



# Ventsim Visual™ Newsletter

**VENTSIM SOFTWARE**  
Chasm Consulting

Volume I Issue 4  
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## Ventsim Visual™ Version 1.5 Software Released!

### New Updates to Ventsim Visual

Version 1.5 of Ventsim Visual marks a significant new release version.

The new version can be downloaded or updated from <http://www.ventsim.com/>

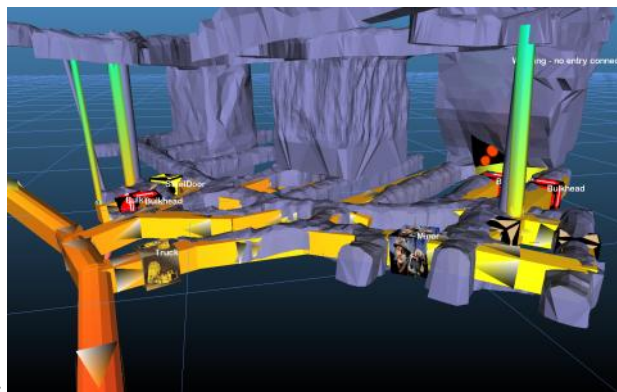
[PLEASE NOTE THAT YOUR LICENSE MAINTENANCE PERIOD MUST BE VALID TO USE NEW VERSIONS.]

**In addition to literally hundreds of minor improvements and fixes, the new version 1.5 has the following major improvements. Some features are exclusive to the Advanced version only.**

- Dynamic fume dispersal simulation, primarily for examining the effects of blasting and the spread time and concentration of fumes throughout the mine. In typical Visual fashion, this is displayed as an animated 'movie' which can be paused and examined at any time. See page 2 for more details.
- Enhancement to the Financial analysis tool to include the purchase cost of fans in the analysis.
- Global Financial analysis tool. Leading on from the Financial tools available in earlier versions, the Global tool will quickly analyse and report on every single airway in the network to ensure an optimum size has been chosen, and no bottlenecks exist.
- Improved reporting of network summaries now include additional graphs showing the sources of

heat and moisture in a mine.

- Rotate coordinates function to rotate all or part of model on a grid.
- Variable terrain virgin rock temperature adjustment. For extensive mines with variable terrain depth, the VRT can be adjusted against the actual surface cover depth, rather than a specific elevation.
- Improved DXF exporting now supports exporting 3D Ventsim Solids and colours to external DXF files. These files can be loaded into any CAD package.
- Files in use will now be locked as read-only to prevent other users from modifying them simultaneously.
- Most forms now have a direct Create Image or Copy to Clipboard function so images can be quickly copied or saved and used in other documents.



Ventsim Simulation of Drawpoints with 3D Survey Shapes

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### About Ventsim Software.

**Ventsim Visual™ is a mine ventilation simulation package that comes in two versions.**

#### Standard

- Full 3D modeling
- Real-time animation of airflow and fans
- Dynamic coloring of airways and data
- Airflow simulation and fan modeling
- Steady state contaminant spread, sourcing and emergency simulation
- Financial functions to analyze airflow and fan costs.
- Variable speed fans which can be reversed or turned off.

#### Advanced

- All the Standard features
  - Thermodynamic heat and moisture modeling
    - Strata heat and moisture
    - Refrigeration
    - Diesel heat and emissions
    - Electrical heat sources
    - Oxidization
  - Compressible airflows and different mine air densities and fan operating environments.
  - Financial analysis wizards
  - Dynamic blasting fume spread
  - Recirculation predictor
  - Diesel particulate simulation
- Ventsim Visual software is available under a purchase license or limited time rental.**

## Training Courses Australia

Chasm Consulting (the developer and distributor of Ventsim Software) is pleased to announce a series of Ventsim Visual two (2) day training courses in

**Brisbane 19-20 July 2010**

**Sydney 22-23 July 2010**

**Perth 27-28 July 2010**

## Training Courses North America

In addition, expressions of interest are invited for the following proposed courses in North America.

