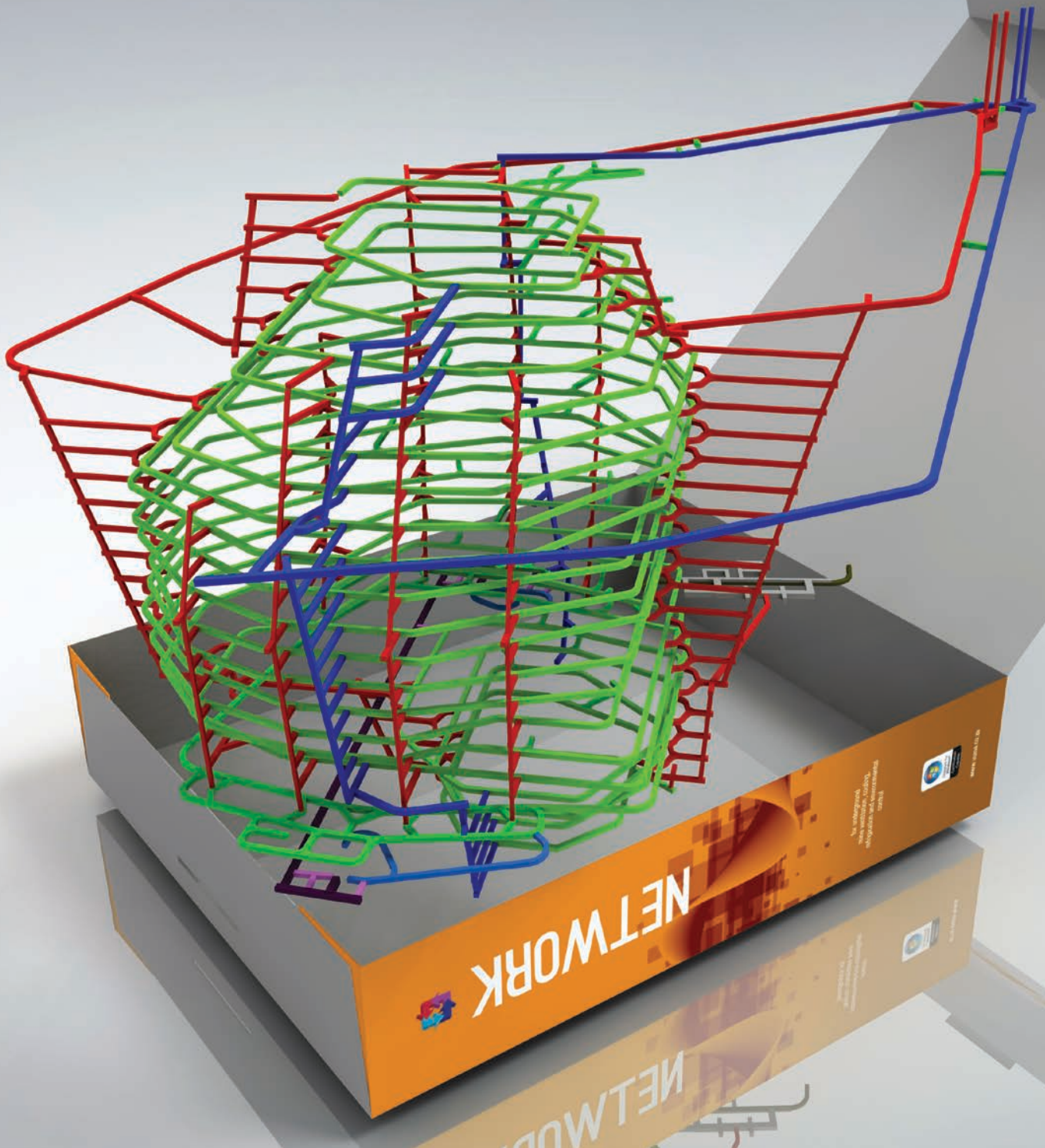




**Software for Mine Ventilation,
Cooling and Environmental Control**



INTRODUCTION

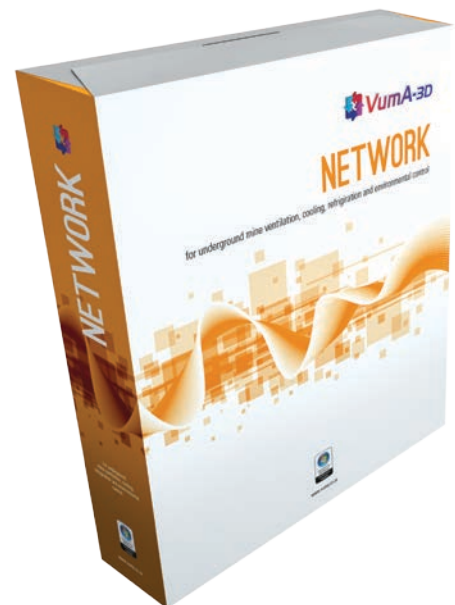
VUMA Software is part of the BBE group. VUMA employs a team of software developers and support staff dedicated to the development, training and maintenance of world-leading software packages for mine ventilation, cooling and environment control.

VUMA (Ventilation of Underground Mine Atmospheres) has developed a suite of 3D interactive simulation programs that accurately predicts environmental conditions. VUMA can be used with confidence for ventilation optimisation, planning and life of mine designs.

