Guideline No.: EN/001 Issue Date: July 2010

Title: Air Environment Guideline
Issued by: Environment Department

1.0 Air Environment General Guidelines

Clean air is a basic requirement of human health and well-being. Air pollution, however, continues to pose a significant threat to health worldwide. According to a WHO assessment of the burden of disease due to air pollution, more than two million premature deaths each year can be attributed to the effects of urban outdoor air pollution and indoor air pollution (from the burning of solid fuels).

Air pollutants may be either emitted into the atmosphere (primary air pollutants) or formed within the atmosphere itself (secondary air pollutants) apart from the physical state of pollutants (such as gaseous or particulate matter), it is important to consider the geographical location and distribution of sources. The local, urban, regional and global scale of air pollution can be distinguished, depending primarily on the atmospheric lifetime of specific air components.

There are some general guidelines / features, which are common to most works. Such guidelines are outlined below:

a. As part of proper supervision, the owner shall make tests and inspections of the process at frequent intervals as required by the Authority.

b. The results of all tests shall be recorded by the Authority representatives.

c. Adequate facilities for sampling shall be provided on chimneys and ducts.

d. The reference test method for particulate emissions is by the procedure of British Standard 3405:1983 or similar All limit values including EGs are expressed as being at the gas reference conditions of 30°C and a pressure of 1 bar, without correction for water vapor content.

e. Emissions shall be monitored continuously wherever practicable.

f. Roads and operating areas shall be hard surfaced and kept clean.

g. A good standard of housekeeping is essential.

h. Staff at all levels shall receive proper control training and instructions in their duties, with special emphasis on start-up, shutdown and abnormal conditions.

i. Chimney heights shall be determined by the Authority taking into account all the relevant information on throughput, type of material, quality of emission, fuel type and rate of usage, local circumstances, etc.

j. Dry emissions shall normally be vented to air with an efflux velocity of 10 – 15 m/sec at full load.

Environment, Health & Safety Division
P.O. Box 17000, Dubai, United Arab Emirates
Tel: +971 4 8811881 • Fax: +971 4 8818857
Email: ehs.environment@trakhees.ae • Web Site: www.trakhees.ae

إدارة البيئة والصحة والسلامة
ص.ب ١٧٠٠٠، دبي، الامارات العربية المتحدة
هاتف: ٨٨١١٨٨١ ٤ ٩٧١+ • فاكس: ٨٨١٨٨٥٧ ٤ ٩٧١+
البريد الإلكتروني: ehs.environment@trakhees.ae • الموقع الإلكتروني: www.trakhees.ae

k. When waste gases are wet, or have been in contact with liquids, the maximum chimney velocity shall be 9 m/s to prevent the emission of liquid droplets physically stripped from the wet inside chimney surfaces by high velocity gases.

l. The minimum height of any chimney shall not be less than 3 meters above the ridge of any tallest building to which it is attached or adjacent.

m. There shall be suitable means for dealing with spillages, as agreed with Authority.

n. The construction of any boiler, heater, oven, etc. shall comply with PCFC requirements (see relevant EG).

o. For any spray painting operation, a proper painting booth should be constructed with a proper extraction / filtration system to the Authority's satisfaction; no open air spray painting will be allowed.

p. Proper extraction / filtration system to be provided for the air borne emissions from the proposed machinery. The detailed drawings to be submitted to PCFC for approval.

2.0 Chimneys

When the best practicable control means for prevention of emission of noxious or offensive substances have been used, the second part is to render harmless and inoffensive such substances as may be discharged. This is achieved by dispersion from suitably tall chimneys, taking into account the composition, volume rate of emission and temperature of the waste gases. The final decisions on the heights and diameters of chimneys shall be taken by the Authority.

For purposes of deciding on chimney heights of industry in the Free Zone, industry is divided into two parts:

a. Where chimneys are needed to disperse the products of combustion fuel; and

b. Where chimneys are needed to disperse airborne emission from process operations.

In the case of (a), for relatively small plants where the heat output is below 30MW, the publication on "Chimney Heights" issued by the UK government and obtainable from HMSO is used for determining heights of chimneys. It is a well-tried document over many years and allows multiple sources to be sited in industrial areas without exceeding permitted ground level concentration. On a case-by-case basis air dispersion modeling would be required from the clients.

3.0 Air Dispersion Modeling

Models are widely used in science to make predictions and/or to solve problems, and are often used to identify the best solutions for the management of specific environmental problems. Models may be physical – a scaled-down representation of reality; or, mathematical – a description of the system using mathematical relationships and equations.

