II Development and environmental conservation

1. Economic development and decrease in pollutant emission

(1) OECD report

Japan has a precious experience that since 1970's we succeeded in both environmental conservation and economic prosperity by development and transfer of technology on industrial pollution and energy problems including saving energy.

As shown in Table 3, for 20 years from 1970 to 1990, while Japan had recorded the highest economic development in the world (growth rate of GDP from 1987 to 1992 was 24.1 %), the emission of pollutants especially air pollutants decreased drastically. For example, while GDP increased by 133 % , emission of sulfur dioxide decreased by 82 % and nitrogen oxides by 21 %.

Table 3. Change of GDP and load to the environment

	Change of rate (%)	
	1970 ~ 1990	1980 ~ 1990
GDP	133.4	50.2
Amount of shipping etc. in manufacturing industris	127.3	52.4
Main load to the environment		
Sulfur dioxide emission	-82.4(1970 ~ 1989)	30.6(1980 ~ 1989)
Carbon dioxide emission by energy consumption	35.7	13.1
Nitrogen oxides emission	-21.2 (1970 ~ 1989)	7.1 (1980 ~ 1989)
Amount of municipal waste eneration	19.6 (1975 ~ 1990)	14.8
Nitrogen furtilizer consumption	- 11.1	- 0.3
Water utilization amount	1.9(1975 ~ 1990)	1.2

Source : OECD

One part of 'OECD report Japanese environmental policy ' Which was published at March 1994 is quoted in the following.

—— In the past 20 years, Japanese economy has not been damaged in spite of very eager environmental policy. The environmental policy and the economic growth policy are compatible and rather mutual supportive. —— The influence by the expensive pollusion control measures on macrocconomics index, including GDP, employment, price, and trade, was negligible and considering the indirect benefit, such as promoting technological innovation, the benefit was bigger. ——'

Moreover, this report evaluates the Japanese environmental policy as follows.

'—— Japan succeeded in decoupling between economic growth and 1.energy consumption 2.emission of air pollutant etc.—— '

Fig. 8 shows the transition of product shipping amount and sulfur dioxide concentration in Yokkaichi City for 28 years from 1965 to 1993. While the product shipping amount increased about 7 times higher from 240 billion yen in 1965 to 1700 billion yen in 1993, sulfur dioxide level decreased by one eighth from 0.049 ppm in 1965 to 0.006 ppm in 1993.

Fig.9 shows the transition of product shipping amount and fuel consumption (the corresponding value in fuel oil of pollution control plan cooperative company , the following are the same) and Fig. 10 shows transition of fuel consumption and sulfur dioxide concentration.

Japanese marvelous economic recover after the war is called Japanese miracle. And the fact that while pollution problems had been overcome in a short period, there was no serious influence on the whole economy is evaluated as the other Japanese miracle. There are several reasons of the latter miracle: development of the end-of-pipe anti-pollution technology including desulfurization equipment and denitrification equipment mentioned in chapter, development of CP (cleaner production) technology including energy saving and change of the industrial structure.

