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8-16-1987

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#### Citation Information

Qing, Shi, "Hazardous Materials and Wastes in China: Management and Legislative Principles" (1987). *Proceedings of the Sino-American Conference on Environmental Law (August 16)*. <https://scholar.law.colorado.edu/proceedings-of-sino-american-conference-on-environmental-law/20>

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Shi Qing, *Hazardous Materials and Wastes in China: Management and Legislative Principles*, in PROCEEDINGS OF THE SINO-AMERICAN CONFERENCE ON ENVIRONMENTAL LAW (Natural Res. Law Ctr., Univ. of Colo. Sch. of Law 1987).

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# **HAZARDOUS MATERIALS AND WASTES IN CHINA: MANAGEMENT AND LEGISLATIVE PRINCIPLES**

**Shi Qing\***

## **INTRODUCTION**

This paper introduces the recent general situation concerning hazardous waste management in China. China produces about 40 million tons of hazardous waste annually. The Division of the Solid Waste Management at the Chinese National EPA is now in charge of the management work. This paper includes a brief introduction to the Pollution Control Standard of Non-Ferrous Metals promulgated by the nation and the legislative principles for the formulation of regulations on the management of hazardous waste as well as the treatment, disposal, reclamation and utilization techniques of a few kinds of hazardous wastes.

## **MANAGEMENT OF HAZARDOUS MATERIALS**

Management of hazardous materials and wastes in China is implemented by the individual departments of government. In 1961 the State Council promulgated the following regulations and rules: "Regulations on the Management of Safe Production for the Medium and Small-Size Chemical Plants", "Interim Rules on the Management for Storage of Hazardous Chemicals", "Interim Rules on the Permit for Managing and Purchasing Hazardous Chemicals", "Regulations on Transportation of Hazardous Material by Railway", "Regulations on the Management for Preventing Fire of Hazardous Chemicals", and "Interim Rules on the Punishment in Violation of Regulation on the Management of Explosive and Combustible Materials." These regulations were put into effect respectively by the Ministry of Chemical Industry, the Ministry of Railways, the Ministry of Commerce and the Ministry of Public Security. The municipalities of Shanghai, Tientsin, Beijing and the

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other big cities also issued their own Regulations and Rules for the management of hazardous materials.

Due to the rapid increase in the production and usage of chemicals in China, the State Council further promulgated "Regulations on the Safe Management of Hazardous Chemicals" on February 17, 1987, referring to the experience in management of chemicals in the developed countries. The so-called hazardous materials in the regulations mentioned above are explosives; compressed gases and liquified gases; combustible gases (liquids and solids); spontaneously combustible materials and combustible materials in the wet condition; oxidants and organic peroxidants; toxidants; and corrosives. They are classified in seven categories according to the national classification standard, "Classification of Hazardous Goods and Number of Items". The regulations deal with the production, usage, storage, management, transportation and packaging of the hazardous chemicals as well as penalties for violation of the regulations.

The production of hazardous materials is controlled by the national uniform production program. The production of toxic and hazardous materials by small town plants is prohibited due to lack of effective pollution control within the plants. All of the plans for constructing new plants or extending existing plants, which produce hazardous chemicals, must be considered and approved by the government authority higher than the one in which the plant is located, and reported to the Ministry of Chemical Industry for file.

The plants which produce, use, store, transport and manage hazardous chemicals must have an adequate monitoring system and the facilities for treatment of wastewaters as well as liquid and solid wastes, and must implement the regulations under the National Environmental Protection Law. Regulations for preventing fire and first aid must be established in the plants. The operators must be equipped with preventive appliances.

The registration and permit system is now implemented for the production, usage, storage, transportation and management of hazardous chemicals. Application for a certificate of permit must be made to the relevant departments of the province or municipality directly under the central government. Examination will be carried out once every two to three years.

Special regulations for transportation of hazardous chemicals have been issued by the relevant ministries of the State Council. Specific requirements for different kinds of hazardous materials are established. Hazardous materials will

not be allowed to be transported if the regulatory requirements are not met.

China produces around 40 million tons of hazardous waste each year. In 1984, comprehensive management of hazardous wastes by the Solid Waste Management Division within the National Environmental Protection Agency was initiated. Comprehensive utilization of wastes has been actively promoted. The formulation of standards of pollution control and rules for hazardous waste management have been initiated, and the planning and construction of model plants for treatment and disposal of hazardous waste has been preliminarily organized.

