

17.0 MODELLING

Both physical and mathematical modelling are important airshed management tools. They are essential components of an air quality impact assessment, in particular when reviewing proposed industrial source emissions to air, both routine and accidental.

17.1 Mathematical Modelling

Mathematical modelling conducted by A.W.N. (Air Water Noise) Consultants is highly regarded. A.W.N. Consultants was one of only a small number of consultants in Australia and New Zealand selected by the Environment Protection Authority of Victoria to sit on the peer review panel for the AUSPUFF model.

A.W.N. has expertise in the use of the following air quality models:-

- AUSPLUME (Australian regulatory Gaussian plume model);
- AUSPUFF/CALPUFF (Puff model);
- ISC-AERMOD (Gaussian plume models);
- Screen (screening model);
- SLAB (emergency release model).

A.W.N. uses the USEPA Building Profile Input Program (BPIP) to better predict the effect of building downwash.

Meteorological data files are available from sites throughout Australia, some exclusively to A.W.N. Consultants. Current meteorological files are:-

Victoria

Albury	Latrobe Valley
Alphington	Longford
Ballarat	Mildura
Benalla	Myrtleford
Bendigo	Paisley
Box Hill	Point Henry
Breamlea (Torquay/Barwon Heads)	Portland
Dandenong	Rosedale
Darnum North	Sydenham
Frankston	Traralgon
Geelong	

New South Wales	South Australia	Western Australia	Tasmania
Bringelly	Adelaide Airport	Subiaco	Bell Bay
Campbelltown		Swanbourne	Railton
Mascot			
Lidcombe			
Wagga Wagga			
Taree			

In addition, A.W.N. has expertise in human health risk assessment utilising the IRAP-h View programme. IRAP-h View incorporates the guidance and procedures contained in the USEPA OSW Human Health Risk Assessment Protocol (HHRAP).

Examples of significant projects in the modelling field are given below:-

1. Transfield Obayashi Joint Venture, Victoria

A.W.N. Consultants was commissioned by Transfield Obayashi Joint Venture to conduct a plume dispersion modelling study to assess the environmental impact of a Melbourne City Link Tunnel vent on ground level and elevated receptors (proposed high rise residential developments).

Vehicular fleet atmospheric contaminant emission estimates were developed for nitrogen dioxide, nitric oxide, carbon monoxide and lead.

The AUSPLUME model was used to conduct the assessment. The "flagpole" receptor option commissioned by A.W.N. Consultants in this project was subsequently incorporated in AUSPLUME Version 4.0.

2. M.C. Herd Pty. Ltd., Victoria

A.W.N. Consultants was commissioned by M.C. Herd Pty. Ltd. to undertake a major odour audit of their abattoir and rendering plant facility at Geelong, Victoria. The audit utilised back calculation, flux chamber and point source emission monitoring techniques to derive odour rates of emission for all odorous sources.

The AUSPLUME modelling assessment examined area, volume and point sources of odour associated with the stockyards, wastewater treatment, rendering processes and land disposal of organic solids.

The modelling project gave a clear direction for odour control measures, and established the required air pollution control equipment odour removal efficiencies. These measures have subsequently been successfully implemented.

3. Clay Brick and Paver Association, Victoria

The Clay Brick and Paver Association, and a number of brick manufacturing companies, commissioned A.W.N. (Air Water Noise) Consultants to conduct an extensive ambient fluorine compound monitoring programme adjacent to Nubrik and Boral Bricks clay brick/tile manufacturing facilities located in Scoresby, Victoria.

Concurrently, a comprehensive stack emission monitoring programme was conducted to enable a statistical assessment of fluorine compound unit emission rates.

The project database has subsequently been used to assess the predictive capabilities of the AUSPLUME gaussian plume dispersion model, and the AUSPUFF non-steady state puff dispersion model. Further projects are planned to refine the capabilities of the models in relation to highly reactive gases, such as hydrogen fluoride.



17.2 CFD Modelling

Computational Fluid Dynamics (CFD) is a computer modelling technique for simulating fluid flow. CFD can predict air speed and direction, temperature, humidity, turbulence levels and concentrations of atmospheric contaminants at thousands of points in space to help design laboratories, cleanrooms, schools, theatres, hospitals, sports complexes and industrial facilities. Air quality and ventilation problems are readily identified and solutions quickly tested.

Other uses for CFD modelling include improving industrial processes, in particular where transport of particles and chemical reactions can interact with the fluid flow.

A.W.N. Consultants is the exclusive agent in Australia and New Zealand for Rowan Williams Davies & Irwin Inc.'s CFD modelling services.

17.3 Physical Modelling

Physical modelling is often necessary to assess the effect of both complex terrain and man-made structures on the dispersal of atmospheric contaminants.

A.W.N. Consultants is the exclusive agent for the air quality services offered by Rowan Williams Davies & Irwin Inc. (RWDI), Canada. RWDI is a 200+ person firm with an international reputation in physical modelling. Scale model tests are conducted in boundary layer wind tunnels to identify the extent of air quality impacts, and to provide solutions.



LEFT
Road tunnel physical modelling

CENTRE
Building models

RIGHT
Water tank modelling

17.4 Software

Lakes Environmental Consultants Inc. appointed A.W.N. (Air Water Noise) Consultants as exclusive agents in Australia, New Zealand and South East Asia for their range of air quality models. Models include CALPUFF View, ISC-AERMOD View, AUSTAL View, CALRoads View, MOBILE View, IRAP-h View, EcoRisk View, SEVEX View, SLAB View, SLAB 3D and Screen View.

CALPUFF View is a pre and post processor for CALPUFF, a puff model that has a series of advantages over plume models. Puff models can consider non-steady-state emissions and are used in a wide variety of air quality studies.

ISC-AERMOD View is a complete air dispersion modelling package which incorporates the following USEPA models into one interface: ISCST3, ISC-PRIME, AERMOD and AERMOD-PRIME. These models are used extensively to assess pollutant concentrations and deposition from a wide variety of sources.

AUSTAL View is a user interface for the German Federal Environmental Agency air dispersion model. AUSTAL View uses a Lagrangian particle tracking air dispersion model that contains its own diagnostic wind field model.

CALRoads View combines three mobile source air dispersion models, CALINE4, CAL3QHC, and CAL3QHCR, into an integrated graphical interface. This package is used for predicting air pollutant concentrations of carbon monoxide (CO), nitrogen dioxide (NO₂), particulate matter (PM), and other inert gases from idle or moving motor vehicles.

MOBILE View is a graphical interface for the USEPA MOBILE6 model.

IRAP-h View is a graphical interface which fully implements the USEPA guidance for evaluating risks from emission sources: the 1998 USEPA OSW Human Health Risk Assessment Protocol (HHRAP).

EcoRisk View fully implements the USEPA guidance for evaluating ecological risk: the 1999 USEPA OSW Screening Level Ecological Risk Assessment Protocol (SLERAP). EcoRisk View simultaneously calculates risk values for multiple chemicals, from multiple sources and at multiple exposure locations.

SEVEX View™ is a unique integrated approach for off-site effects analysis and effective emergency planning, generating realistic hazard zones within a range of 1 to 20 km.

SLAB View is a graphical user interface for the USEPA SLAB model, enabling modelling of toxic and denser than air accidental chemical releases.

Screen View is an interface for the USEPA Screen3 model. Screen3 predicts single source worst case pollutant concentration scenarios.