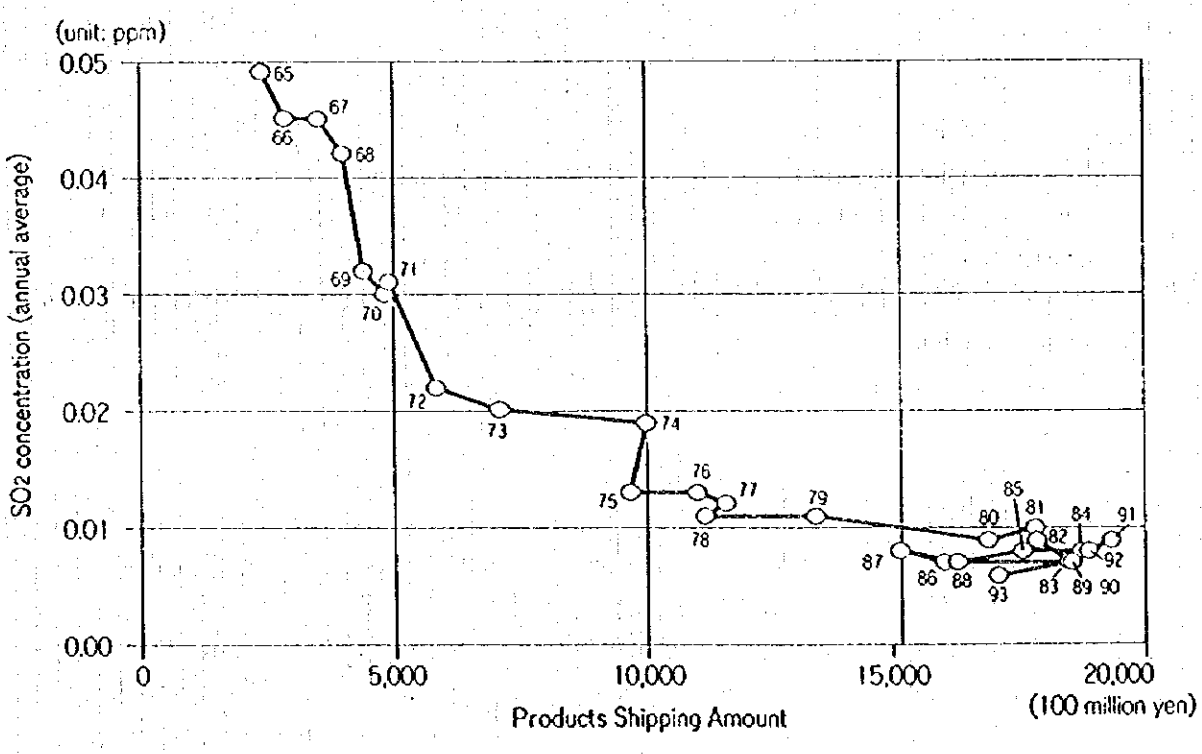


Fig. 8 Products Shipping Amount and SO_2 Concentration

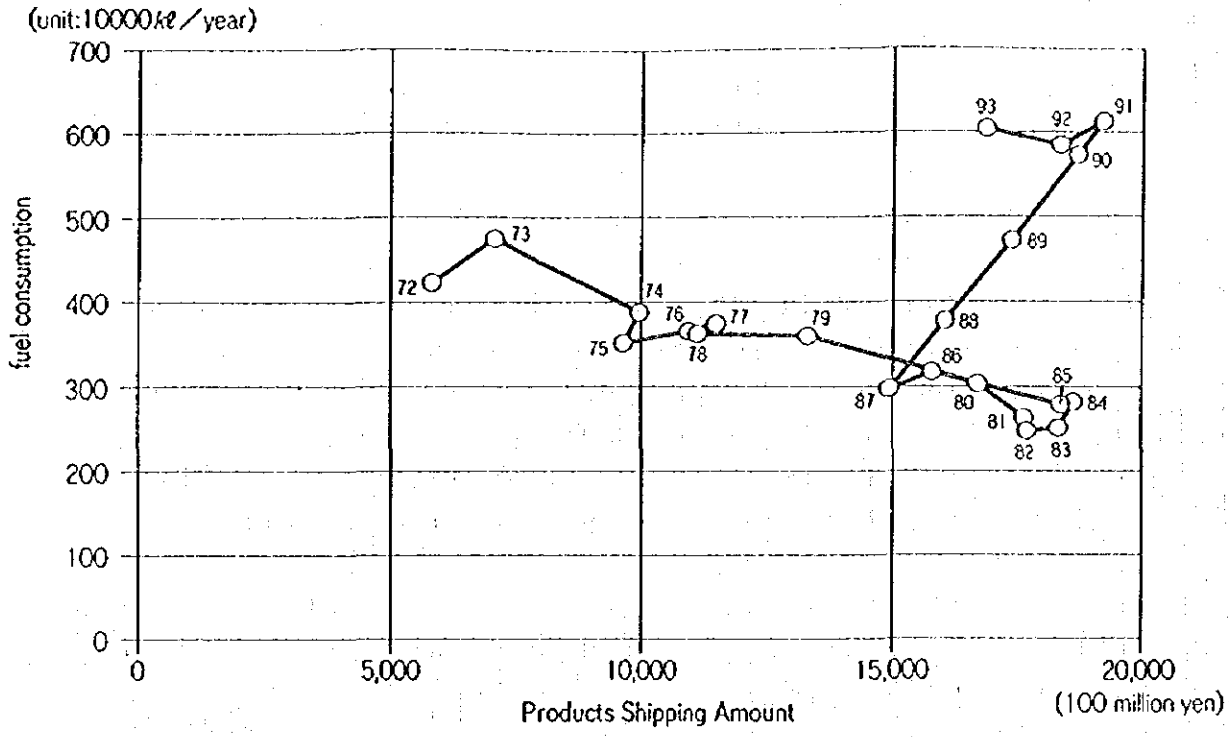


Fig. 9 Products Shipping Amount and Fuel Consumption in Yokkaichi City

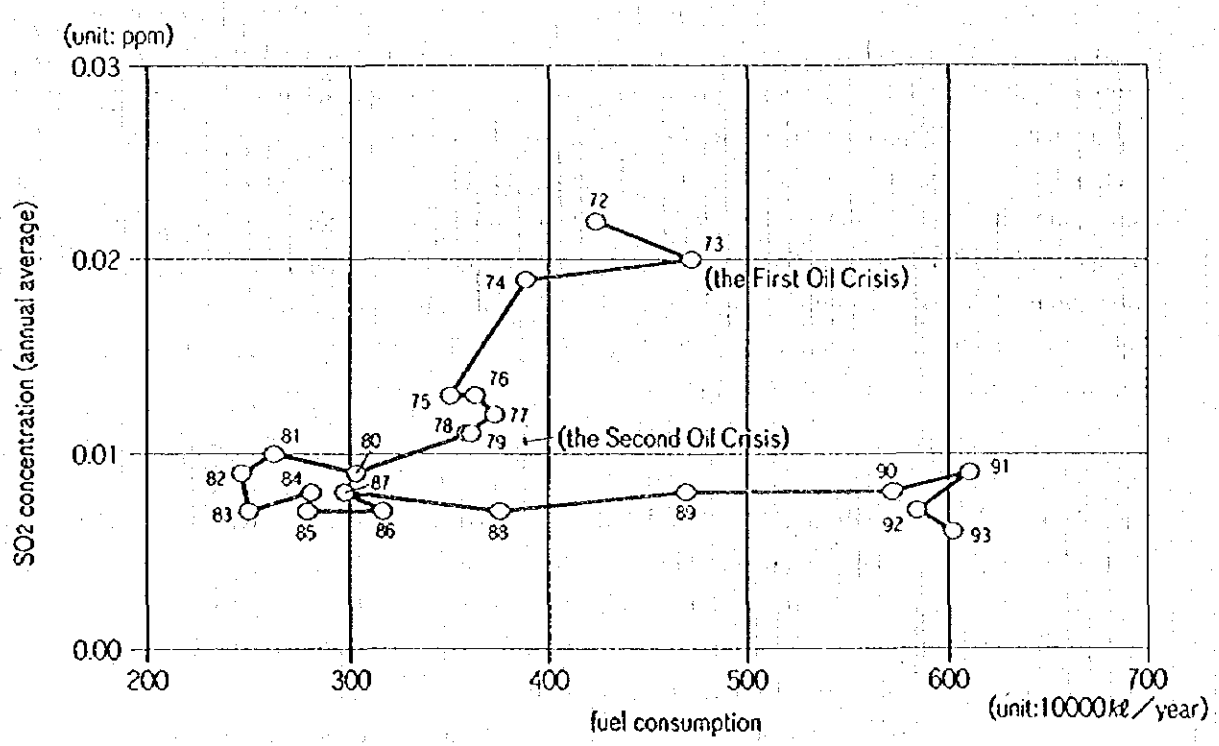


Fig. 10 Relation between Fuel Consumption and SO_2 concentration in Yokkaichi City

(2) Change of the industrial structure

During the rapid economic development in Japan, the secondary industry especially basic material industry including chemical and steel making, which consumes much energy, had played a leading role. Because three fourth of energy was produced by imported oil, the high rise of oil price by two oil crises in 1973 and 1979 influenced greatly on Japanese industry, and it was an incentive to change the industrial structure.
After 1950's, in basic material industry, because it requires much energy cost and raw material cost for manufacturing, the production cost was drastically raised and it lost the relative international competition power. As a result, the manufacturing amount was decreased and it stimulated rationalization. On the other hand in the processing and assembly industry such as manufacturing of electronic parts and precision machines, the demand was expanded by development of up-to-date technologies and the production amount was getting bigger.
The change to the processing and assembly industry with high added-value and high functional products enhanced the added-value more and decreased the load to the environment by production.

(3) Saving energy and saving natural resources

Japanese government has been aiming at saving energy and natural resources with a great effort because of two oil crises. The oil crisis in 1973 raised the fuel cost and stimulated companies to try overcoming energy problems as one of the most important tasks.
In June 1979, the Japanese government enacted the Law concerning Rationalization of Energy Use (Saving Energy Law) to use the fuel according to the economic and social conditions. It stipulates the necessary measures to promote the general rationalization of energy use in factories, buildings, machineries, and equipment.
The ratio of energy consumption in industry is high in Japan, more than 50 % of total energy, higher than that of western countries. It is, therefore, important to save more energy. The following are the provisions stipulated in the law.