In the past decades, quite a number of hazardous waste pollution accidents have occurred. In recent years, because of the boom of small factories and plants in small towns and rural areas, hazardous waste pollution has been developing rapidly and spreading widely and seriously. A great deal of waste effluence has been directly discharged to the sewage system, thus aggravating water pollution. Large quantities of hazardous wastes were mixed with garbage and entered into the environment without notice. Therefore the task for hazardous waste management is exceedingly arduous.

According to the principle, "Whoever causes pollution shall be responsible for its elimination", specified by the National Environmental Protection Law, the large or medium factories and enterprises discharging hazardous wastes are responsible for treatment and disposal. Some of the chemical and petrochemical plants are equipped with incinerators. Waste liquids such as waste acids, waste alkalis, and waste oils are treated or reclaimed by chemical, biological and physical processes in certain chemical plants. The sludge generated from the treatment of waste water is used as forage for earthworms at a vinylon plant and a bleaching and dyeing mill in Sichuan. The content of heavy metal in earthworms' excrement is lower than the standard of pollution control, and, therefore, can be used as fertilizer for planting flowers and trees. Income from this use of fertilizer can help to offset the expense of feeding the earthworms. Moreover, the protein and amino acids contained in the earth-worm's bodies can be separated from the concentrated toxic substances and used as materials for producing medicine and cosmetics, while the separated toxic residues can then be treated and disposed. It is obvious that comprehensive utilization of sludge can be obtained by biological engineering.

In recent years, small plants have spread everywhere. It seems impossible for each of them to treat hazardous wastes totally by themselves. In view of this, the National Environ-

mental Protection Agency has started to help establish treatment centers for various hazardous wastes for a whole city or a specified region. A feasibility study of such a hazardous waste treatment and disposal center as a prototype engineering project has been underway in Shenyang since 1986.

To address the problem of pollution accidents caused by discharges of heavy metal wastes into the environment, the EPA has formulated a standard or norm for pollution control in the non-ferrous metals industry and promulgated unified monitoring and experimental analysis methods (see Appendix 1).

### **LEGISLATIVE PRINCIPLES FOR HAZARDOUS WASTE MANAGEMENT**

The main regulatory principles for management of hazardous waste followed by EPA are as follows:

1. The hazardous wastes specified in regulations are referred to as the solid, semisolid or liquid wastes (except the waste water) which possess one of the following features: toxicant containing, combustible, explosive, corrosive and infectious. These wastes are also referred to as the wasted hazardous items, hazardous intermediate products and by-products, and those wastes which are listed in "hazardous wastes classifications."

2. The guiding ideology and legislative principles are the rational exploitation and full utilization of natural resources, protection for ecological environment, pollution control, protection for human health, and the promotion of national economic development.

3. Give strong encouragement to the application of the low waste or nonwaste technology, the reclamation and utilization of wastes as resources. For those wastes which could not be recovered or reused due to the lack of available techniques or financial incapability, protective measures should be adopted.

4. Implement the general policy of careful management through the total process from the generation, collection, transportation, storage, treatment and disposal of hazardous waste. That is the "total process order list." Implement a system of identification, registration, documentation, labeling, reporting, and certification.

5. The permitted discharge of pollutants contained in the hazardous waste is controlled by two levels, national and local. In general, local standards are more stringent than national, while new enterprise standards are more stringent than the old ones. The government will formulate the unified iden-

tical methods for identification, monitoring, analyzing, and evaluation.

6. The total process starting from waste generation to final disposal or comprehensive utilization should be provided with emergency preparedness measures in case of accidents. Secondary pollution is not permitted during the use of hazardous waste as raw materials. The treatment technology and equipment should be safe. After treatment, environmental monitoring should be implemented. In case of an accident, a responsible person should be identified and remedial measures undertaken.

7. Cooperative and transorganizational management and utilization of hazardous wastes by government, collectives and individuals are highly encouraged. Enterprises dealing with waste collection, transportation, storage and disposal have to be organized and established.

