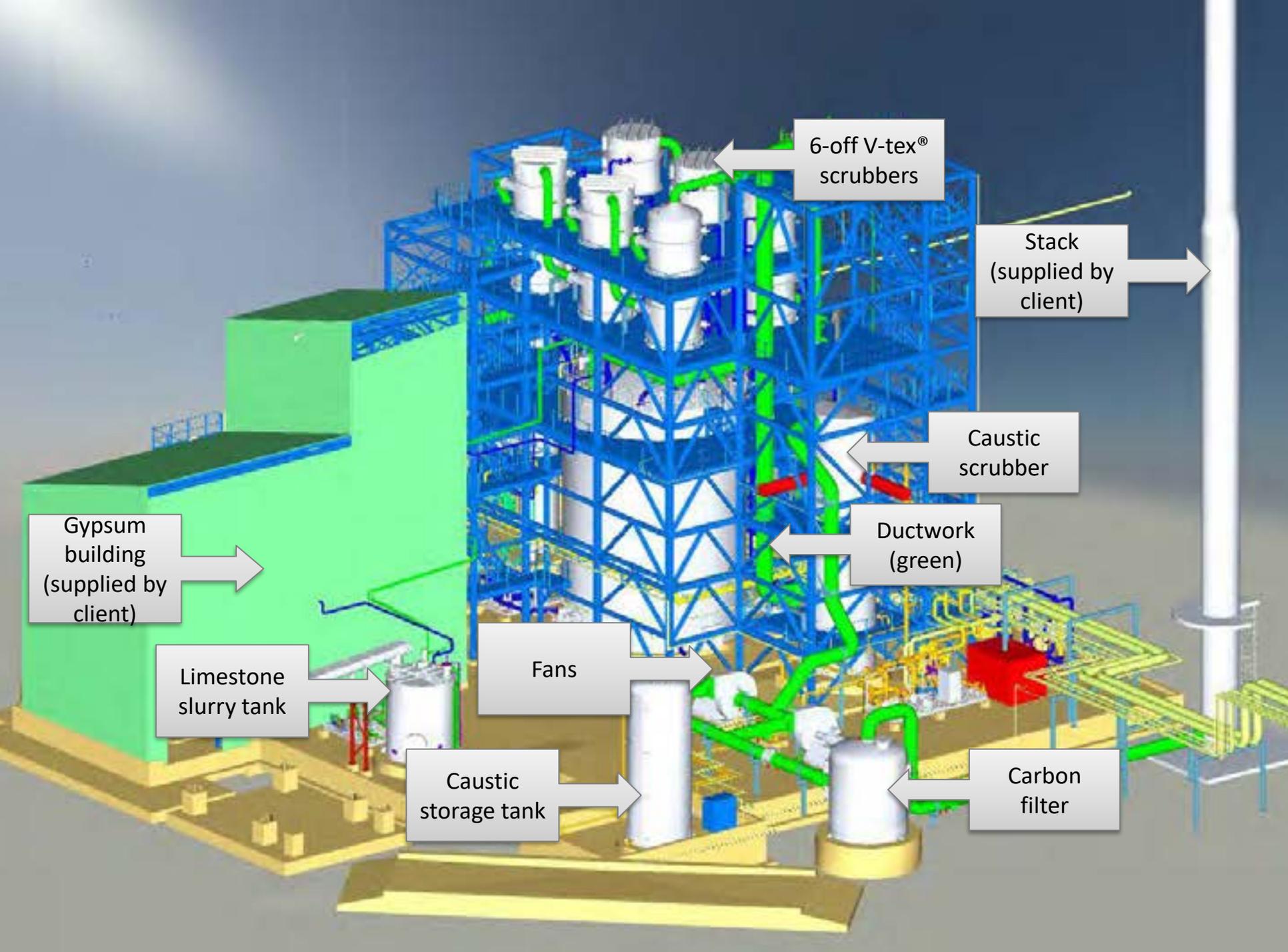
Gypsum
building

Main
scrubber
tank

Quench

Main
scrubber
pumps

Gas inlet
duct



Gypsum building (supplied by client)

Limestone slurry tank

Caustic storage tank

Fans

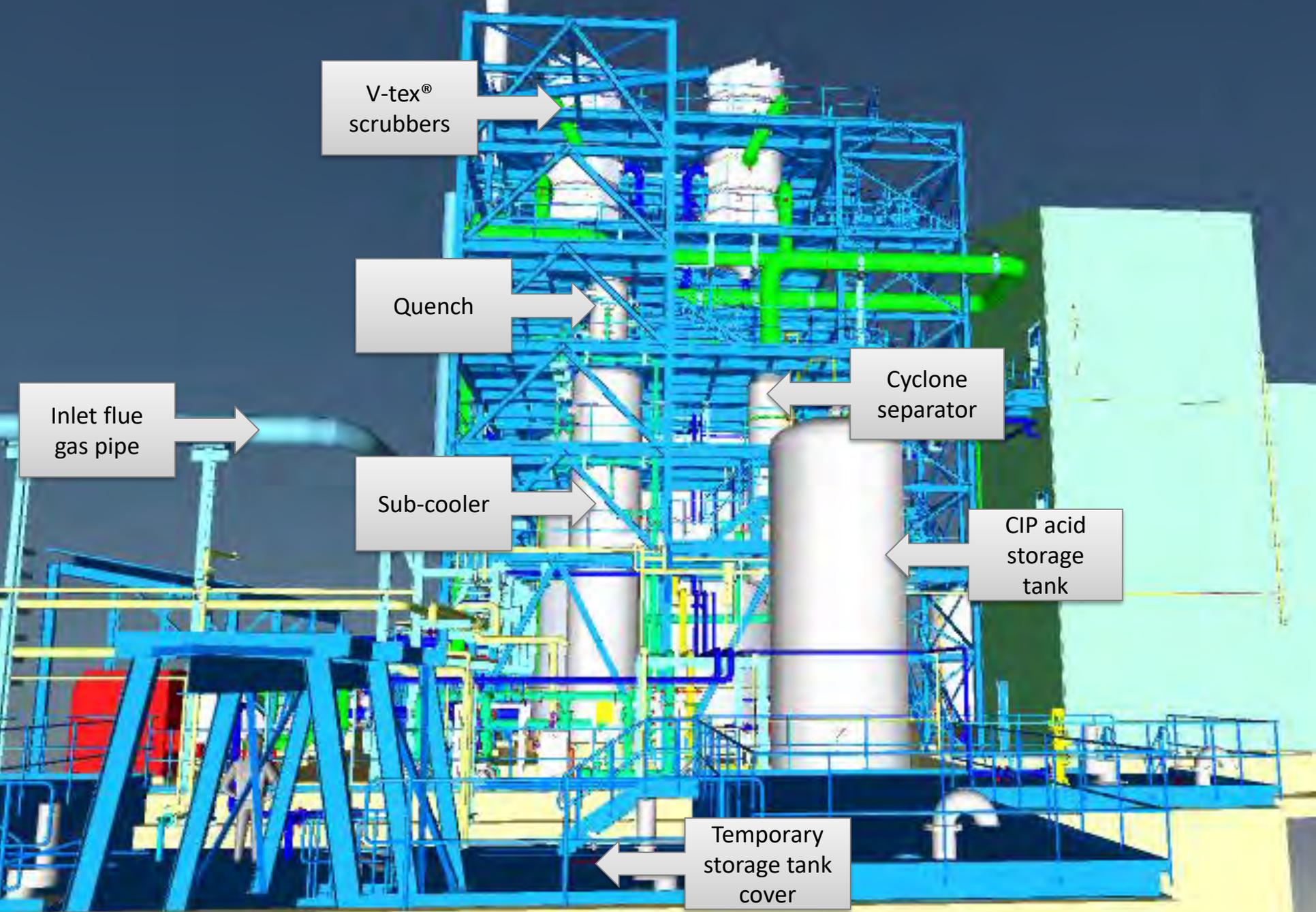
6-off V-tex® scrubbers

Caustic scrubber

Ductwork (green)

Stack (supplied by client)