Contaminants discharged into the air are transported over long distances by large-scale air-flow and dispersed by small-scale air-flows or turbulence which mixes contaminants with clean air. The dispersion by the wind is a very complex process due to the presence of different-sized eddies in atmospheric flow. Even under ideal conditions in a laboratory, the dynamics of turbulence and turbulent diffusion are some of the most difficult in fluid mechanics to model. There is no complete theory that describes the relationship between ambient concentrations of air pollutants and the causative meteorological factors and processes.

An atmospheric dispersion model is a:

a. Mathematical simulation of the physics and chemistry governing the transport dispersion and transformation of pollutants in the atmosphere; and

b. Means of estimating downwind air pollution concentrations given information about the pollutant emissions and nature of the atmosphere.

Dispersion models can take many forms. The simplest are provided in the form of graphs, tables or formulae on paper. Today, dispersion models more commonly take the form of computer programs, with user-friendly interface and online help facilities.

Most modern air pollution models are computer programs that calculate the pollutant concentration downwind of a source using information on the:

a. Contaminant emission rate;

b. Characteristics of the emission sources;

c. Local topography;

d. Meteorology of the area; and

e. Ambient or background concentrations of pollutant.

Environment, Health & Safety Division
P.O. Box 17000, Dubai, United Arab Emirates
Tel: +971 4 8811881 • Fax: +971 4 8818857
Email: ehs.environment@trakhees.ae • Web Site: www.trakhees.ae

إدارة البيئة والصحة والسلامة
ص.ب ١٧٠٠٠، دبي، الامارات العربية المتحدة
هاتف: ٨٨١١٨٨١ ٤ ٩٧١+ • فاكس: ٨٨١٨٨٥٧ ٤ ٩٧١+
البريد الإلكتروني: ehs.environment@trakhees.ae • الموقع الإلكتروني: www.trakhees.ae

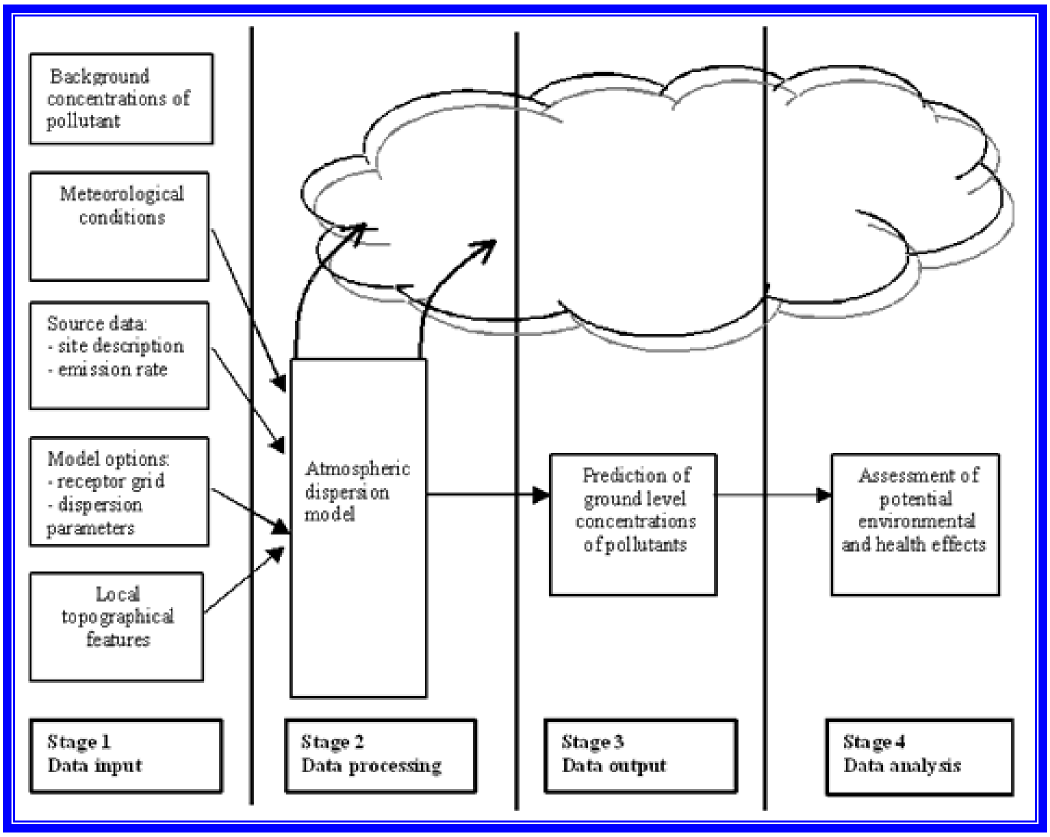

Figure 1.1 – Overview of the Air Pollution Modeling Procedure

The process of air pollution modeling contains four stages (*data input, dispersion calculations, deriving concentrations and analysis*). The accuracy and uncertainty of each stage must be known and evaluated to ensure a reliable assessment of the significance of any potential adverse effects.

