Nevesbu

Naval Architects & Marine Engineers

Barend van der Giesen

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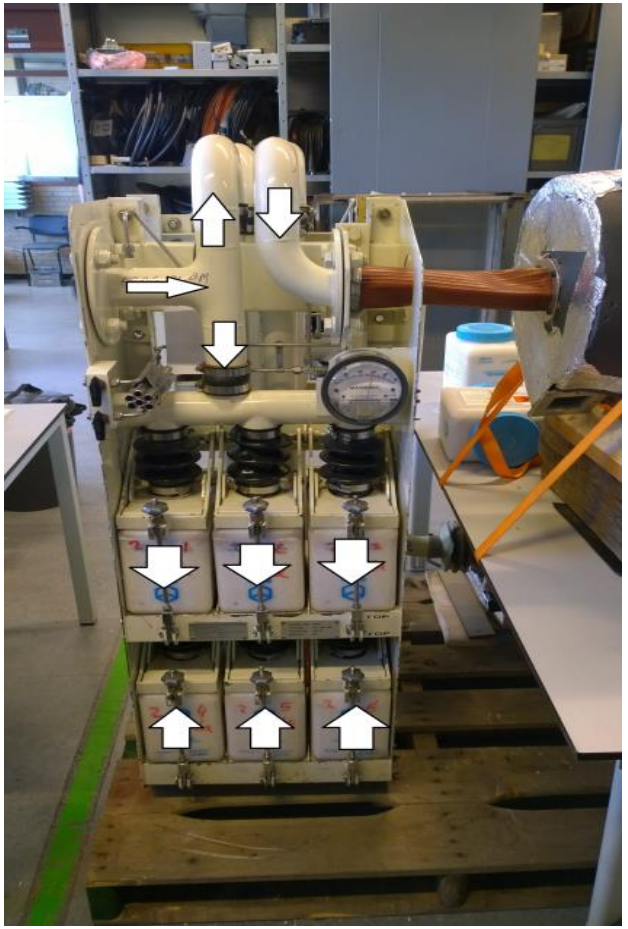
Purpose

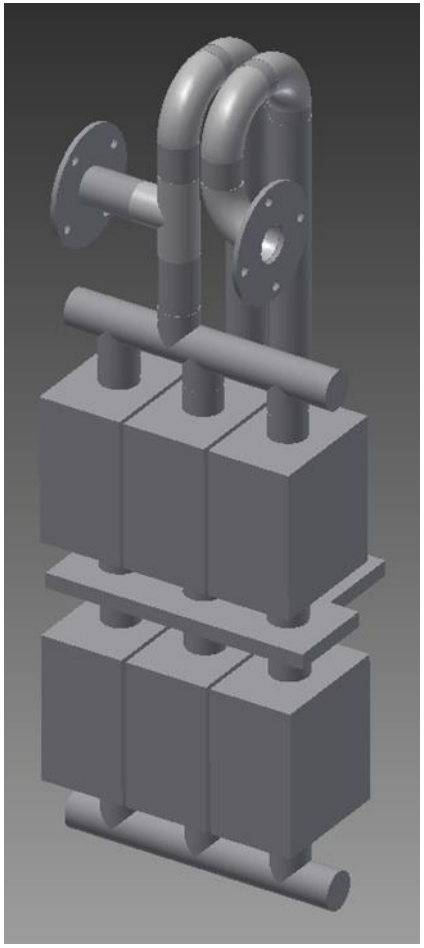
Suspected that the CO_2 adsorption unit does not function as it should