Carbon filter



V-tex®
scrubbers

Quench

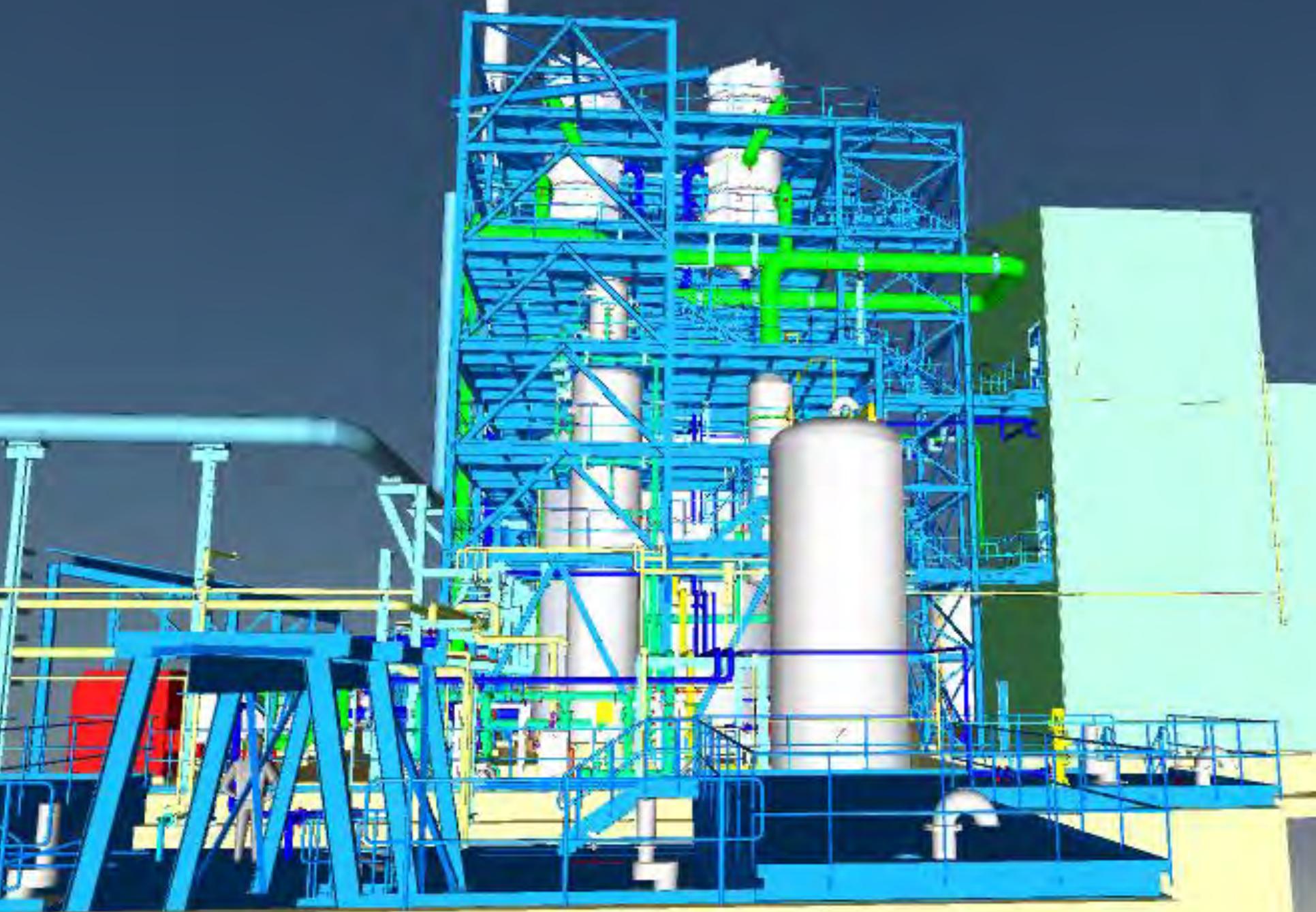
Inlet flue
gas pipe

Sub-cooler

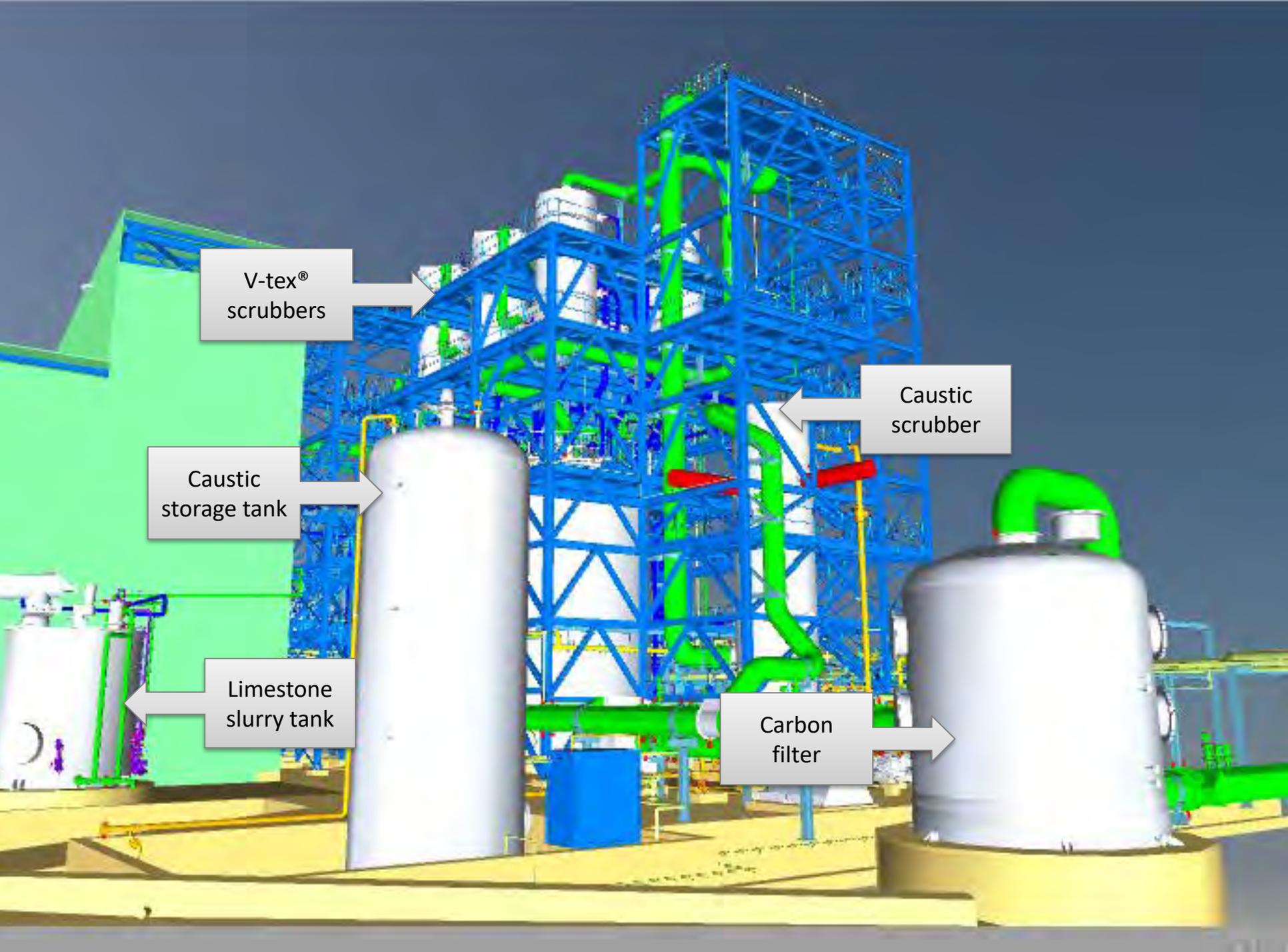
Cyclone
separator

CIP acid
storage
tank

Temporary
storage tank
cover







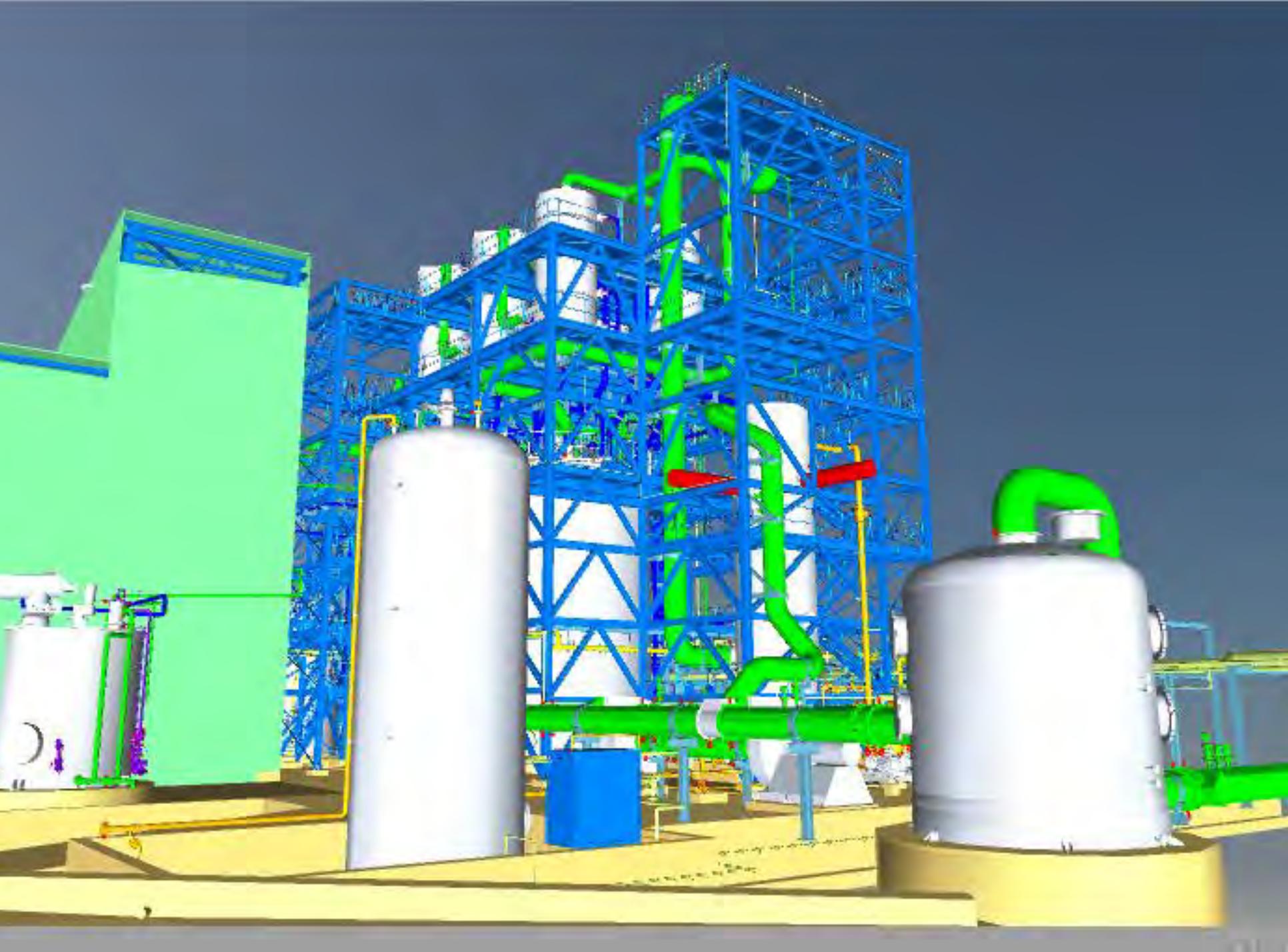
V-tex®
scrubbers

Caustic
storage tank