**Sudbury/Toronto, Ontario 19-20 August 2010**

**Denver, Colorado 31-1 Aug-Sep 2010**

The courses will cover all aspects of Ventsim Visual Standard and Advanced and will focus on the rapid and practical implementation of Ventsim Visual in all aspects of mine and ventilation design, planning and improvement. The course is designed for both new and experienced users.

The two (2) day course will ensure users can both accurately and efficiently build ventilation models utilizing many of the powerful and often little known features in the program (such as DPM modeling, financial analysis and blast dispersion)

**Further details regarding the courses are available on page 3**



## Tutorial - Blast Fume Dispersion Modeling (Advanced)

Ventsim Visual version 1.5 introduces an exciting new function called Dynamic Contamination.

Up until now, only steady state contamination simulation was available in Ventsim, which meant that any contaminant sources (such as blasting fumes) were assumed to emanate indefinitely at the same concentration from a source. This limited the ability of this function to model contaminant location and concentration over a period of time, an essential requirement if blasting fumes spread and clearance times need to be established.

Blast fumes clearance times can be considered as one of the many hidden costs of a ventilation system. Any time lost due to the spread and concentration of blasting fumes preventing personnel from re-entering a mine, can be considered a cost of ventilation in terms of lost productivity and opportunity.

Unfortunately, as mines get larger and development headings extend longer, blasting fumes (from both development and production) can cause many significant delays extending up to several hours in some cases. While some lost time can be reduced with better ventilation flow and design, being able to model and quantify this has been difficult up until now.

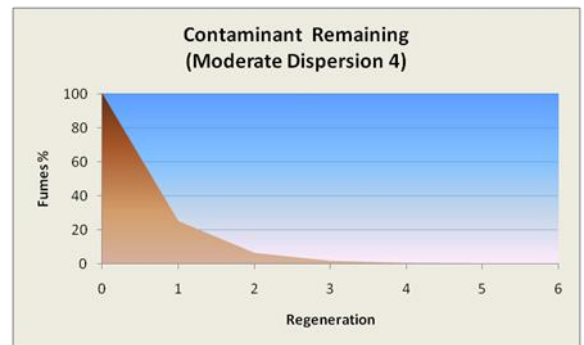
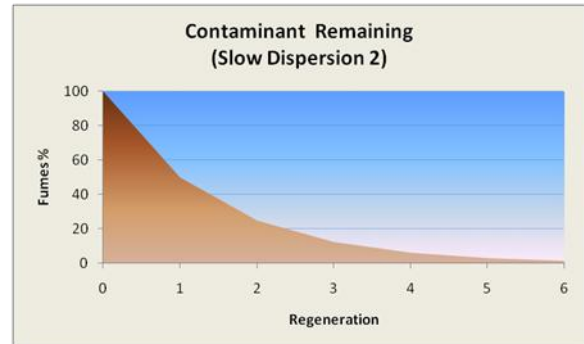
Ventsim Visual Advanced 1.5, allows users to place multiple blast sources throughout a mine, of different sizes and ventilation efficiency, and then model in real time the spread and concentration of fumes (and fresh air) through the mine. The simulation is shown as an animating time scale of contaminant spreading through the mine, which can be paused and examined at any time.

Dynamic contaminant simulation works on the theory that any blasting source will initially contaminate a certain volume of air in the vicinity immediately after blasting. The volume of air contaminated depends on the size of the blast and the subsequent 'throw back' of dust and fumes (this volume factor is defined in Settings). The ventilation system must then remove the contaminated air from the region, moving it through the rest of the network to the exhaust. The rate at which the fresh air ventilation can initially remove the contaminant depends on the efficiency of the ventilation flow to access and remove all fumes from the blast zone.

For example, in an open free flowing drive with good air-flow, contaminant would be expected to be removed quickly as the fresh air forces all pockets of fumes and gas quickly down the drive. A blind heading, ventilated by duct which may be damaged or some way away from the heading end will clear slowly as the fresh air cannot efficiently reach all parts of the drive and remove the fume.