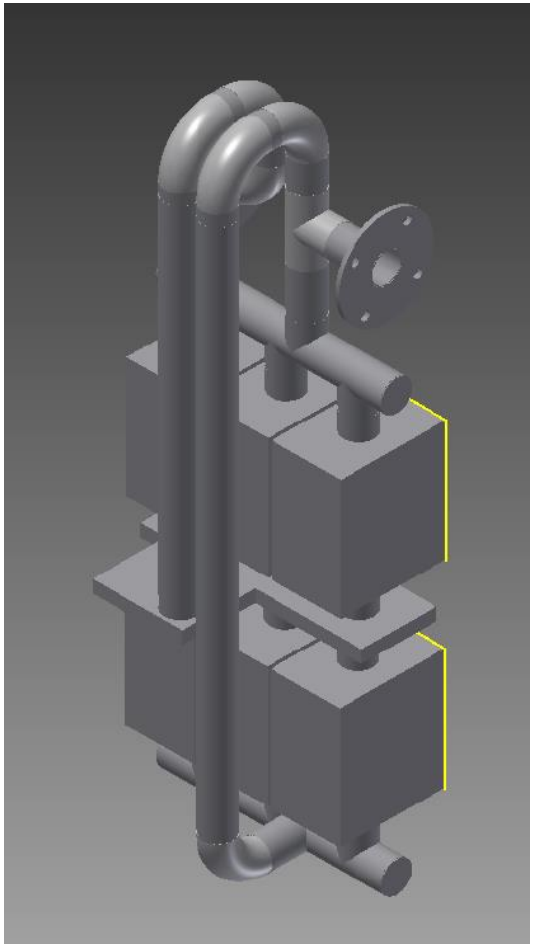
- Number of crew increased
- Allowed CO_2 level decreased