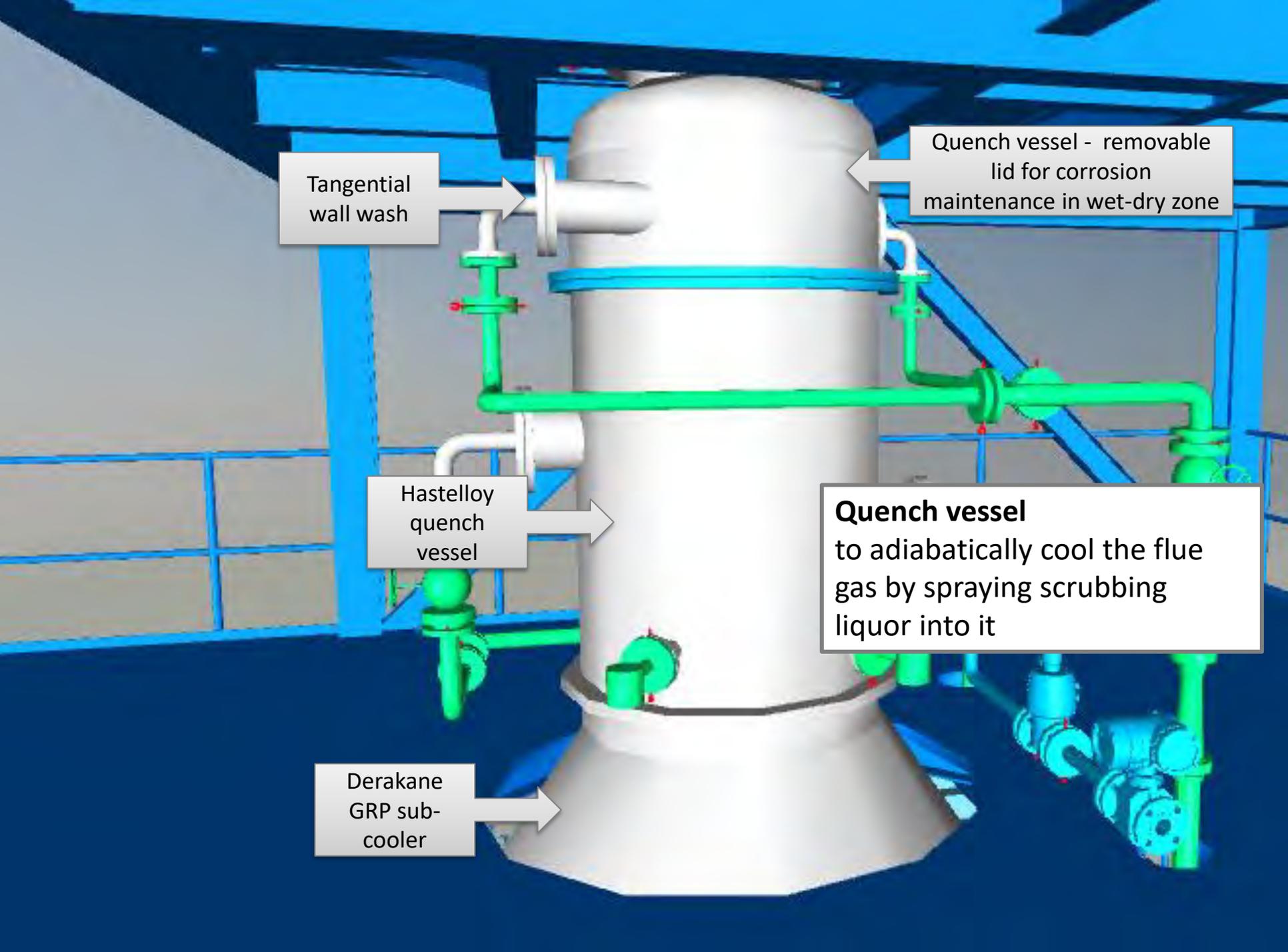
Limestone
slurry tank

Caustic
scrubber

Carbon
filter







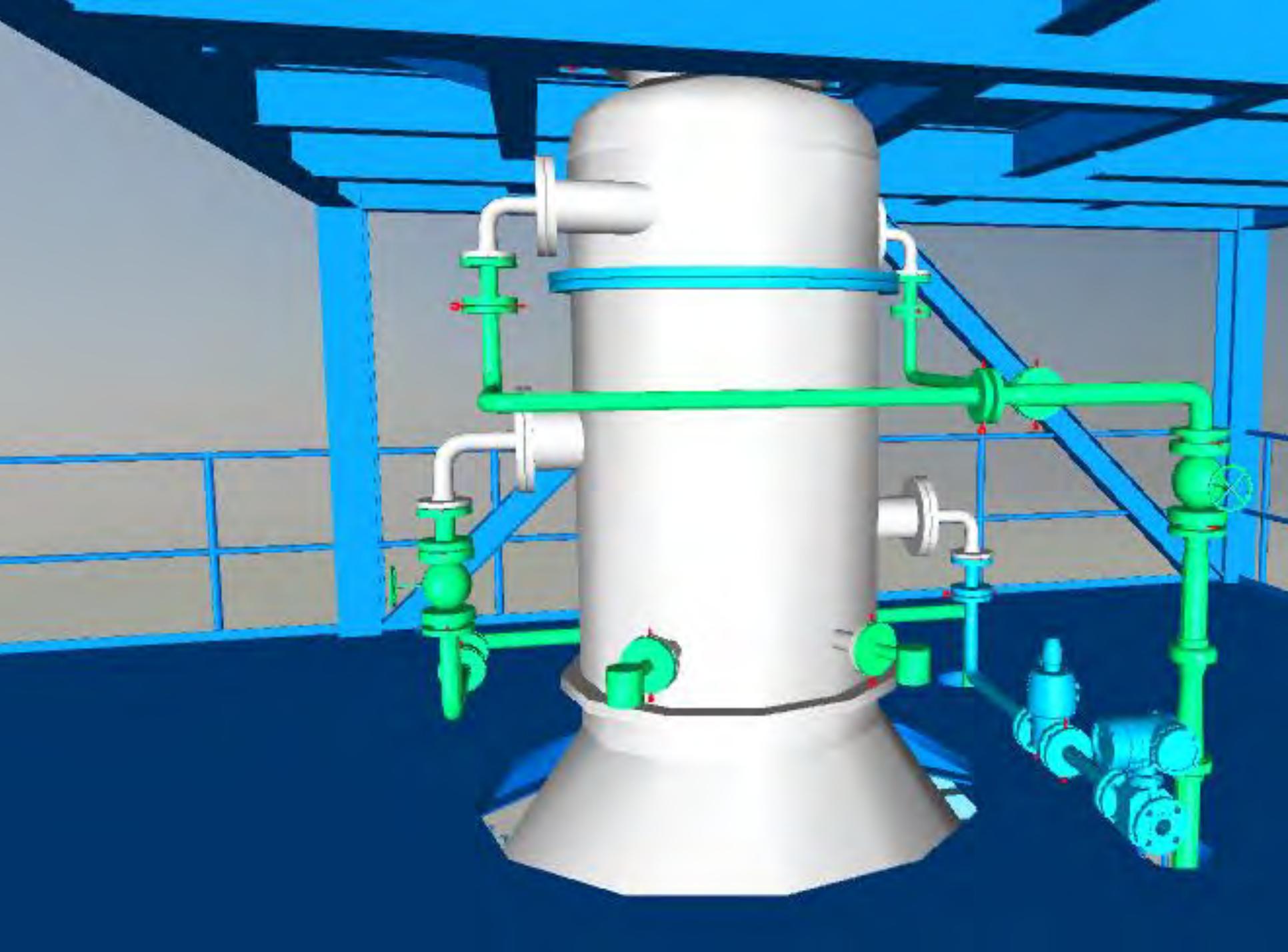
Tangential wall wash

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

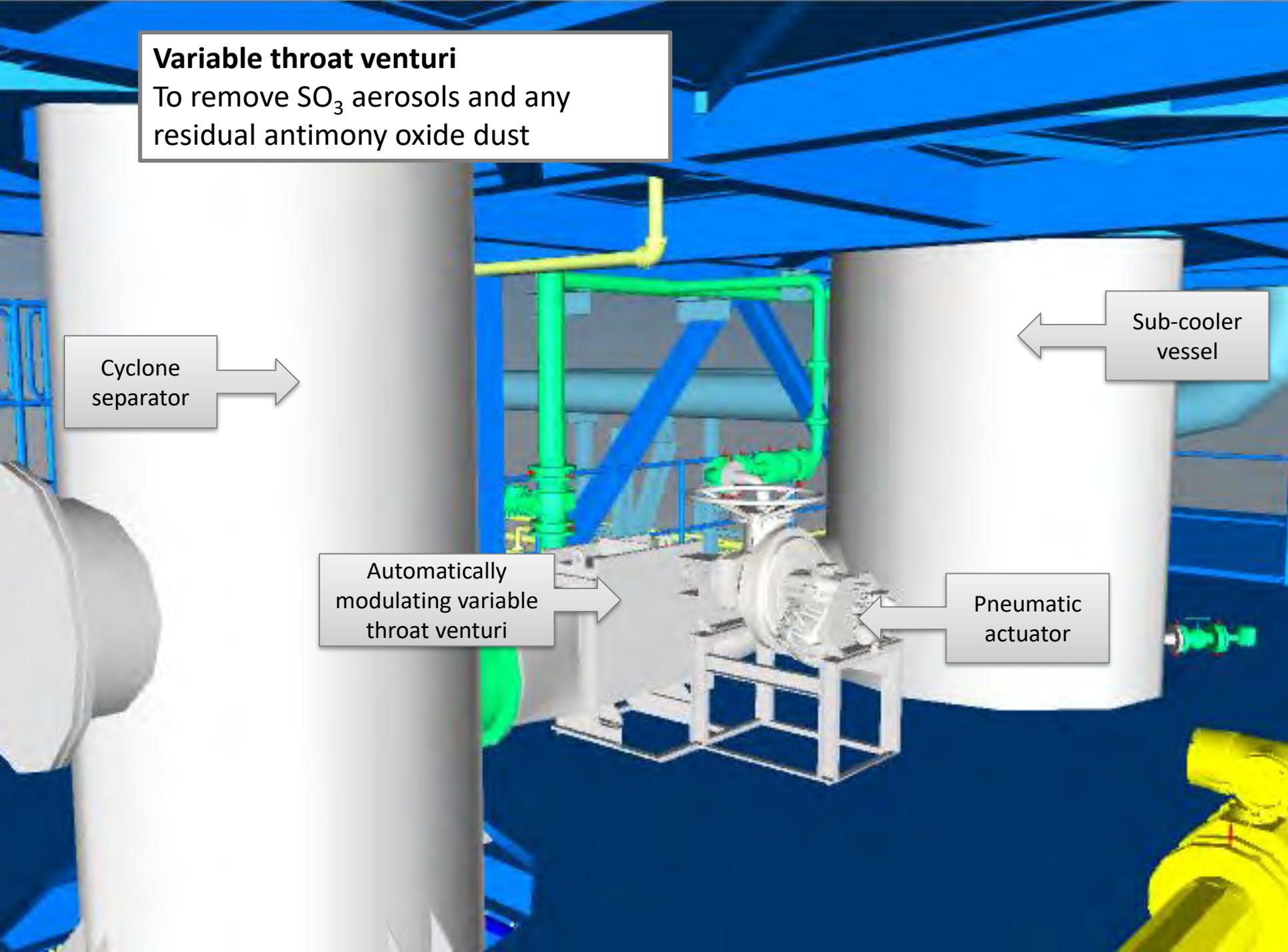
To remove SO_3 aerosols and any residual antimony oxide dust