Models can be set up to estimate downwind concentrations of contaminants over varying averaging periods – ether short-term (three minutes) or long term (annual). The most common use of dispersion modeling is to assess the potential environmental and health effects of discharges to air from industrial or trade premises. Models are particularly valuable for assessing the impacts of discharges from new activities and to estimate likely changes as a result of process modifications.

Modeling results can also be used for:

a. Assessing compliance of emissions with air quality guidelines, criteria and standards.
b. Planning new facilities;
c. Determining appropriate stack heights;
d. Managing existing emissions;
e. Designing ambient air monitoring networks;
f. Identifying the main contributors to existing air pollution problems;
g. Evaluating policy and mitigation strategies (e.g., the effect of emission standards);
h. Forecasting pollution episodes;

i. Assessing the risks of and planning for the management of rare events such as accidental hazardous substance releases;
j. Estimating the influence of geophysical factors on dispersion (e.g., terrain elevation, presence of water bodies and land use;
k. Running “numerical laboratories” for scientific research involving experiments that would otherwise be too costly in the real world (e.g., tracking accidental hazardous substance releases, including foot-and-mouth disease); and
l. Saving cost and time over monitoring – modeling costs are a fraction of monitoring costs and a simulation of annual or multi-year periods may only take a few weeks to assess.

Even the most sophisticated atmospheric dispersion model cannot predict the precise location, magnitude and timing of ground-level concentrations with 100% accuracy. However, most models used today (especially the US EPA approved models) have been through a thorough model evaluation process and the modeling results are reasonably accurate, provided an appropriate model and input data are used.

One of the key elements of an effective dispersion modeling study is to choose an appropriate tool to match the scale of impact and complexity of a particular discharge. When choosing the most appropriate model the principal issues to consider are:

a. The complexity of dispersion (e.g., terrain and meteorology effects); and

b. The potential scale and significance of potential effects, including the sensitivity of the receiving environment (e.g., human health versus amenity effects).

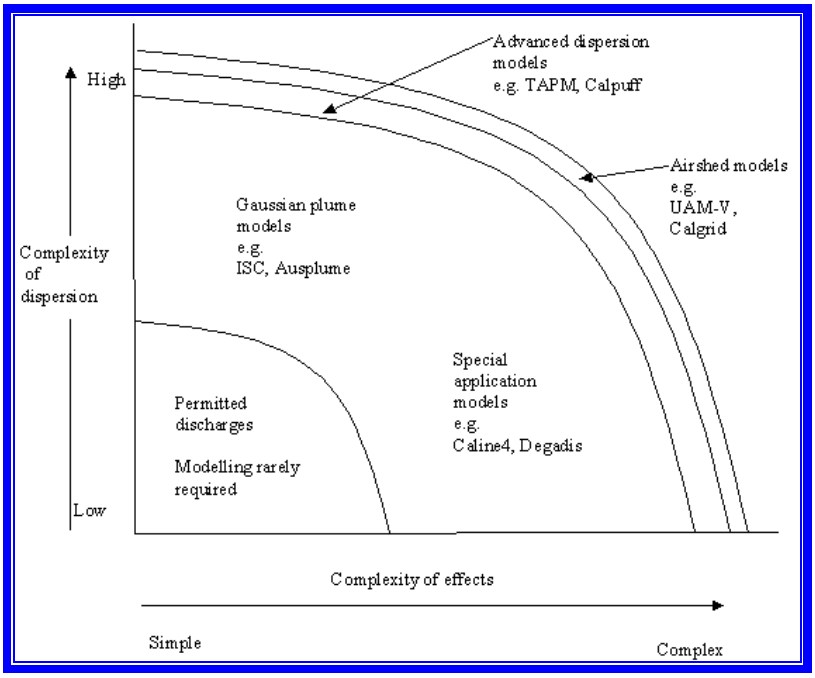

Figure 1.2 – Type of Model Typically Applied according to the Complexity of the Problem
Plots the applicability of different models on a graph of complexity of dispersion (y-axis) against complexity of effects (x=-axis) Ausplume and ISC models can deal with moderately complex dispersion but only limited complexity effects. TAPF and Calpuff can deal with both highly complex dispersions and highly complex effects.