CO_2 adsorption unit

- 2 adsorption units
- 6 canisters
- 60 M3/hour





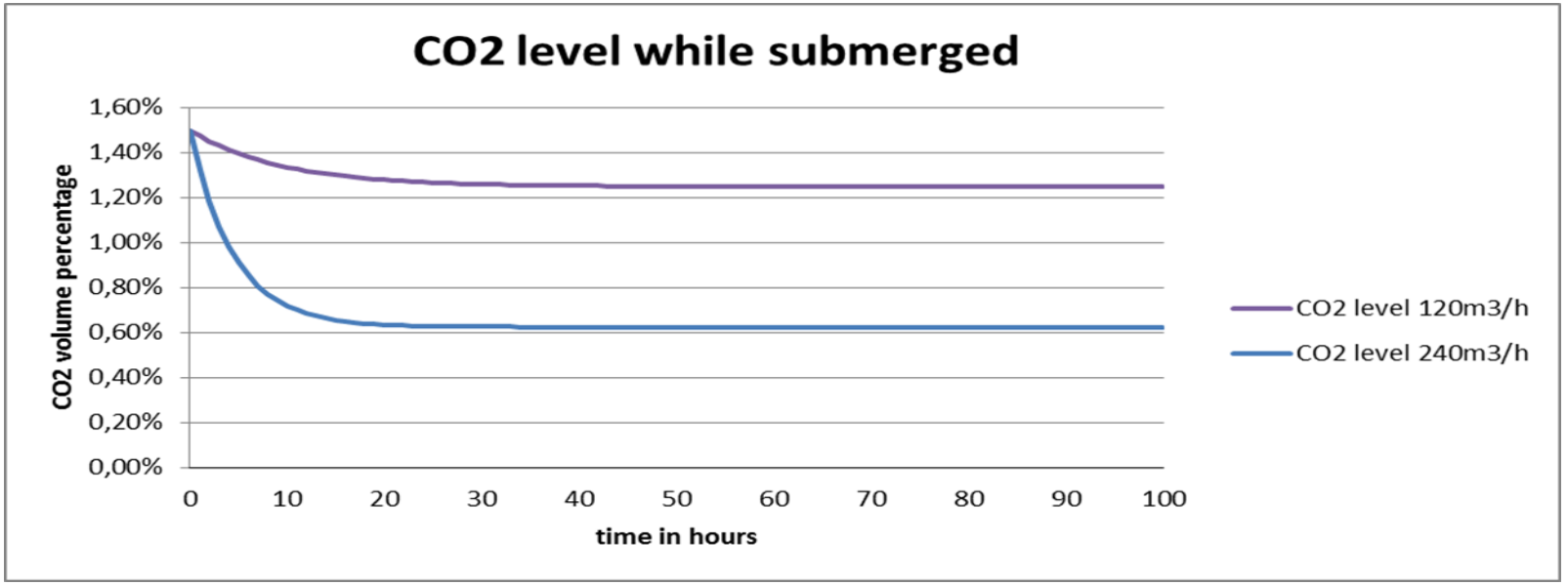
Factors of influence

- Internal factors

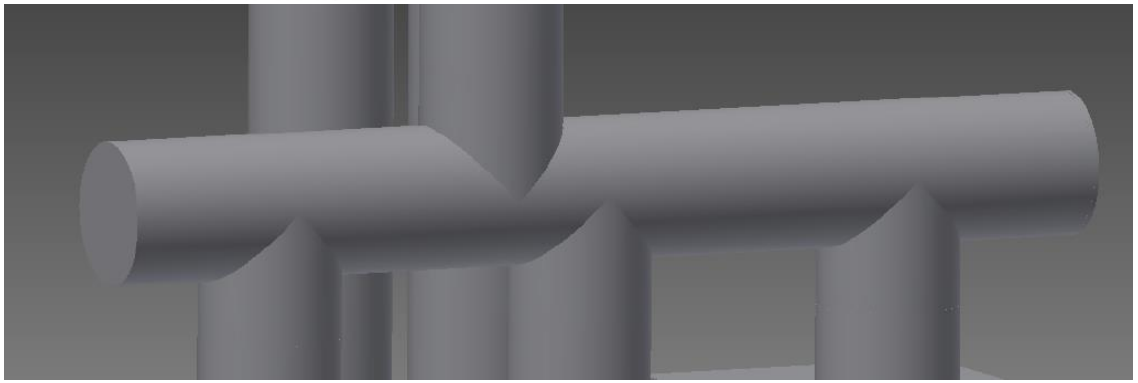
- Building specifications
- Flow
- Canisters

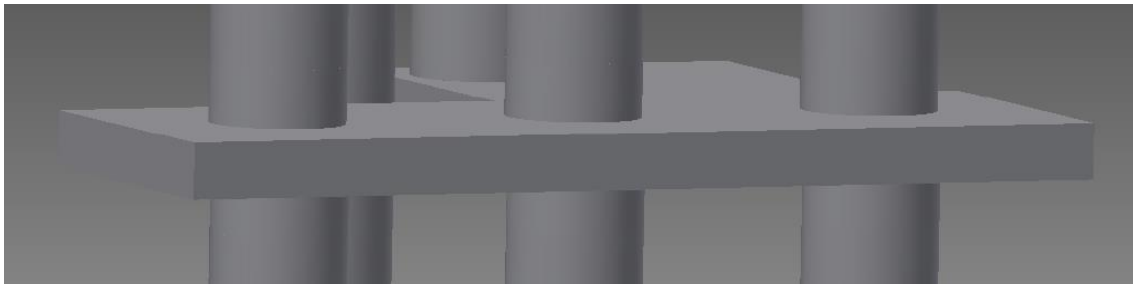
- External factors

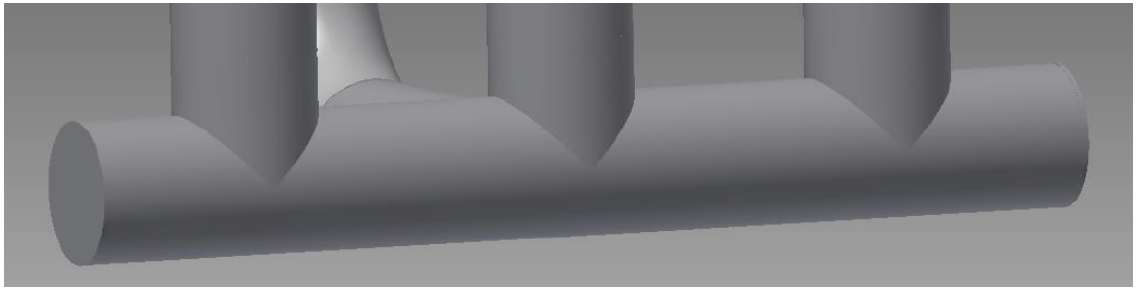
- Mechanical ventilation
- Number of crew
- Allowed CO_2 percentage