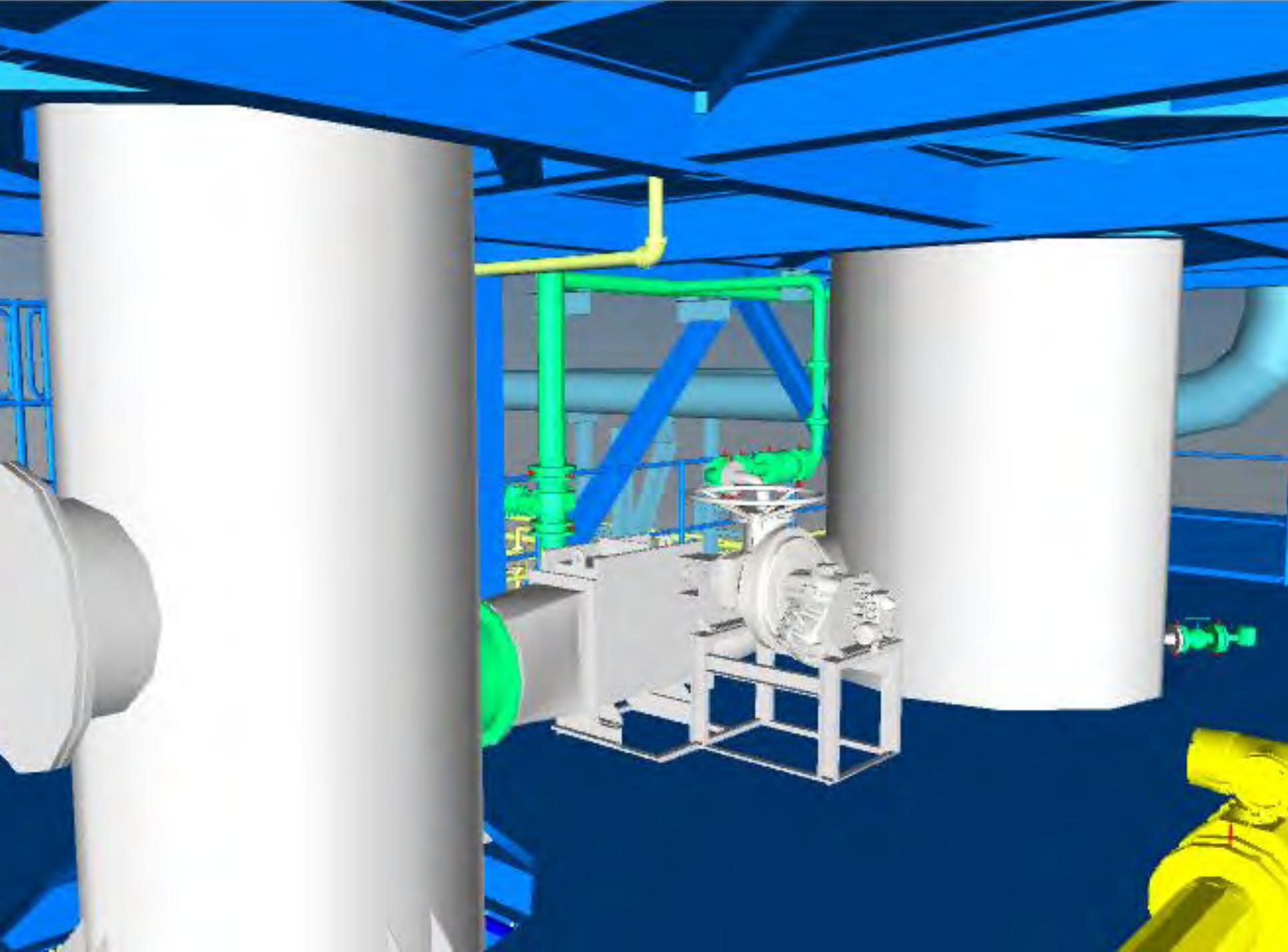
Cyclone separator

Sub-cooler vessel

Automatically modulating variable throat venturi

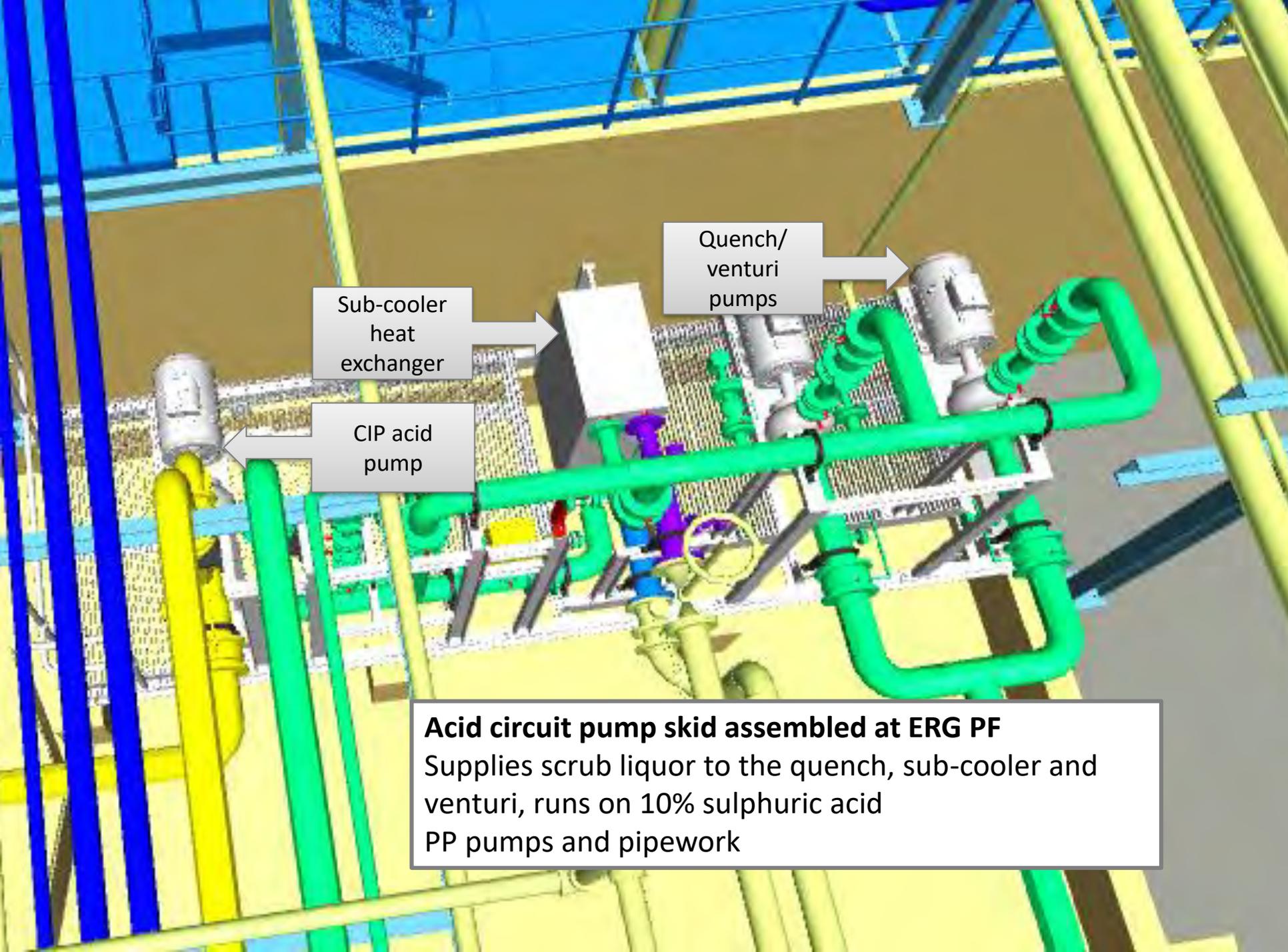
Pneumatic actuator







MADE IN UAE

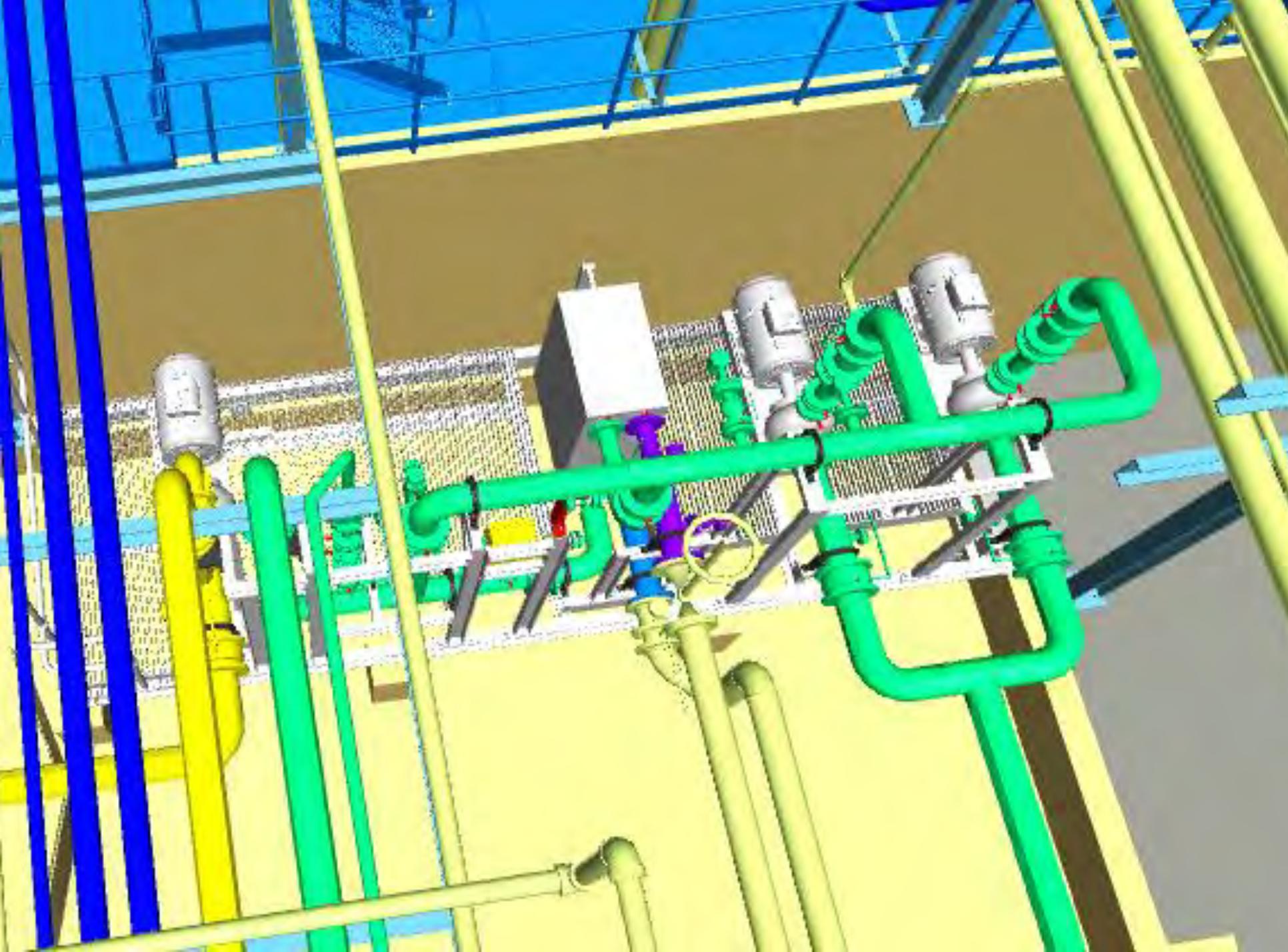


Sub-cooler
heat
exchanger

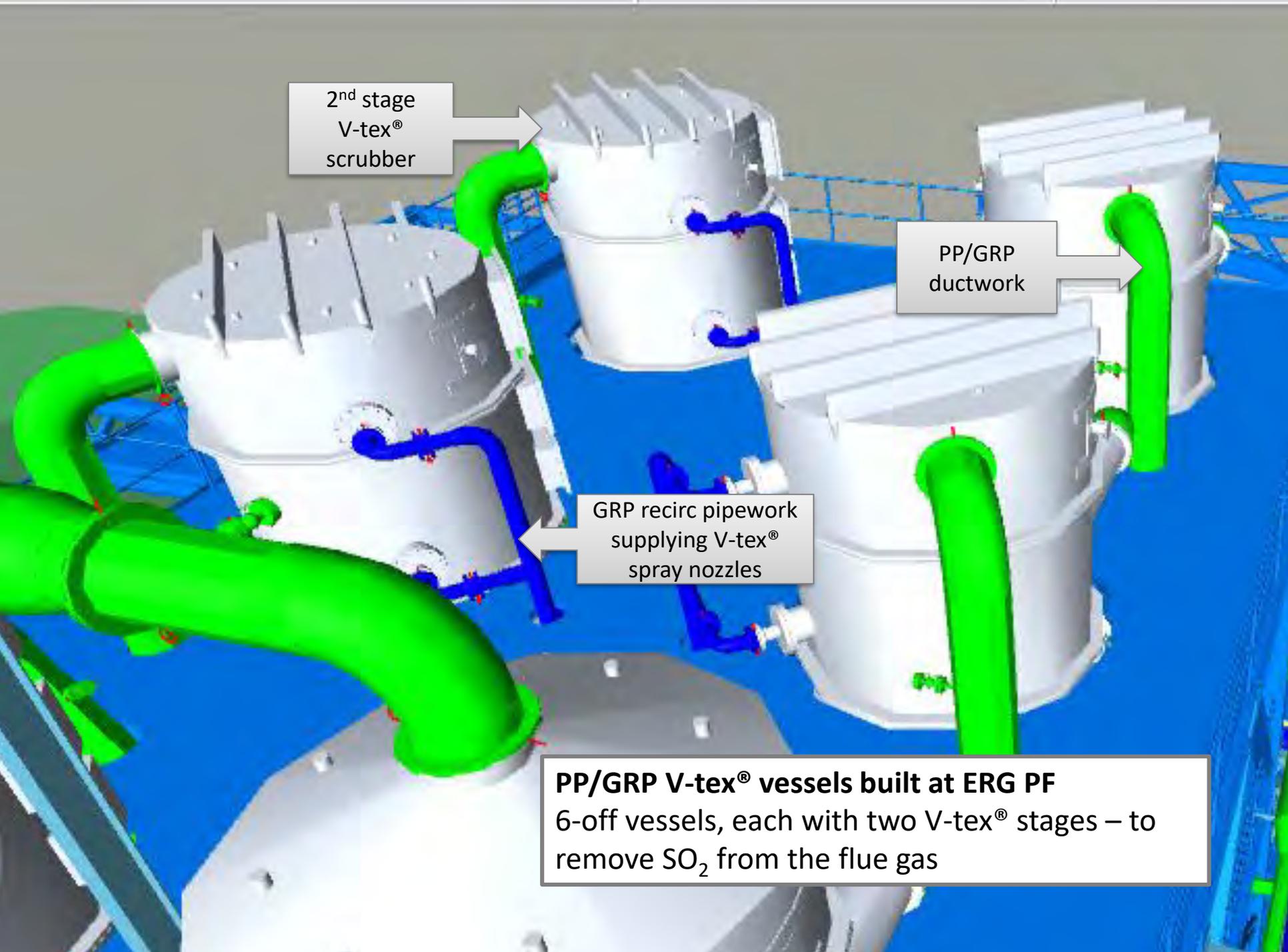
CIP acid
pump

Quench/
venturi
pumps