OUR PRODUCTS

VUMA3D-network

- VUMA3D-network is an interactive network simulation program that is used for the simulation of steady-state environmental conditions encountered in underground mines.
- **Simultaneous simulation of:**
 - Airflow
 - Air thermodynamic behaviour
 - Gases (including radon and DPM)
 - Dust emissions.
- **Applications include:**
 - Planning/design
 - Verify environmental performance parameters
 - What-if scenarios
 - Energy optimisation
 - Dust/gas tracing
 - Fault finding/trouble shooting.
- **New features:**
 - Blast module
 - Clearance/tracking of contaminants
 - Determine blast clearance time.
 - Fire module
 - Considers combustion effect of fire on network, i.e. ventilation flow turnaround
 - Simulates the success of possible firefighting scenarios
 - Simulates existing fire control measures, e.g. doors installed to control a conveyor belt fire.



VUMA3D-coal

- Functions in the same way as VUMA3D-network but has been developed to satisfy the specific needs of coal mines
- Used for the simulation of steady-state environmental conditions encountered in underground coal mines
- Solves airflow and pollutant (dust, gas, smoke) distributions interactively throughout a coal mine ventilation circuit
- Represents coal mine layouts and mining methods.



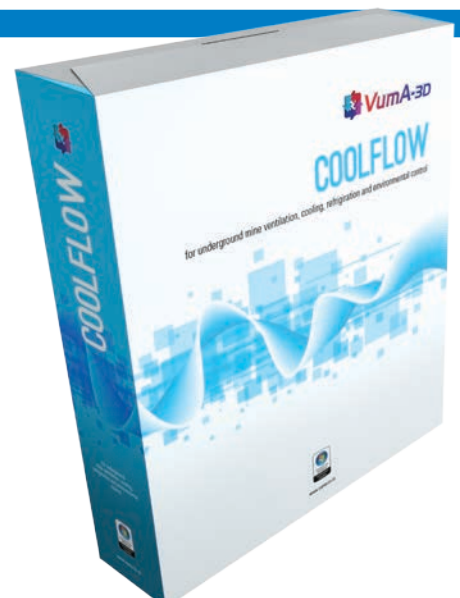
VUMA3D-live

- Based on VUMA3D-network and interfaces with on-line monitoring of underground conditions
- Uses a limited number of measured/instrument inputs obtained from the mine SCADA system to predict real-time environmental conditions throughout a mine.
- **Benefits include:**
 - Real-time monitoring
 - Visualisation of underground ventilation conditions
 - Alarm when abnormal conditions are detected
 - Forward prediction of conditions
 - Daily reporting
 - Forward emergency planning and response
 - Planning energy conservation and changeover strategies
 - Risk analysis.



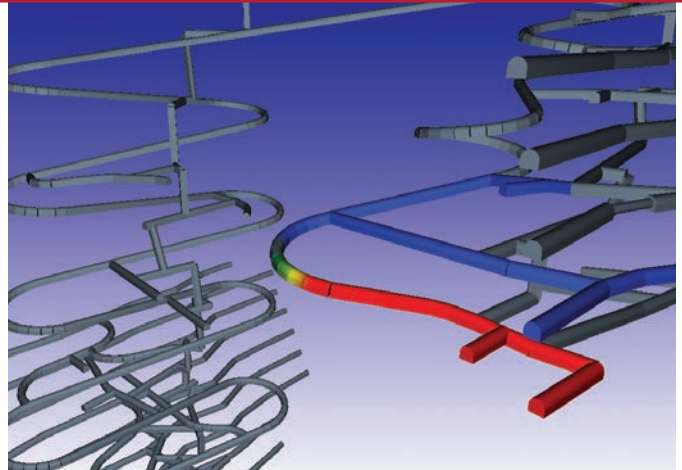
VUMA3D-coolflow

- Mine water circuit modelling tool accounting for the full thermodynamic interaction of the water reticulation network with the ventilation system
- Water flow is distributed as a function of pressure and the thermal effect of all network components (pipes, turbines, dams, etc.) is included to assist the optimal control of thermal energy systems
- Import VUMA3D-network models into VUMA3D-coolflow
- **Applications include:**
 - Effectiveness of cooling distribution strategies
 - Predict network system losses quantified per component
 - Simulates chilled water dams with ice melting
 - Effects of chilled water in production zones



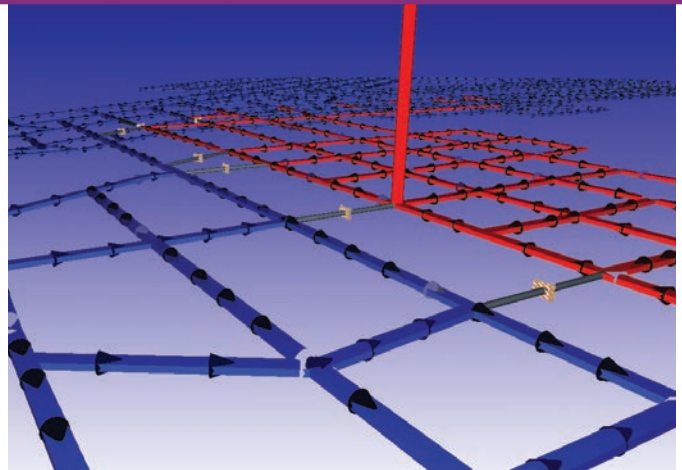
WHY SIMULATE?

- Ensure safe mine environments
- Optimise existing ventilation and cooling resources
- Reduce primary ventilation system power
- Minimise major ventilation capital expense surprises.



WHY USE VUMA?

- VUMA strives to remain the mine ventilation software package of choice through continuous development, servicing our clients, their needs and ensuring our products' accuracy
- Import directly from various mine plan formats and utilise tools to "clean up" and modify networks faster
- VUMA has been developed by international leaders with over a century's combined experience
- VUMA's algorithms were developed using measured data from some of the world's deepest mines
- For enhanced accuracy the solution algorithm assumes compressible air heat
- VUMA's solution engine contains effective and specialised modelling algorithms for all types of mining activities in hard rock and coal mines.



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