HATCH

AIR QUALITY TECHNOLOGIES

# DESIGN OPTIMIZATION OF BUILDING VENTILATION SYSTEMS USING SPECIALZIED ANALYSIS AND SIMULATION

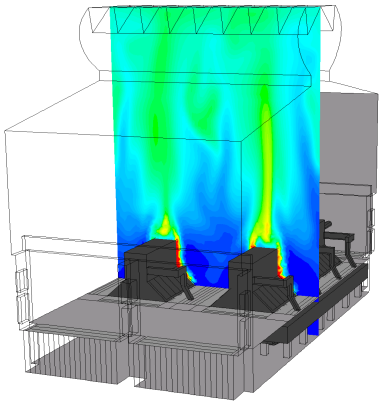
Effective building ventilation systems are required in controlling air temperature, humidity, and contaminant levels for worker safety and proper equipment operation. The design of building ventilation systems are made challenging by:

- The complex layout of most industrial buildings.
- The substantial heat and contaminant release in most industrial facilities.
- The stringent limits on air quality.

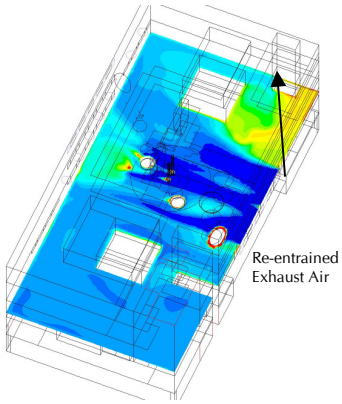
Traditional design methods for ventilation systems rely on empirical calculations, design rules-of-thumb, and experience, and these are invaluable for establishing a preliminary ventilation design. However, further analysis is often required using specialized design tools to be able to predict detailed aspects of the ventilation system performance for optimized design.

Computational Fluid Dynamics (CFD) modelling is an inexpensive way to identify and correct design problems before they are discovered in the field. CFD provides a detailed understanding of air, heat, and contaminant flows, and allows for ventilation designs to be evaluated under a variety of process, operating, and climatological conditions. For example, a complete understanding of the building air flow movement allows engineers to identify stagnation zones where contaminants may accumulate or where ventilation air may be restricted, so that appropriate mitigation measures can then be used to resolve these problems. During early stages of the design there is an opportunity to make simple design changes to the building to improve the ventilation performance and reduce cost. CFD is also an effective tool for diagnosing root causes of ventilation problems in existing facilities.

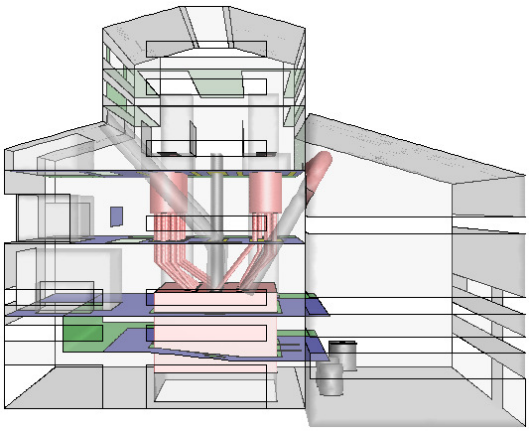
Hatch is uniquely positioned to apply expert knowledge in modelling and process understanding to the design of industrial ventilation systems. Hatch has been working at the forefront of CFD modeling for 15 years, and has been a leader in the design of industrial facilities for more than 50 years.



*Contours of hydrogen fluoride concentration in a potroom of the Sayanogorsk aluminium smelter potroom building*




*Contours of temperature in the Koniambo furnace building. CFD modelling identified the risk of hot exhaust air to be re-entrained into the building through ventilation louvers*

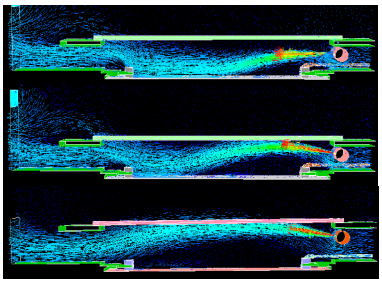


*CFD Model geometry for the Onca Puma smelter and refinery building.*

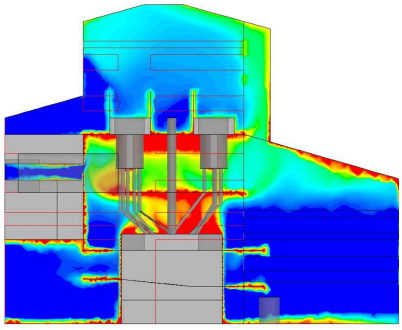
HATCH

AIR QUALITY TECHNOLOGIES

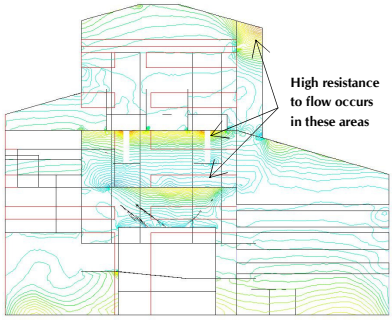
# DESIGN OPTIMIZATION OF BUILDING VENTILATION SYSTEMS USING SPECIALZIED ANALYSIS AND SIMULATION



*Three design iterations of the push-pull ventilation system for the EW Cell House for VBNC illustrate how direct jet impingement on the bath was avoided*



*Air temperature predictions in the Onca Puma smelter and refinery building.*




*Lines of constant pressure (isobars) in the Onca Puma smelter and refinery building highlight where the bottlenecks for ventilation air are in the building.*

## SELECT PROJECT EXPERIENCE LIST

### SMELTER BUILDING VENTILATION

**ONCA PUMA PROJECT, VALE**
CFD modelling was used to validate the natural ventilation of the smelter and refinery building. Modelling provided an inexpensive and timely method for evaluating the effects of various building layout changes.

**KONIAMBO FERRONICKEL PROJECT, XSTRATA**
Extensive CFD modelling was used to design the Koniambo smelter building ventilation system. Modelling allowed engineers to consider the effects of local wind conditions on the internal ventilation, including exhaust re-entrainment and increased air flow rates through louvers during high winds.

### CASTHOUSE VENTILATION

**PHASE II EXPANSION, ALUMINERIE ALOUETTE**
Process ventilation and CFD modeling expertise was used in the design of a novel casthouse ventilation system followed by implementation and commissioning. The casthouse has been operating successfully since plant start up in 2004.

### ELECTROWINNING CELL HOUSE VENTILATION

**VBNC, VALE INCO**
Advanced modelling was used to optimize a preliminary design that was based on empirical calculations. The modelling work lead to changes in the push-pull ventilation system for capture and control of acid mist emissions from the bath.

### POTROOM VENTILATION

**SAYANOGORSK SMELTER EXPANSION, UNITED COMPANY RUSAL**
Specialized flow and thermal modeling analysis was required during the design of a potroom ventilation system for the Sayanogorsk smelter expansion to meet workplace hygiene standards of the Russian Federation.

### AUTOCLAVE BUILDING VENTILATION

**PUEBLO VIEJO PROJECT, BARRICK GOLD**
Design of building ventilation system for cooling of 3 autoclave trains. Forced air delivery system optimized to meet autoclave shell temperature requirements.