AIR-POLLUTION CONTROL IN TAIWAN

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Introduction

Air pollution has been defined in several ways. In one sense, it is considered to be emission to the atmosphere of any material that has a deleterious effect on living systems. Major sources of air pollution are: (i) transportation; (ii) domestic heating; (iii) electric-power generation; (iv) refuse burning; and, the topic of this paper, (v) industrial fuel burning and process emissions.

History

Taiwan has changed from an agricultural-based economy to an industrial-based economy through industrialization programs implemented by the government. Although industry has contributed to the nation's economic growth, it has also given rise to adverse environmental effects, especially air pollution. For this reason, industry must now regard air-pollution abatement as an economic plus, instead of an economic minus.

Legislative trends

Efforts in Taiwan to control pollution are, in general, modelled on those undertaken by advanced nations, *e.g.*, U.S.A., Japan and European countries. Many local statutes and administrative laws have been enacted hastily in response to a public demand for a "clean environment". Consequently, most of the legislation has not been based on well planned judicial and administrative processes. In other words, the pollution-control laws in Taiwan are still in their infancy.

Environmental standards

In the case of the metals industry, the major problem influencing environmental issues is the air pollution emanating from the emission of particulates, sulphur oxides, carbon monoxide, etc. From 18 August, 1986, the Bureau of Environment Protection has dictated that the level of particulate pollution should not exceed 700 mg Nm^{-3}, when measured at the discharging outlet of any pollution source. A maximum value of 10 mg Nm^{-3} has been set for the lead and the lead chemical industries (Table 1).

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TABLE 1

Environmental pollution standards in Taiwan

Pollutant	Criteria		Test method
	Discharging air standard	Ambient air standard	
Particulate	700 mg Nm^{-3}	500 μg Nm^{-3}	1. JIS Z8808 EPA method 2. Sampled with high volume, refer to ASTM D4096 3. Air composition: CNS K 9018 or JIS K 2301
Sulphur oxides			1. CNS K 9008, JIS K 0103
• Combustion process	1100 ppm	0.3 ppm	EPA method 6/8 JIS B 7981
• Other processes	650 ppm	0.3 ppm	2. ASTM D 2914 JIS B 7952
Carbon monoxide	4000 ppm		1. JIS K 0098
Lead & lead compounds	10 mg Nm^{-3}	10 μg Nm^{-3}	1. JIS Z 8808 2. Sampled with high volume, analyzed by atomic absorption spectroscopy

Note: Nm^3 = volume of 1 cubic metre of air at 101 kPa and 273 K.

In order to apply strict controls on environmental standards, the Bureau of Environment Protection has been reorganized and upgraded to Ministry level; it is now known as the Department of Environment Protection. As a consequence, both battery manufacturers and lead smelters are paying greater attention to minimizing air-pollution by the use of collection equipment. However, collection of sub-micron particles requires highly efficient devices such as baghouses, high-energy scrubbers, and electrostatic precipitators. Such equipment involves considerable investment of capital and high running costs. At present, only 936 out of 56 027 factories in Taiwan have fitted pollution-control equipment to waste-air streams. However, the Department of Environment Protection is imposing fines on defaulting factories until their operations meet the relevant pollution standard.

Battery manufacturers in Taiwan also pay attention to the health of their employees. Most manufacturers conduct regular monitoring of workroom atmospheres, as well as exhaust ventilation and filtration systems. In addition, workers in both the smelter and the 'lead area' of a factory are subjected to monthly blood-lead tests. The blood-lead level should be kept below 60 μg per 100 ml.