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





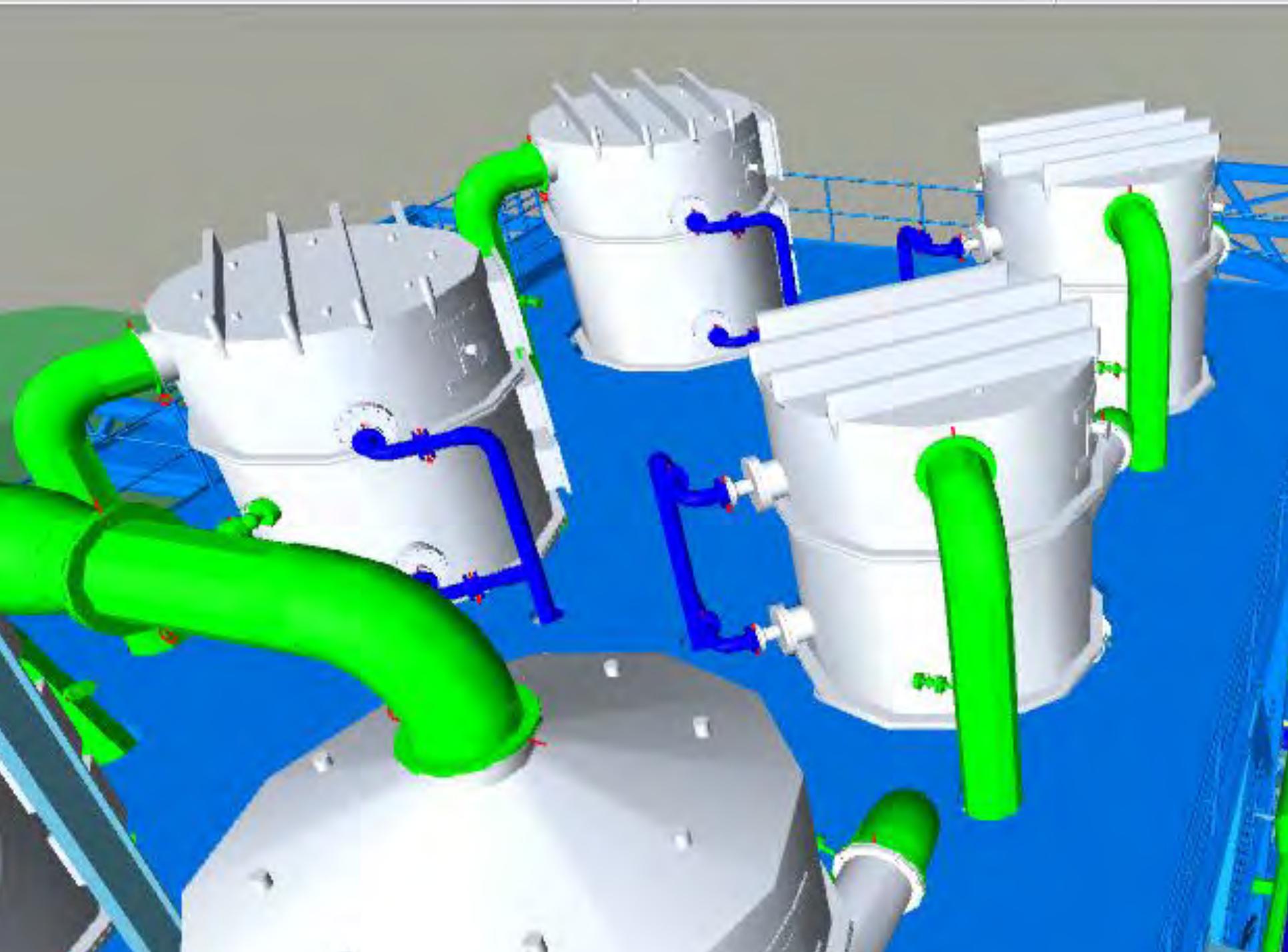


2nd stage
V-tex[®]
scrubber

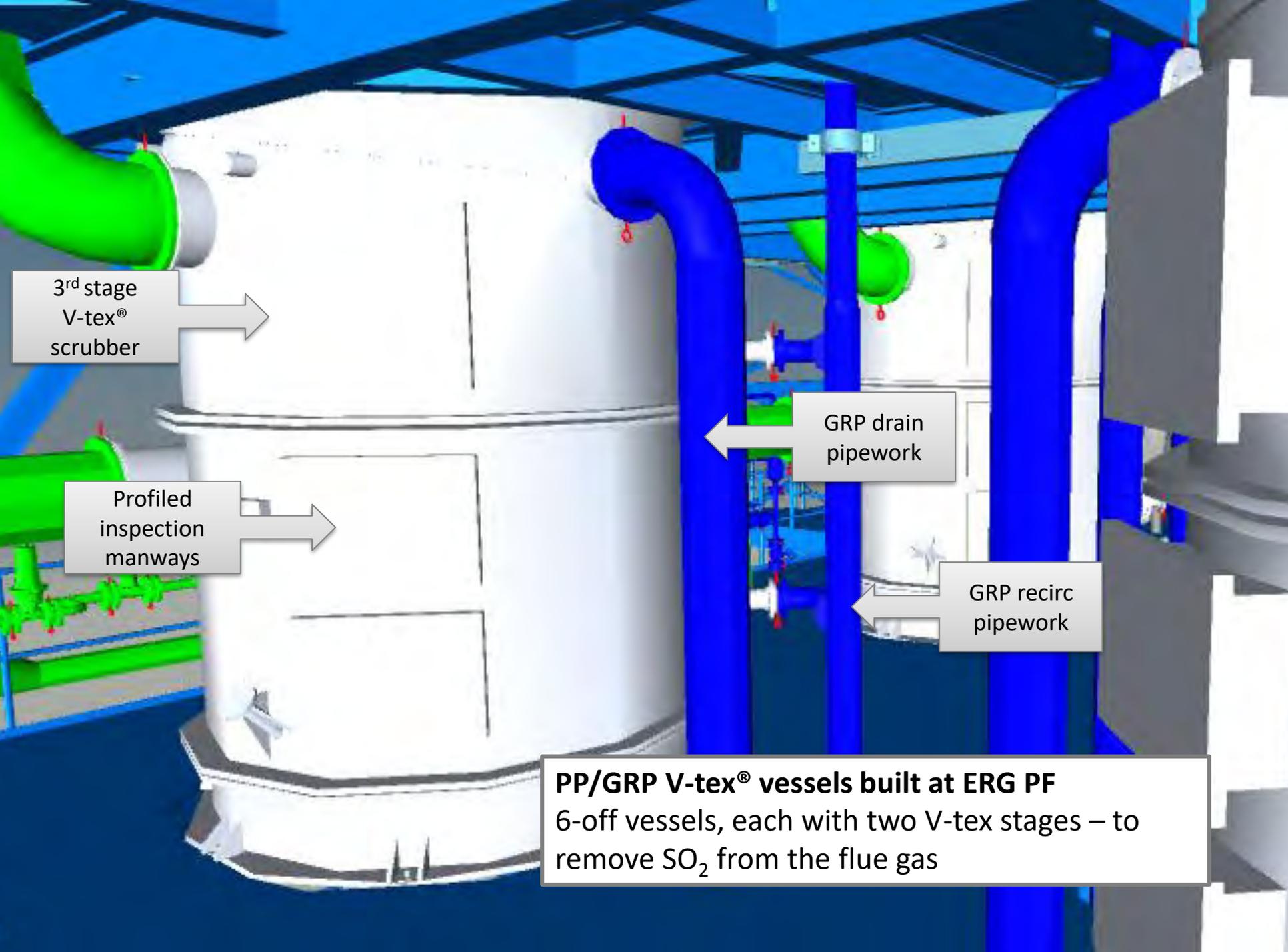
PP/GRP
ductwork

GRP recirc pipework
supplying V-tex[®]
spray nozzles

PP/GRP V-tex[®] vessels built at ERG PF
6-off vessels, each with two V-tex[®] stages – to
remove SO₂ from the flue gas