Analysis



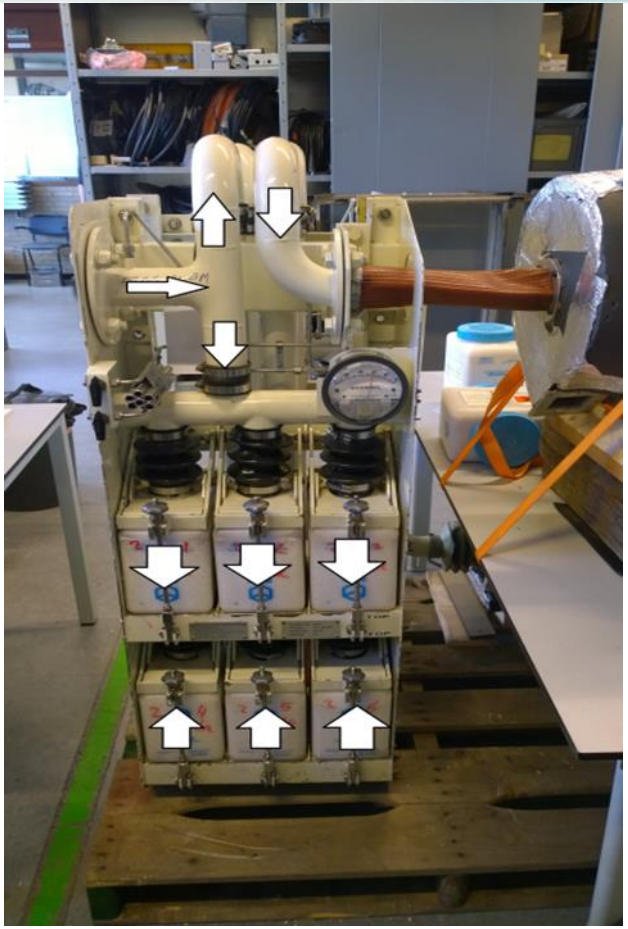




- Test
- Analytic calculation
- CFD Calculation

Test carried out

- Channeling and flow Distribution using colored powder
- Practical test
- Run as used on board
- Both units