Ventsim uses an 'inverse power' series to determine the rate of clearance. Every time the air is replaced in a region (called a regeneration), a certain percentage of contaminant is removed. For example a clearance

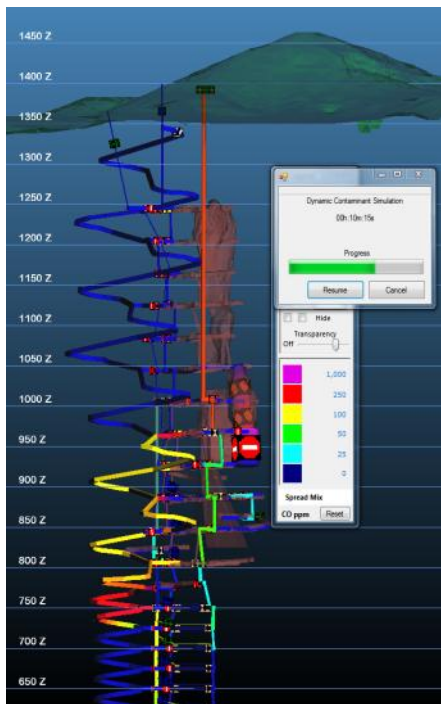
rate of "2" – defined as "slow" in Ventsim, would half the remaining contaminated volume (50%) every air regeneration. A value of '4 – (Moderate) would reduce the contaminant to only a quarter (75% reduction) every air regeneration. Ventsim calculates the contaminant concentration downstream by calculating how much contaminant volume is 'injected' into the fresh airstream over the regeneration period.



The contaminant and explosive concentration and amount can be placed with the SMOKE button and can be changed in the EDIT – Contamination box. A unlimited amount of dynamic sources can be placed throughout the network, each with a different blast size and clearance rate (to simulate a number of development headings and stopes firing simultaneously for example). The concentration units entered can be changed to any concentration based unit (eg %, ppm, mg/m3 etc). The unit name can also be changed in the Settings > Contamination menu section. The Dynamic Simulation is activated from the Run menu or from the Contaminant Simulation side button access.

**EXAMPLE** Blasted development headings have been previously measured to initially have up to 2000 ppm of CO carbon monoxide immediately after blasting. Therefore a concentration of 2000 is entered (the setting unit can be changed to "CO ppm" if the user wants to), and the explosive amount set to 200 kg. When dynamic simulation is chosen, the concentration of fumes (in ppm CO) is shown through the network second by second. Clearance times can be established when concentrations fall below a specified limit (for example 30 ppm). At any time, the colour legend and limits can be changed to show these concentration as colours.

**Warning :** Dynamic contaminant simulation has many factors which can initially be difficult to predict. It is highly recommended users calibrate their models with actual data if they have the opportunity. The simulation does not replace real gas measurement or observation when entering blasting areas.



Dispersal of Carbon Monoxide from large stope blast



## Global Financial Analysis—Optimizing all your Ventilation Costs

A new feature in Version 1.5, is the ability to analyze every airway in the mine for size suitability.

An observation made with many mines is that there are often 'bottlenecks' - that is areas of high resistance or high airflow that require lots of fan pressure and power to overcome. It is these areas (which often only form a minority of a ventilation network) that consume in many cases the majority of ventilation power. Spending only a small amount of additional money on larger airway sizes, can sometimes payback millions of dollars in wasted ventilation power over the life of the mine.

The function works by analyzing the cost of every airway in the mine based on the currently simulated airflow. Mine ventilation costs are essentially made up of three components.

1. **Mining Cost.** The cost of mining the airway passage. To simplify analysis, a cost per m<sup>3</sup> of mining for horizontal and vertical airways has been used (specified in the Settings > Cost menu item). While only an approximation, this approach is sufficient to determine the relative merits of each airway size.
2. **Ventilation Power Cost :** The cost of providing the fan power to ventilate the air through the airway at the volume and pressure required. This is based on the default fan and motor efficiency, and the cost of power, provided for in the Tools > Settings > Costs. The power cost (which can include a maintenance component) is added over the default number of years the airway is required. There is an option in the settings to discount (reduce) future power cost by a discounted percentage to obtain a present value of the costs.
3. **Fan Capital Cost :** The cost of purchasing the portion of fan required to ventilate the airway. Once again a simplified approach has been taken, by estimating a purchase cost per kW of fan power. While this once again is an approximation, it is sufficient for simulation ranking purposes.