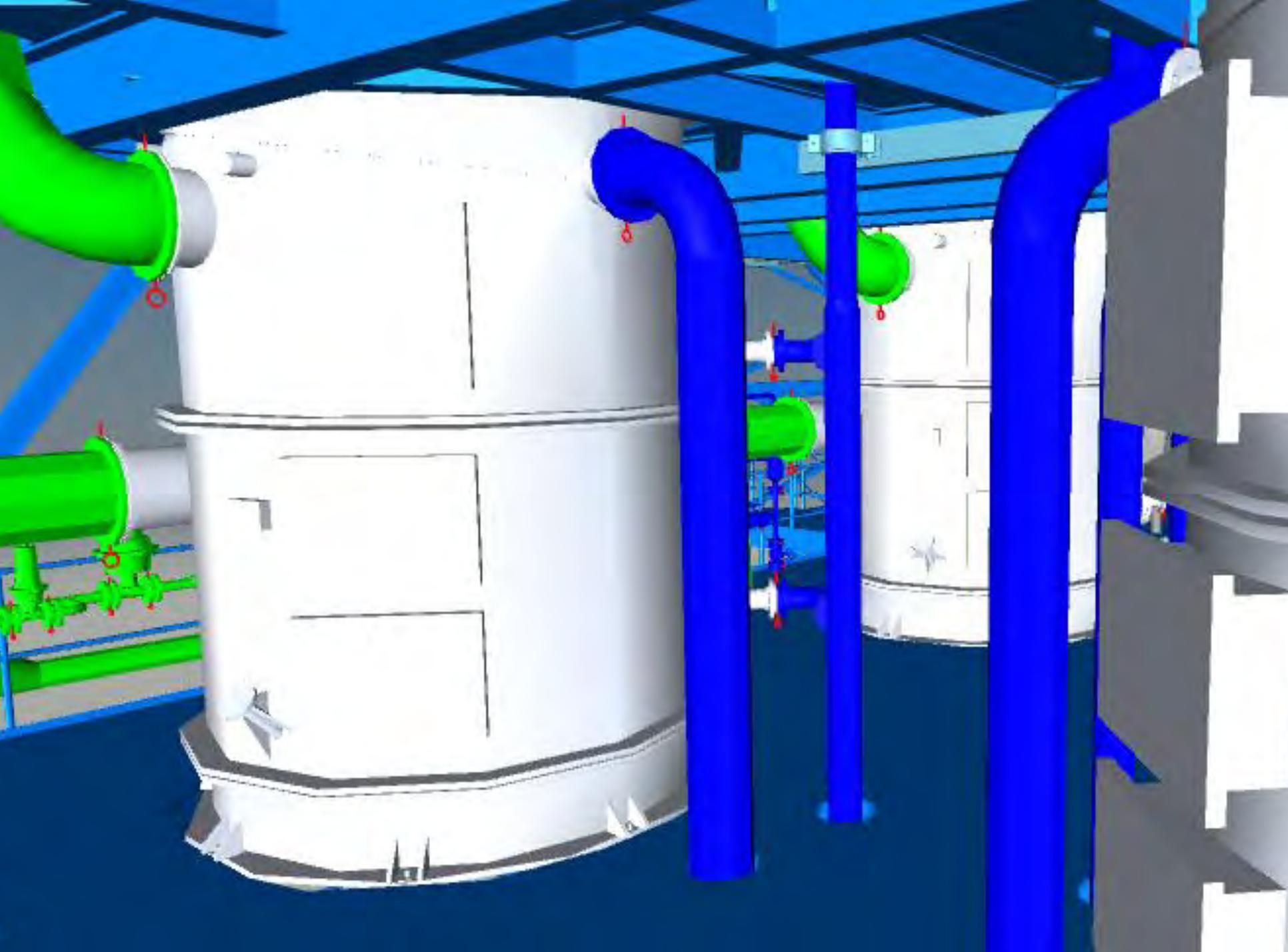
3rd stage
V-tex®
scrubber

Profiled
inspection
manways

GRP drain
pipework

GRP recirc
pipework

PP/GRP V-tex® vessels built at ERG PF
6-off vessels, each with two V-tex stages – to
remove SO₂ from the flue gas





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*

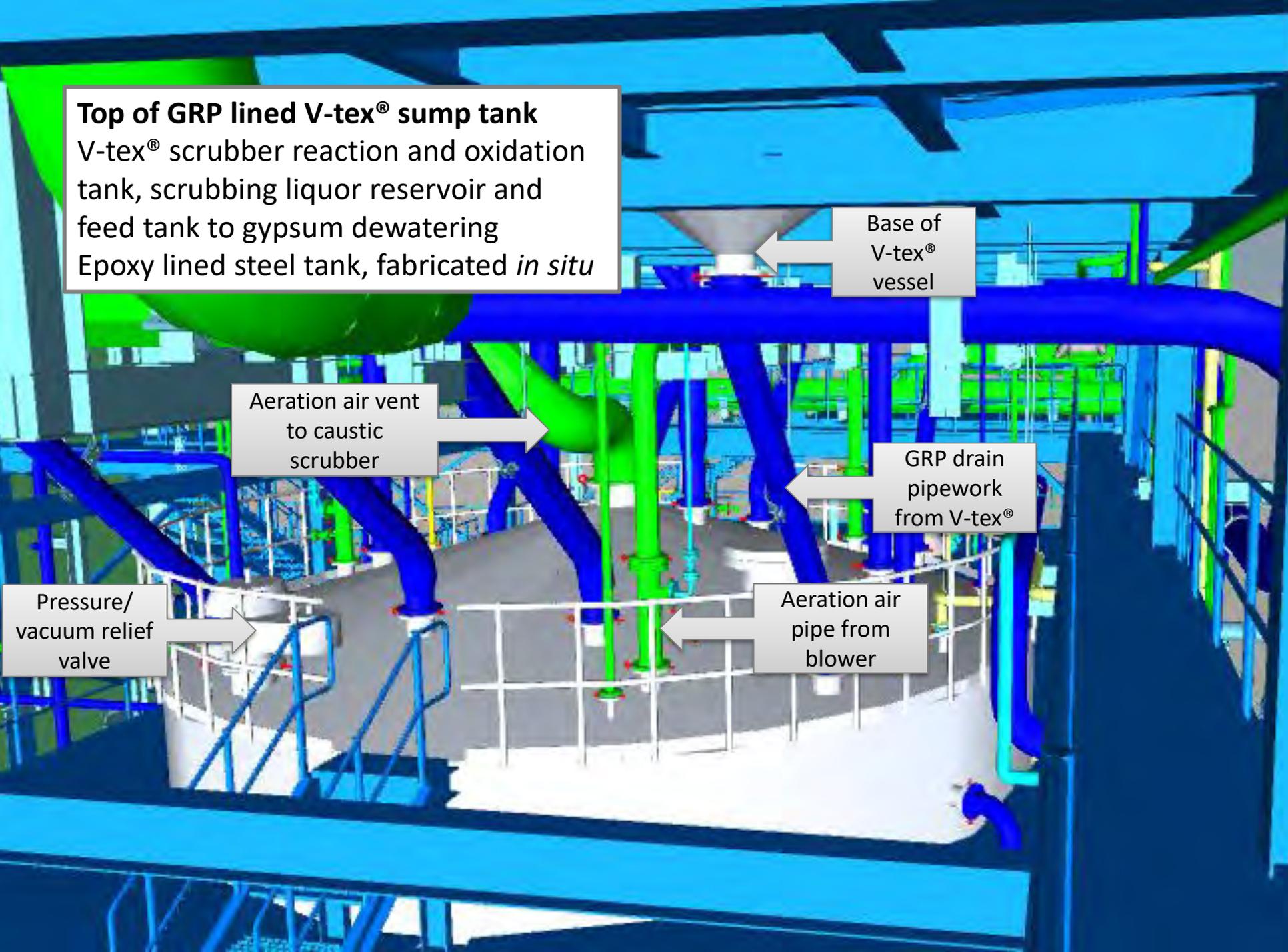
Base of
V-tex[®]
vessel

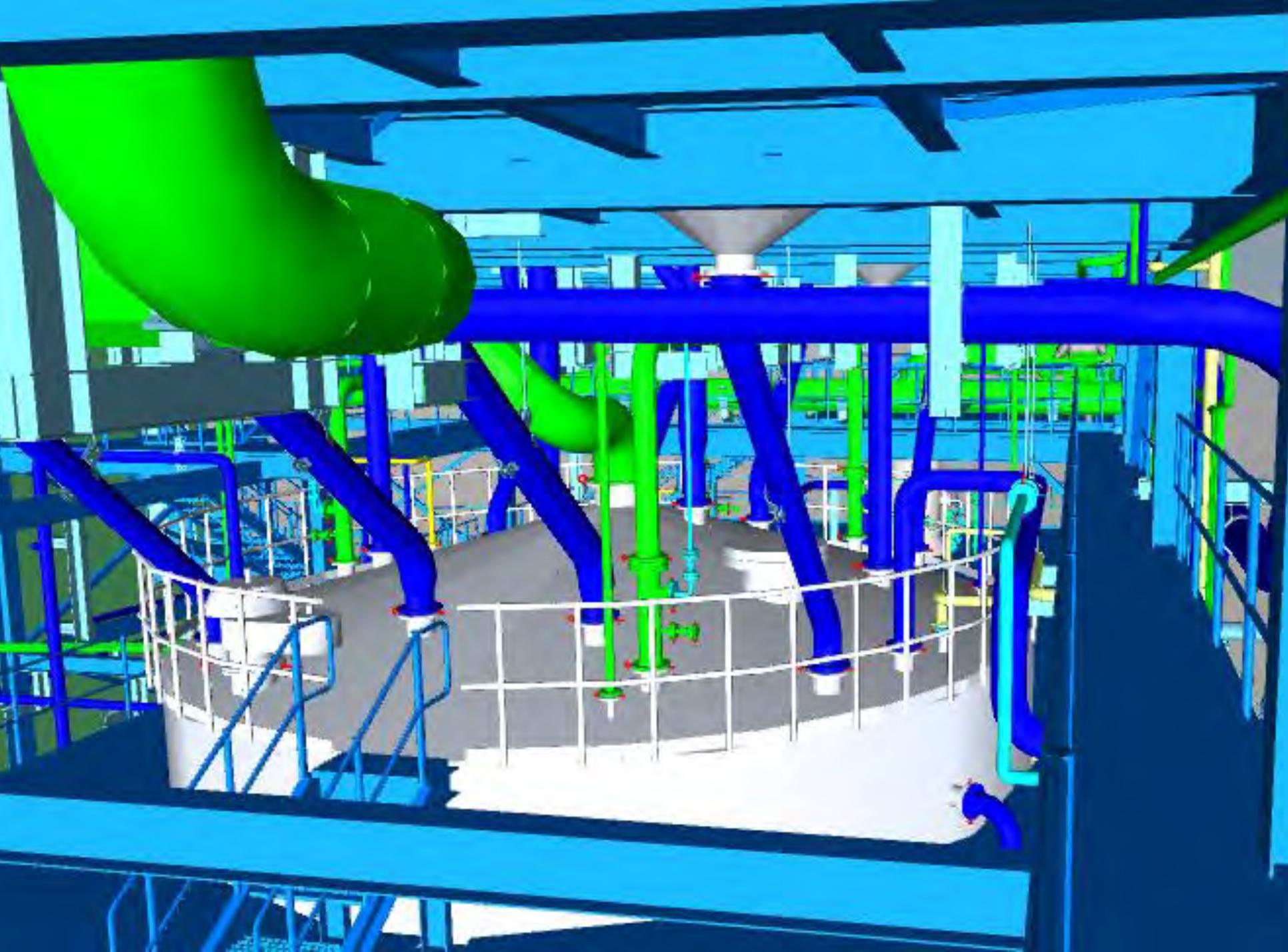
Aeration air vent
to caustic
scrubber

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

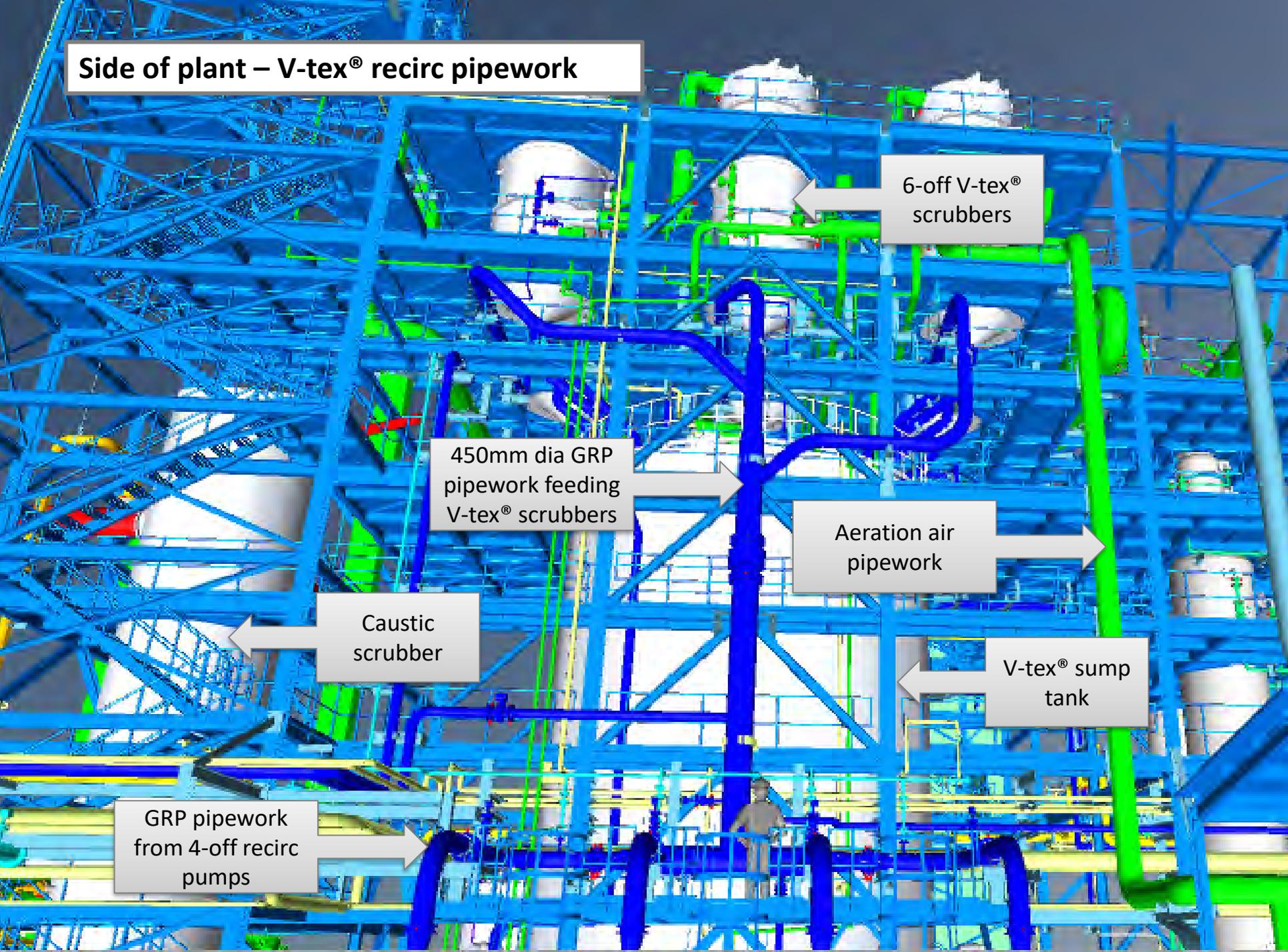
450mm dia GRP pipework feeding V-tex® scrubbers