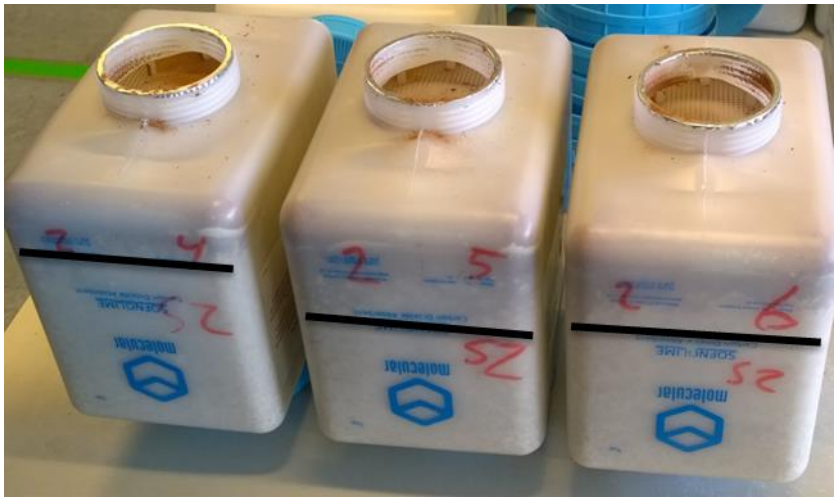


Testing results

- Long Room

Testing results

- Sonar Bay

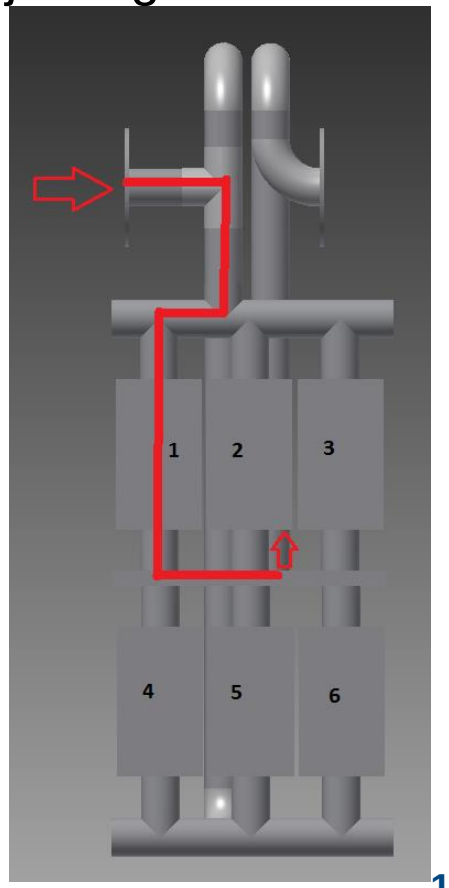


Analytic calculation

- Calculation of the pressure losses in each pipe branch
- Equalizing pressures in each pipe branch by adjusting the flow rate
- Iteration method: newton step one dimensional

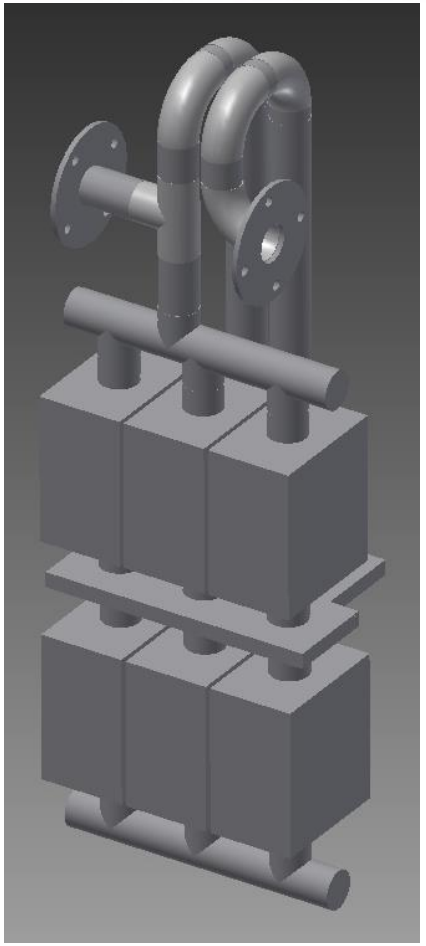
$$Q_1 = \Phi_1 + \frac{\overline{dp} - dp_1}{\frac{\partial p_1}{\partial \Phi_1}}$$