The sum of these three costs forms the basis of the lifetime cost of each ventilation airway size.

The simulation will only consider increasing airway size for global analysis. While it is possible to recommend smaller airways, in the vast majority of cases, airways are practically sized to ensure personnel or equipment can travel through

them, and therefore the recommendation of a smaller size would be pointless in most cases.

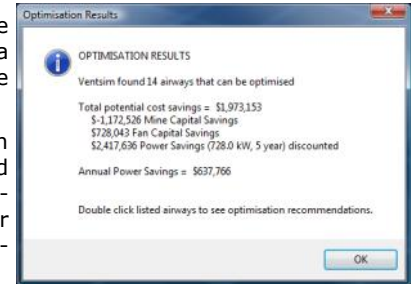
Once complete, each airway can be examined for the overall cost benefit to determine whether a change in size is warranted.

The simulation will show the likely increase in mining cost, offset by reduced ventilation power and fan savings.

At this stage, the user can either accept the recommendation, or undertake further analysis with the more detailed Selected Financial Optimizer.

If the recommendation is an existing airway, then this may still provide justification for additional new airways or perhaps even enlarging of existing airways.

Finally, remember that recommended airway sizes **are for the currently simulated flow only**. Enlarging an airway size will change the flow characteristics and often increase simulated flows unless fixed quantities are being used. To achieve the projected savings, fan sizes will need to be manually reduced and perhaps regulators adjusted to ensure flows remain at the original amount.



Selected airway optimization can be performed after global .

## Ventsim Visual Training Courses—Brisbane, Sydney and Perth, July 2010

An intensive two day training course will be held in the following cities during July (as per the preliminary dates on the front page). The course will focus on the features and technical application of Ventsim Visual Standard and Advanced in all aspects of mine ventilation, including many of the new features found in recent versions. Topics covered will include;

- General ventilation modelling and design
- Fan duty design
- Economic optimisation of ventilation circuits
- Heat, moisture and refrigeration modelling
- Diesel particulate (DPM) modelling
- Simulation of contaminants, gas, smoke and fires



Attendees will need to bring a laptop and will be provided with a short term training license for use during and after the course. Cost is AUD \$1200 + gst for the two days, including lunch and course notes and training licenses. Spaces are strictly limited. Contact [craig@ventsim.com](mailto:craig@ventsim.com) if you are interested in attending.



## Some Simple Ventilation Design and Heat Advice

**Heat in mining is largely an inevitable consequence of mining in the earth at depth with machinery.**

How much heat produced in a mine, and the effect it has on ventilation temperatures is largely a consequence of the type and geothermal gradient of the rock, how deep and extensive the mine is, and the amount and type of equipment being used. Once mines extend beyond a limiting depth, refrigeration is often the only way to keep extending the mine to deeper depths and maintain a safe working environment. Ventsim Visual is an ideal tool to examine the effects of heat in a mine, and to evaluate ways to improve air quality and temperature.