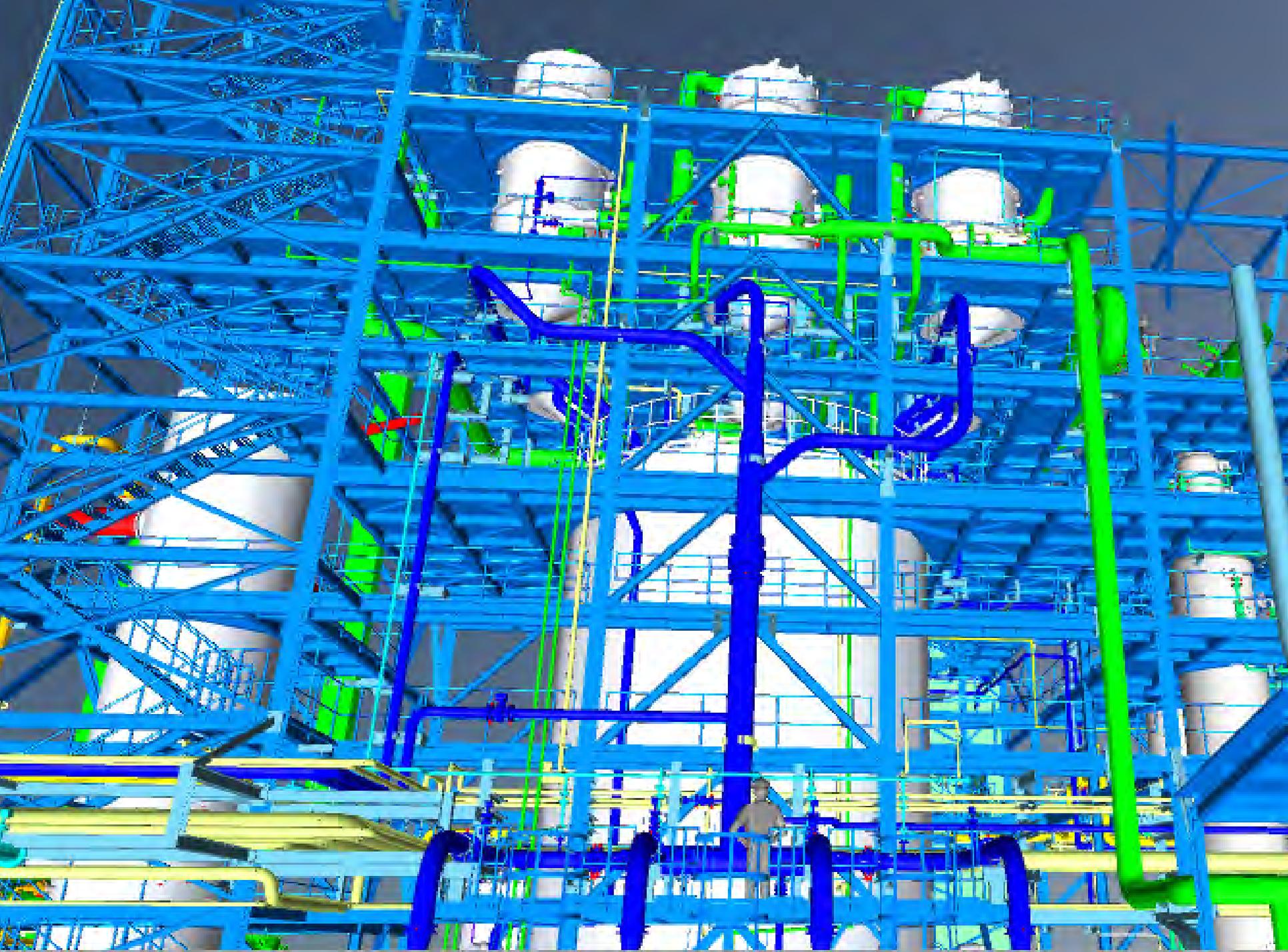
Aeration air pipework

Caustic scrubber

V-tex® sump tank

GRP pipework from 4-off recirc pumps

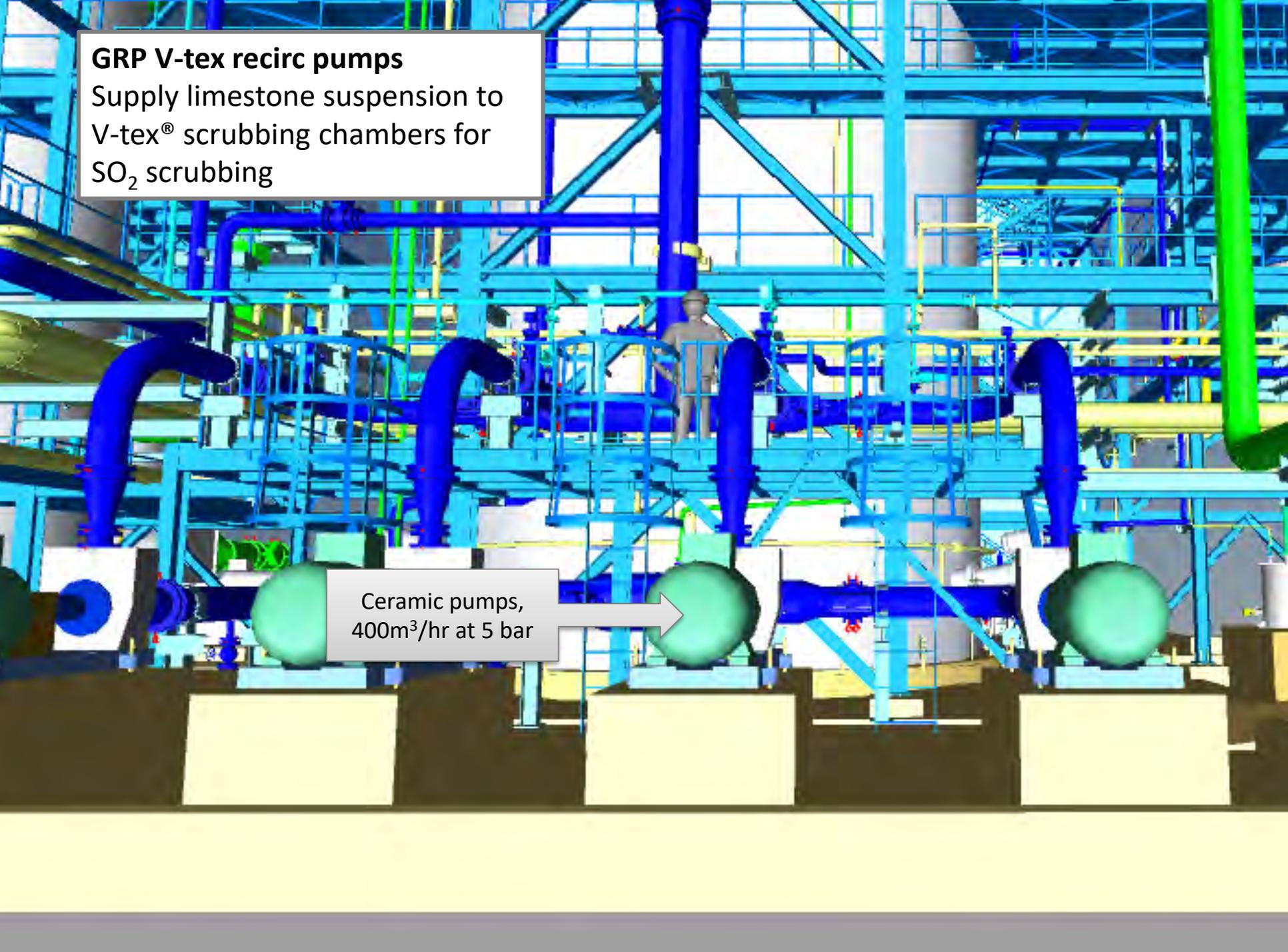




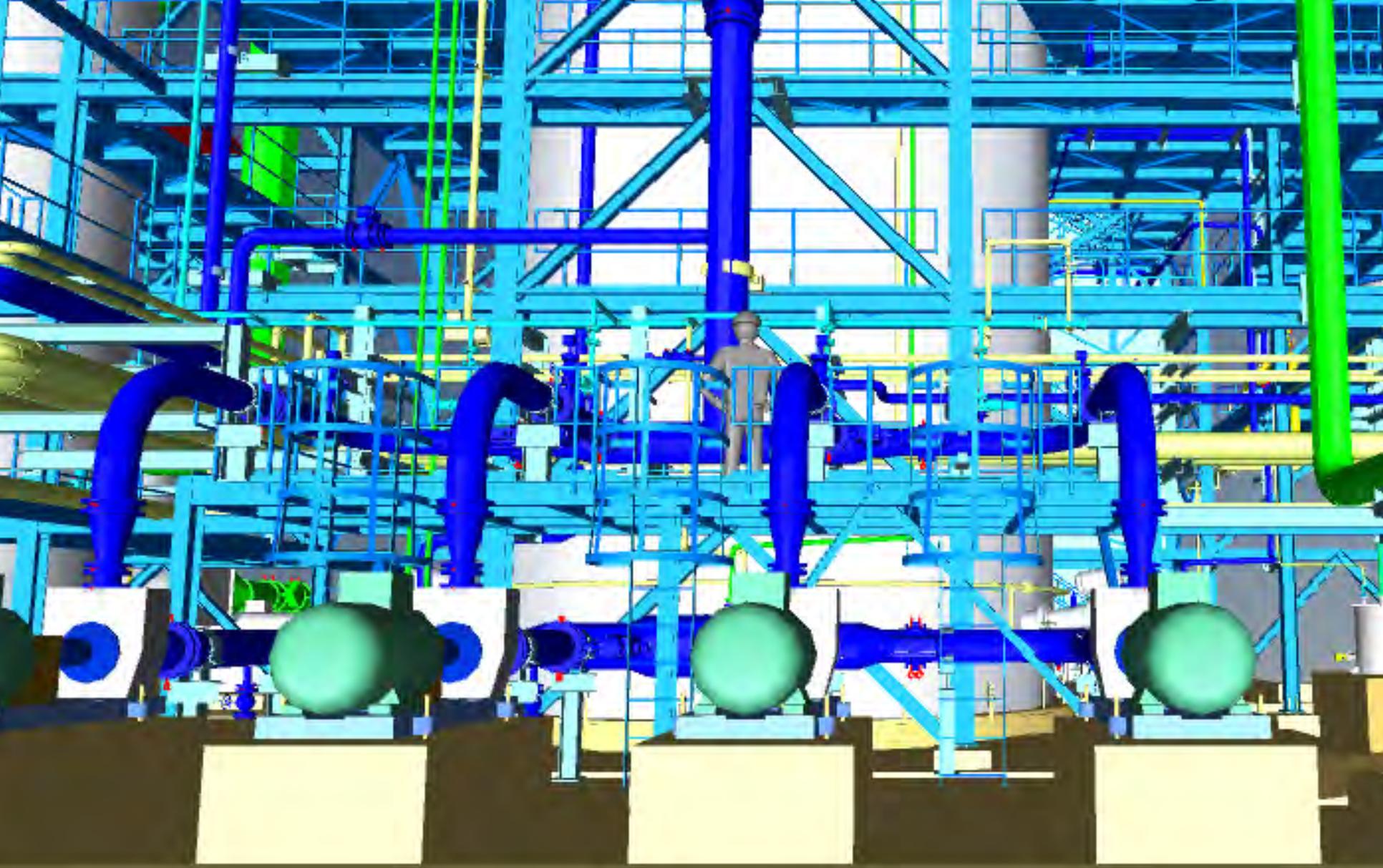


GRP V-tex recirc pumps

Supply limestone suspension to V-tex® scrubbing chambers for SO₂ scrubbing



Ceramic pumps,
400m³/hr at 5 bar





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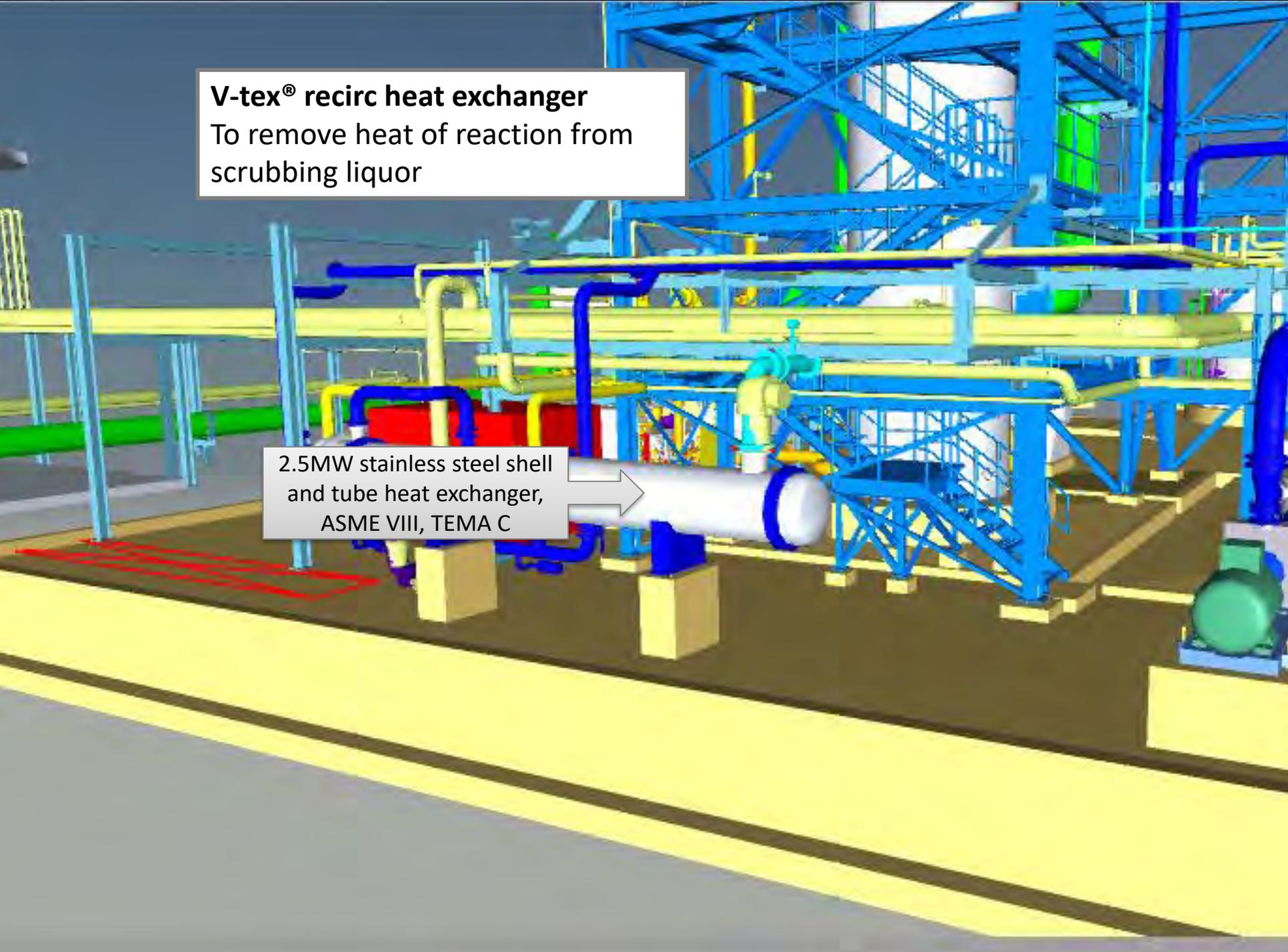
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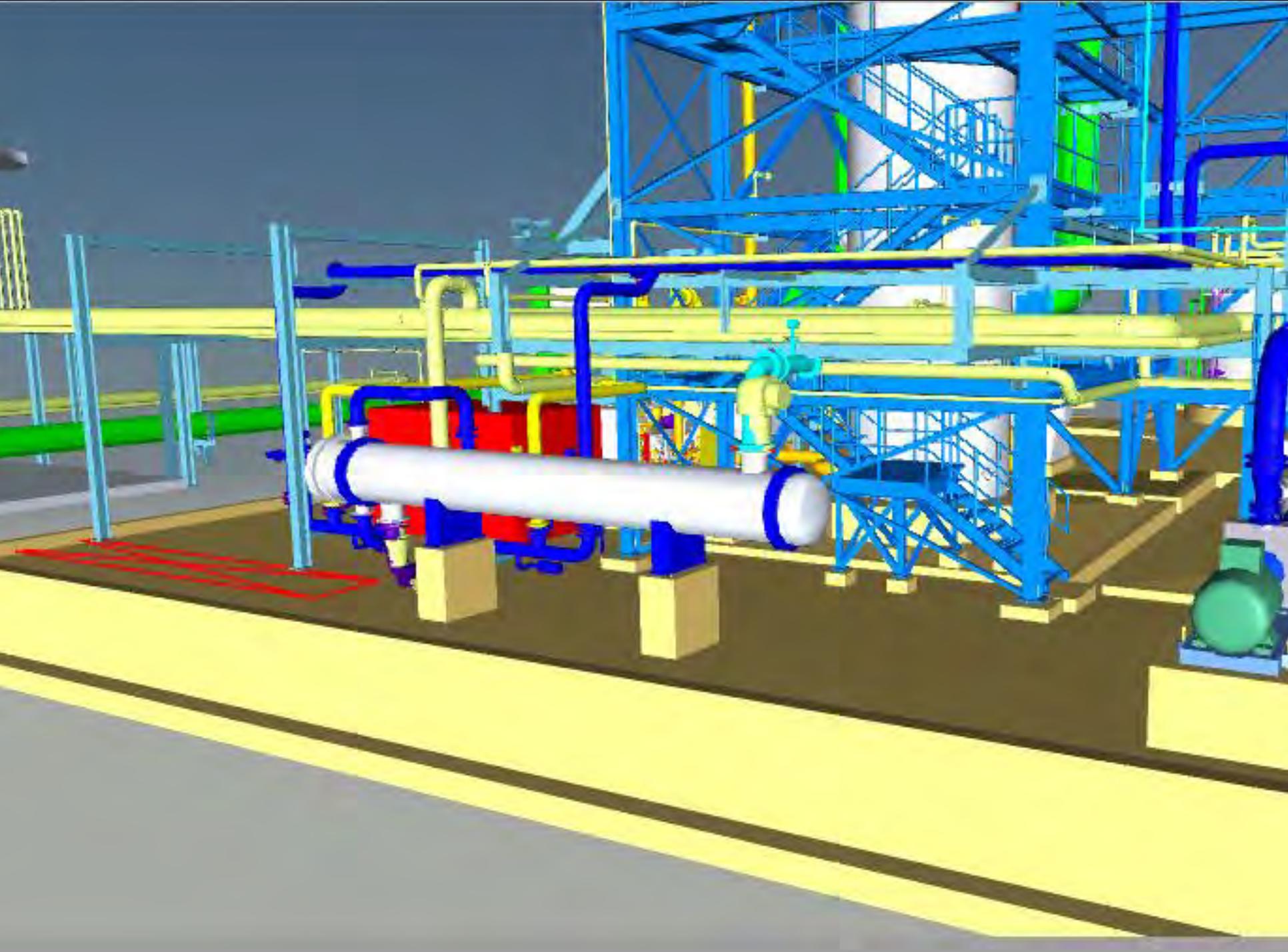
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V-tex[®] recirc heat exchanger