4.0 General Industry Air Emission Guidelines

		Emission Limit
	a. Particulate Matter	
(i.)	Inert dust in ducts and chimneys from combustion sources	250 mg/m^3
(ii.)	Fugitive Dust – there shall be no significant visible emission except from combustion sources	
(iii.)	There are many dusts and fumes which can have a harmful or nuisance effect on humans, animals, vegetation and materials of construction and for which special limits of emission are required. The following list if not exclusive and substances not on the list will be considered based on their merits.	
	Iron oxide fume from oxygen refining	75 mg/m^3
	* Petroleum – solids from catalytic crackers	100 mg/m^3
	* Petroleum – furnace carbon black	5 mg/m^3
	Phosphorus (as P_2O_5)	5 mg/m^3
	Tar fumes	20 mg/m^3
	Vinyl Chloride	10 mg/m^3

*Note: Desired range of Sulfur Recovery Units (SRUs) efficiency 98 – 99.9%

All volumes are referred to standard conditions of 30°C and 1 bar; electricity works burning fossil fuels are also referred to standard 12% emission of carbon dioxide in the waste gases

(iv.) Routine methods of assessment may be used by agreement with the Authority, and continuous monitoring instruments shall be fitted wherever practicable

(v.) Emissions in normal operation should be free from visible smoke and in any case should not exceed 250 mg/m^3

(vi.) Sand is prohibited for use as blasting media. Use of any abrasive blasting media containing more than 1% silica shall not be used in abrasive blasting operations in PCFC

(vii.) All abrasive blasters operating in PCFC shall use a recyclable non-metallurgical abrasive material

	Emission Limit
b. Gaseous Emissions	
Amines – total amine	5 ppm v/v
– trimethylamine	1 ppm v/v
Asphalt fumes	5 mg/m^3

The waste gases from industrial processes are often a mixture of acid gases, whilst it is not practicable to measure each component separately, it is convenient to measure the total acidity and to express it as sulfur trioxide (see below table) as a basis for comparison.

5.0 Source Emission Criteria – Air Pollutants

Substance	**Symbol**	**Sources**	**Maximum Allowable Emission Limits (mg / Nm^3)**
Visible Emissions		Combustion Sources Other Sources	Ringlemann 1 or 20% opacity or 250 None
Carbon Monoxide	CO	All sources	500
Nitrogen Oxides (expressed as Nitrogen Dioxide)	NOx	Combustion Sources Material Producing Industries Other Sources	See Table 1.3 1500 200
Sulfur Dioxide	SO_2	Combustion Sources Material Producing Industries Other Sources	500 2000 1000
Sulfur Trioxide including Sulfuric Acid Mist (expressed as Sulfur Trioxide)	SO_3	Material Producing Industries Other Sources	150 50
Total Suspended Particles	TSP	Combustion Sources Cement Industry Other Sources	250 50 150
Ammonia and Ammonium Compounds (expressed as ammonia)	NH_3	Material Producing Industries Other Sources	50 10
Benzene	C_6H_6	All sources	5
Iron	Fe	Iron and Steel Foundries	100
Zinc and its Compounds (expressed as Zinc)	Zn	Electroplating / Galvanizing Industries	10
Lead and its Compounds (expressed as Lead)	Pb	All sources	5
Antimony and its Compounds (expressed as Antimony)	Sb	Material Producing Industries Other Sources	5 1
Arsenic and its Compounds (expressed as Arsenic)	As	All sources	1
Cadmium and its Compounds (expressed as Cadmium)	Cd	All sources	1
Mercury and its Compounds (expressed as Mercury)	Hg	All sources	0.5
Nickel and its Compounds (expressed as Nickel)	Ni	All sources	1
Copper and its Compounds (expressed as Copper)	Cu	All sources	5
Hydrogen Sulfide	H_2S	All sources	5

Chloride	Cl^-	Chlorine Works Other Sources	200 10
Hydrogen Chloride	HCl	Chlorine works Other Sources	200 20
Hydrogen Fluoride	HF	All sources	2
Silicon Fluoride	SiF_4	All sources	10
Fluoride and its Compounds including HF and SiF_4 (expressed as Fluoride)	F^-	Aluminum Smelters Other Sources	20 50
Formaldehyde	CH_2O	Material Producing Industries Other Sources	20 2
Carbon	C	Odes Production Waste Incineration	250 50
Total Volatile Organic Compounds [expressed as total organic carbon (TOC)]	VOC	All sources	20
Dioxins and Furans		All sources	1 (ng TEQ / m^3)

6.0 Ambient Air Quality Standards

Substance	Symbol	Maximum Allowable Limits (µg / m^3)	Average Time
Sulfur Dioxide	SO_2	350	1 hour
		150	24 hour
		50	1 year
Carbon Monoxide	CO	23 (mg)	1 hour
		10 (mg)	8 hour
Nitrogen Dioxide	NO_2	290	1 hour
		110	24 hour
Ozone	O_3	160	1 hour
		120	8 hour
Total Suspended Particles	TSP	230	24 hour
		90	1 year
Particulate Matter	PM_{10}	300	1 hour
		150	24 hour
Lead	Pb	1	3 months
Benzene	C_6H_6	50	1 hour
Fluoride	HF	3	24 hour
		0.5	3 months