**First, let's examine a couple of popular misconceptions about heat at depth.**

- *Increasing airflow will decrease temperatures.*

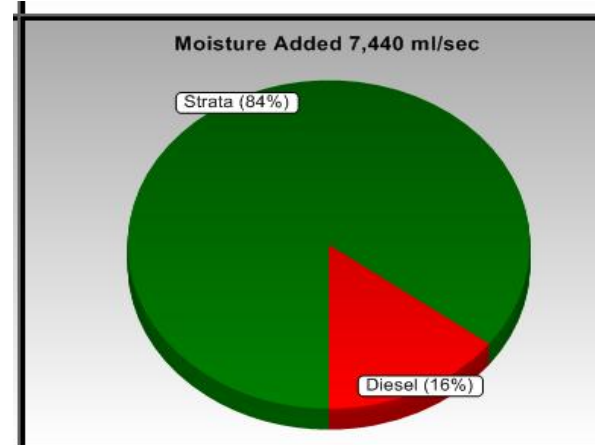
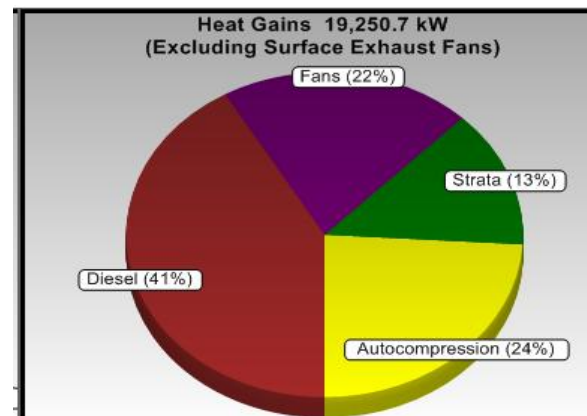
Only partly. While it is true that increased airflow will dilute the effect of machinery heat and rock strata heat, it has no effect on reducing heat from autocompression. In deeper mines, autocompression makes up a significant portion of the heat inputs, therefore increasing ventilation flow may have little effect on reducing overall temperatures. In addition, if extra fans are required in the intake streams to push more airflow, the fans will put additional heat in the air—often between 2 - 4 degrees dry bulb (and about a third of that wet bulb) per 100kW depending on fan pressure.

- *Adding water to the air through sprays and evaporation will increase the wet bulb temperature.*

Theoretically, adding moisture to the air through evaporation (if it is the same temperature as the air) has practically no effect on wet bulb temperature. If this is done in the immediate vicinity of personnel working it can actually be beneficial as it cools the dry bulb temperature and reduces the reliance on sweating. *HOWEVER*, the decreased dry bulb (ambient) temperature results in the air being more receptive to heat input from rock strata (ie it increases the heat transfer rate from rock). This means downstream wet bulb temperatures will eventually increase at a faster rate!

**Now, let's look at way to reduce heat (without refrigeration) in working areas.**

1. Avoid re-using air. A popular and convenient ventilation method is to re-use air from declines or other upstream areas with development or production activities. While this is often convenient, every time the air is reused (not recirculated of course!) the temperature and humidity increase due to rock exposure, machinery, moisture evaporation and often fan power).
2. A more efficient method is to dedicate a fresh air source (such as a raise) to provide independent air to areas without risk of contamination by other activities. With careful planning, this can often form a second means of egress, and ensure the area has minimal disruption during blasting or other mining activities
3. Use the most direct path. The longer the route that air travels underground, the more heat and moisture it will pick up from rock strata. Sourcing fresh air from a decline for example, will expose the air to 700-800% more heat and evaporative moisture than sourcing it from a shaft.

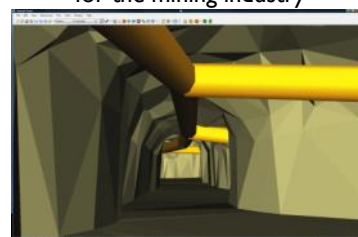


Examples of Heat and Moisture Added in mine <1km deep  
[New graph feature—Ventsim version 1.5]

4. Ensure air is directed to only where it is needed and turn off development fans not being used. Not only is running fans unnecessarily a waste of power which puts additional heat in the air, the heat generated by rock strata in force ventilated areas re-enters the mine and mixes with the cooler air creating overall higher temperatures. Unless the area is to be immediately used or requires ventilation of fumes, turn off unnecessary development fans!

### Chasm Consulting (incorporating Ventsim Software)

Ventilation Simulation Software, Training and Consulting  
for the mining industry



Download our brochure

[www.chasm.com.au/ChasmInfo.pdf](http://www.chasm.com.au/ChasmInfo.pdf)