$$\Phi_1(new) = Q_1 * \frac{\Phi_{totaflow}}{\sum_{i=1}^{6} Q_i}$$



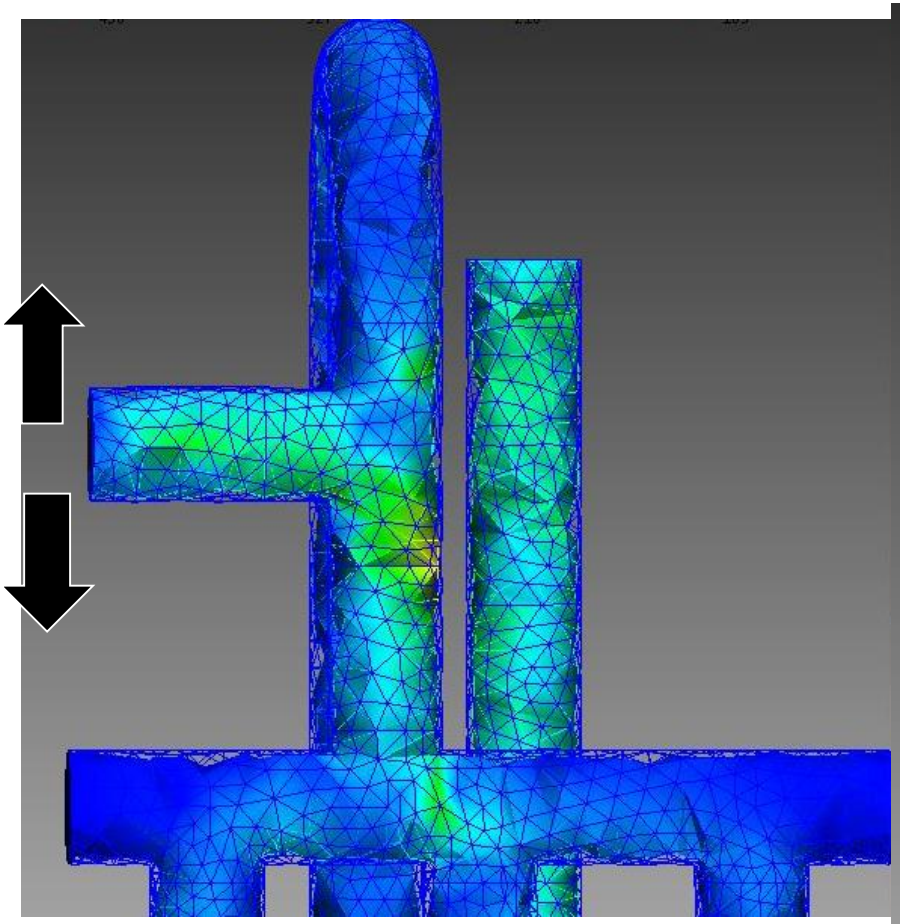
CFD analysis

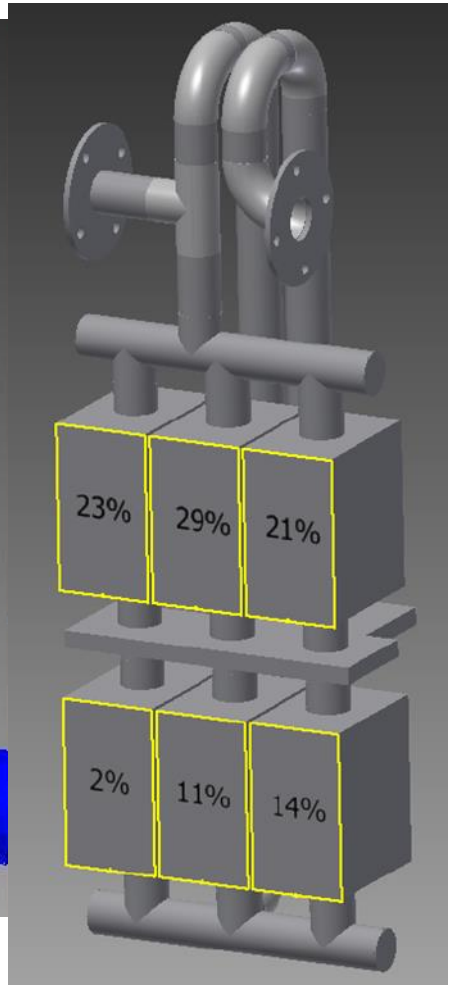
- 3D model
- Setup
- Results



CFD Results Intake

- Bottom 27%
- Top 73%





Results

Canister → Methode ↓	1	2	3	4	5	6
Iteration	25%	26%	23%	3%	12%	11%
CFD	23%	29%	21%	2%	11%	14%
Testing	$1 \geq 2$	$2 \leq 1$ $2 > 3$	$3 < 2$	$4 < 6$	$5 \geq 6$	$6 \leq 5$ $6 > 4$

Conclusion

The distribution of airflow over the canisters is not equal.

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