To remove heat of reaction from scrubbing liquor

2.5MW stainless steel shell and tube heat exchanger, ASME VIII, TEMA C



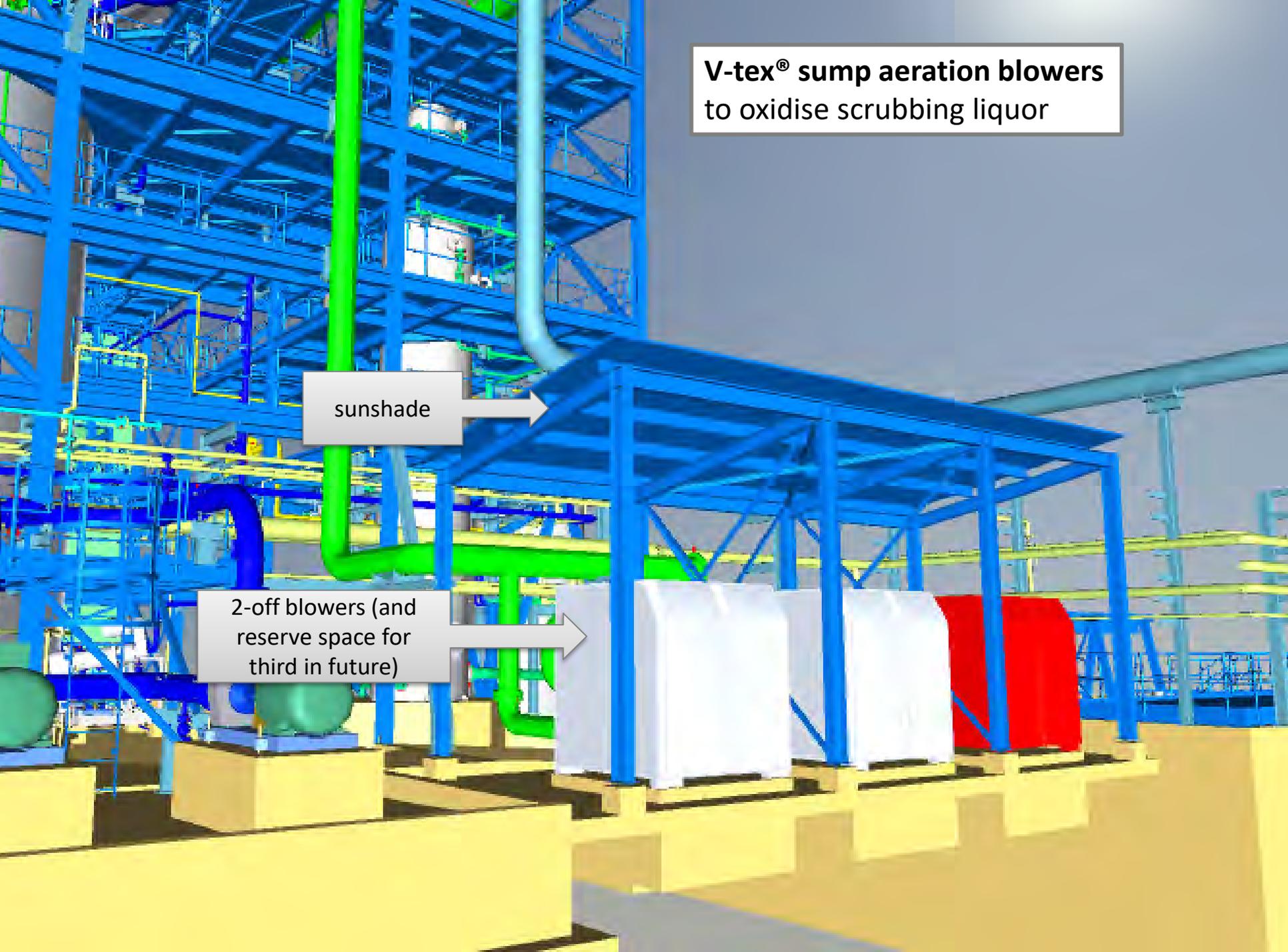


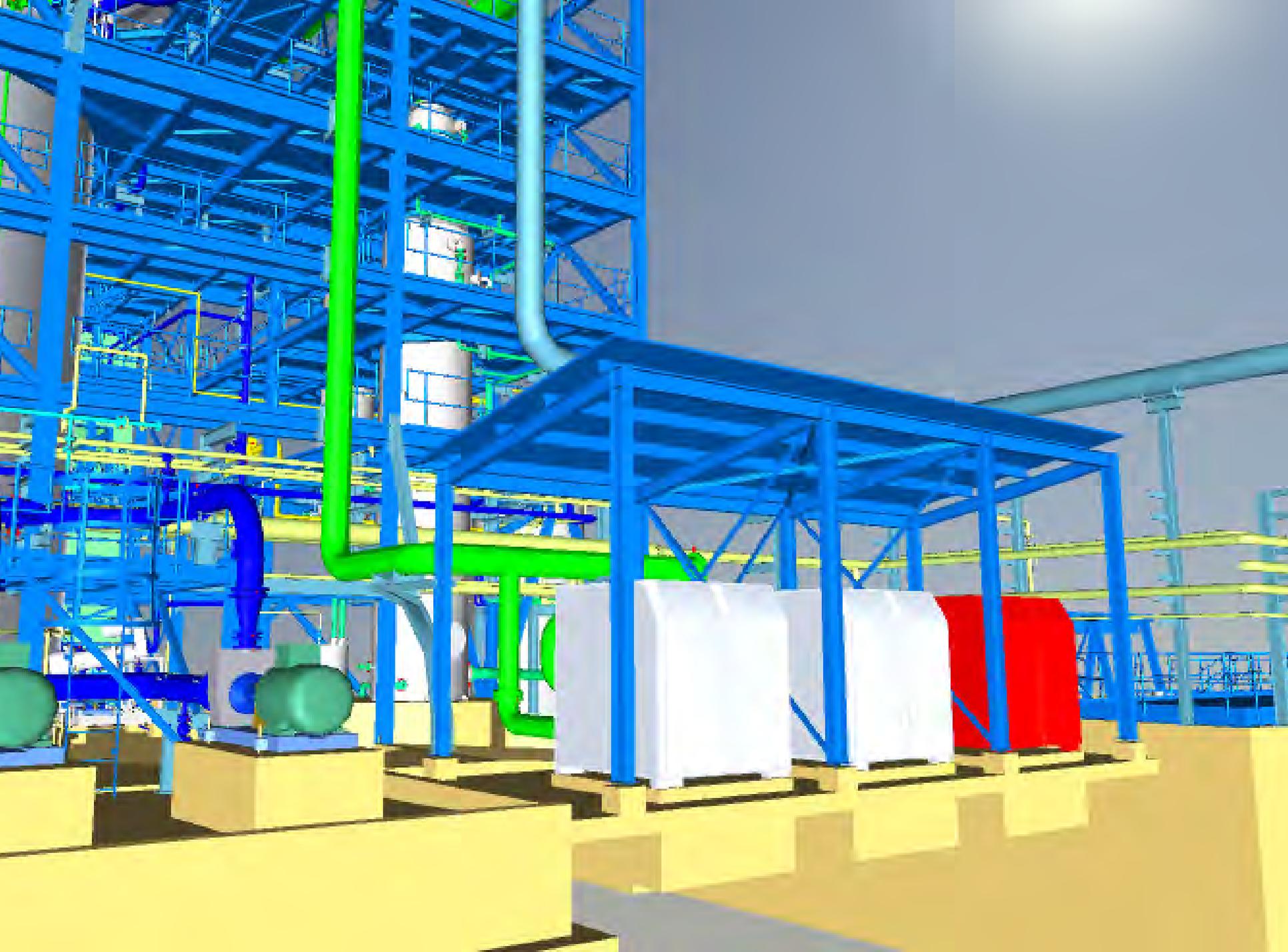


V-tex® sump aeration blowers
to oxidise scrubbing liquor

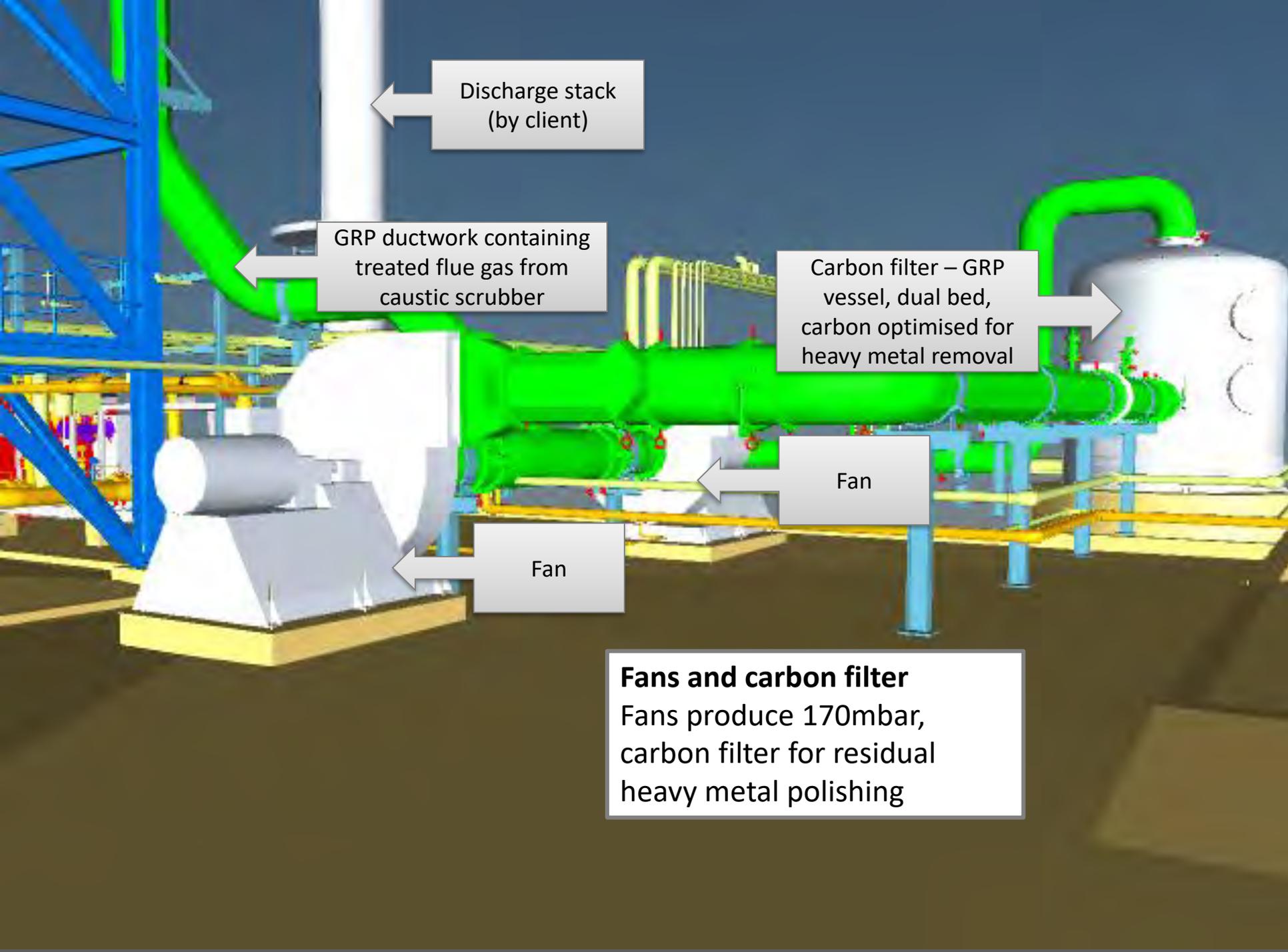
sunshade

2-off blowers (and
reserve space for
third in future)









Discharge stack
(by client)

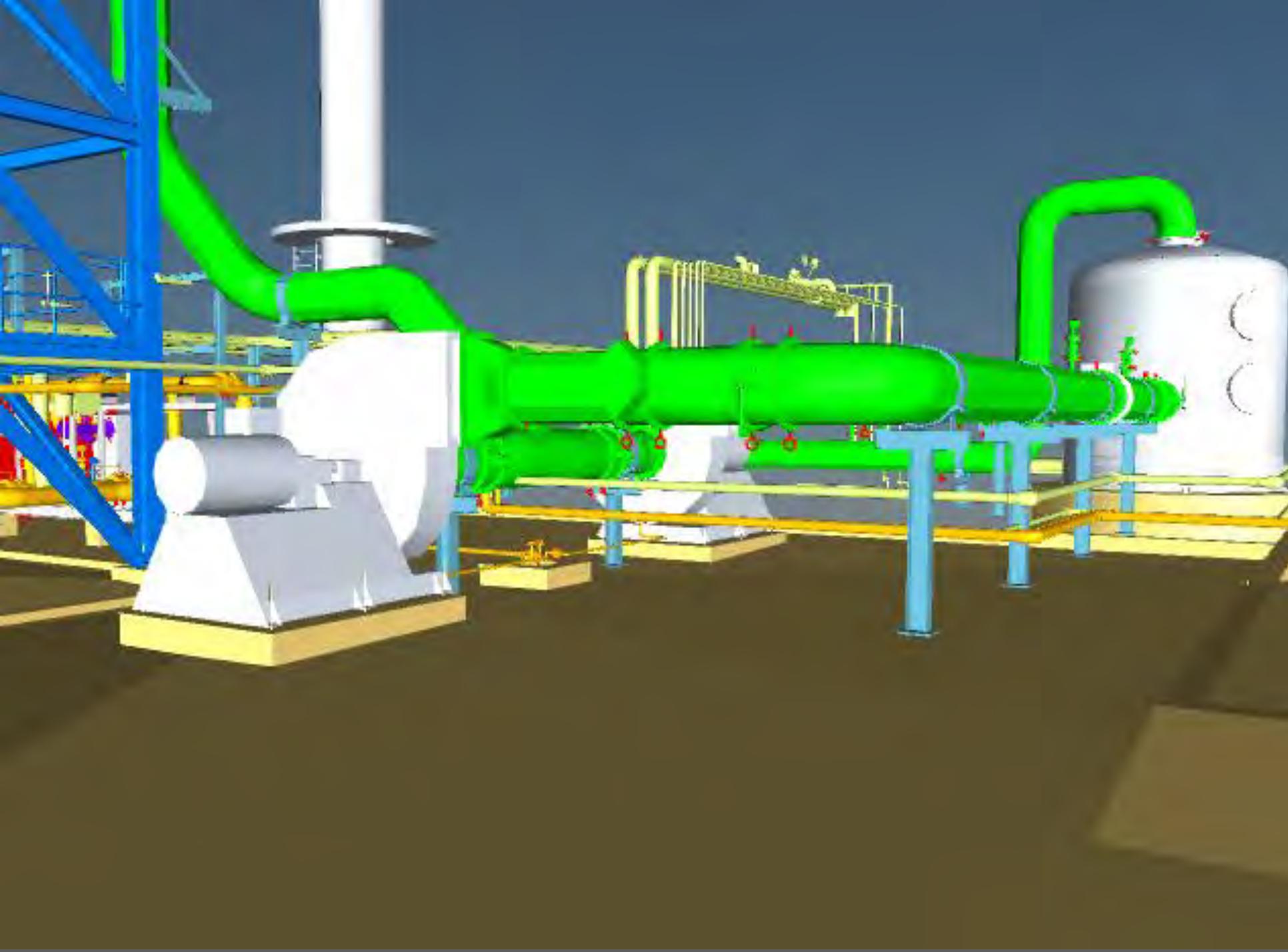
GRP ductwork containing
treated flue gas from
caustic scrubber

Carbon filter – GRP
vessel, dual bed,
carbon optimised for
heavy metal removal

Fan

Fan

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





Gypsum Building

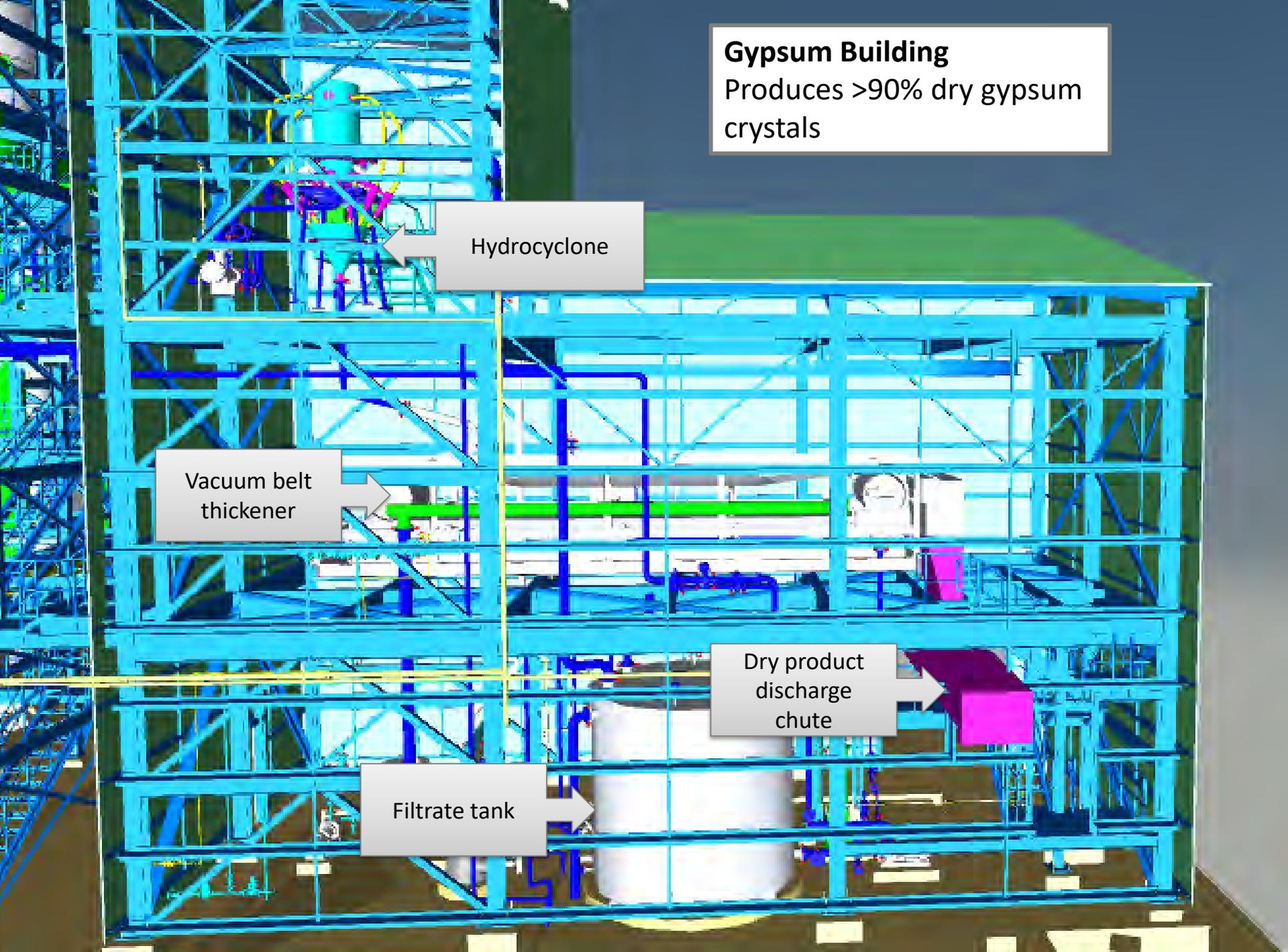
Produces >90% dry gypsum crystals

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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