8. Preferential treatment is given to those who utilize the hazardous wastes as raw materials for reproduction. Low taxation or exemption from taxation are provided to collectives and individuals who deal with the collection, transportation and disposal of hazardous wastes.

9. According to the principle of "whoever causes pollution should be responsible for its elimination", specified by national environmental protection law, the waste producer is responsible for pollution abatement and pays charges for the discharge of waste and penalties for above standard discharges. Fees paid for the waste discharge are somewhat higher than those paid for waste treatment. The penalty amount should be higher than the fee for treatment.

10. Environmental protection agencies take the responsibility for planning, coordinating, monitoring and directing the management of hazardous wastes, while the public security agencies take the responsibility for the effect of the hazardous waste pollution on public safety. The local government authorities and industries take the responsibility for centralized treatment and disposal of similar kinds of hazardous wastes. For the identification and evaluation of hazardous wastes, the National Environmental Protection Agency will appoint special research institutions or organizations to establish a special evaluation committee.

11. The penalty for arbitrary discharges of hazardous wastes may range from financial penalties to criminal punishments in accordance with the degree of violation. On the other hand, awards will be given to those who succeed in comprehensive utilization of hazardous wastes or in pollution control.

## APPENDIX 1

The promulgated standards and norms for pollution control of cadmium, mercury, arsenic and zinc including their chemical compounds are listed in the following table:

**TABLE 1**  
**IDENTIFICATION STANDARD OF LEACHING TOXICITY**

Toxic Substance	The Highest Permissible Concentration in Leaching Liquor (mg/l)
1. Mercury and its compounds:	0.05 (calculated as Hg)
2. Arsenic and its compounds:	1.5 (calculated as As)
3. Lead and its compounds:	3.0 (calculated as Pb)
4. Cadmium and its compounds:	0.3 (calculated as Cd)
5. Hexavalent Chromium compounds:	1.5 (calculated as Cr <sup>6+</sup> )
6. Copper and its compounds:	50 (calculated as Cu)
7. Zinc and its compounds:	50 (calculated as Zn)
8. Nickel and its compounds:	25 (calculated as Ni)
9. Beryllium and its compounds:	0.1 (calculated as Be)
10. Fluoride and its compounds:	50 (calculated as F)

Among the accidents caused by the pollution of heavy metals, those involving chromium-containing wastes are increasing in number. There are eighteen chromates manufacturers in China. The chromium plating plants exist in almost every city and town. The pollution from hexavalent chromium bearing waste is a relatively serious problem. Many institutes have developed successfully more than ten technologies for treatment, disposal, recovery, and utilization of chromium-bearing wastes. The main technologies are listed as follows:

### Treatment and Disposal:

1. Dry calcinating for removal of toxicity;
2. Wet sodium sulfite for removal of toxicity;
3. Detoxicating process with ferrous sulfate;
4. Detoxicating process with complex compound;
5. Detoxicating process with aqueous vapour;
6. Cement solidification;
7. Isolating process with anti-leaching concrete partition and so on.

### Comprehensive Utilization:

1. Use as colouring agent of glass;
2. Producing chemical fertilizer—calcium superphosphate;
3. Producing cast stone;
4. Producing mineral wool;

5. Replacing magnesium limestone as iron-smelting flux;
6. Producing slag brick;
7. Producing aggregate of ceramic concrete;
8. Use as material of cement manufacture and so on.

All technologies mentioned above have been put into practice in plants of different scale in China.

### **RECOVERY OF CHEMICAL PRODUCTS FROM CHROMIUM-CONTAINING DEPLETED ELECTROLYTES AND RESIDUES**

There are many kinds of chromium-containing wastes electrolytes in the electroplating industry. The content of  $\text{CrO}_3$  varies from 50 g/l to 350 g/l. In addition, there are various metal ions such as  $\text{Cr}^{3+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Al}^{3+}$ , etc. and anions such as  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$  in these wastes. Besides, there are a great deal of sludges, residues such as trivalent chromium-containing residues in chemical reduction and active carbon processes, and the residues in barium salt and electrolysis reduction processes. Because the components in the residues are very complicated, it is difficult to treat the wastes, causing serious environmental pollution. Various chemical products have been produced by converting and recovering this kind of waste.

Products are: lead chlorate, lemon yellow, iron oxide red bottom mud, sodium nitrate, aluminium sulfate, etc.