① Criteria in industries
The Minister for International Trade and Industry provides concrete criteria about 110 items as the criteria and the target of saving energy in the following 7 fields.

Rationalization of fuel combustion (combustion facility)
Rationalization of heating, cooling and heat transfer (heat utilization facility)
Recovery and utilization of waste heat (waste heat recovery facility)
Rationalization of transfer heat to power etc. (power generation facility with heat supply)
Prevention of electric loss by resistance etc. (electric facility)
Rationalization of transfer electricity to power, heat etc. (electric facility)

②. Designated energy control factory

The Minister for International Trade and Industry designates large scale factories which consume much fuel or electricity (fuel : more than 3,000 kl/year in crude oil, electricity : more than 12 million kw/year) as the designated energy control factory for promotion of energy consumption rationalization.

As of March 1994, about 2,200 factories for heat and about 2,600 factories for electricity were designated.

As a result of effort for energy saving by the government and industries after the first oil crisis, GNP against energy consumption as a guideline of energy consumption efficiency decreased drastically by 35 % in 1993 compared to the first oil crisis in 1973. It is shown in Fig. 11.

The enactment of the energy saving law and cost reduction by energy and resource savings in companies strengthen the nature of companies, enhanced the international competition power, increased export, released industries from the recession by oil crises and contributed to stable development.

Saving energy and saving resources helped to decrease the generation amount of pollutant. As shown in Fig. 12, according to the research by Environment Agency on sulfur oxides emission and their sources, saving energy contributed greatly to emission decrease. The fact that enterprises had to overcome the pollution and take some measures against oil crisis helped the short term increase of the enterprises' investment. On the other hand, saving energy and natural resources for cost reduction contributed to the environmental conservation.

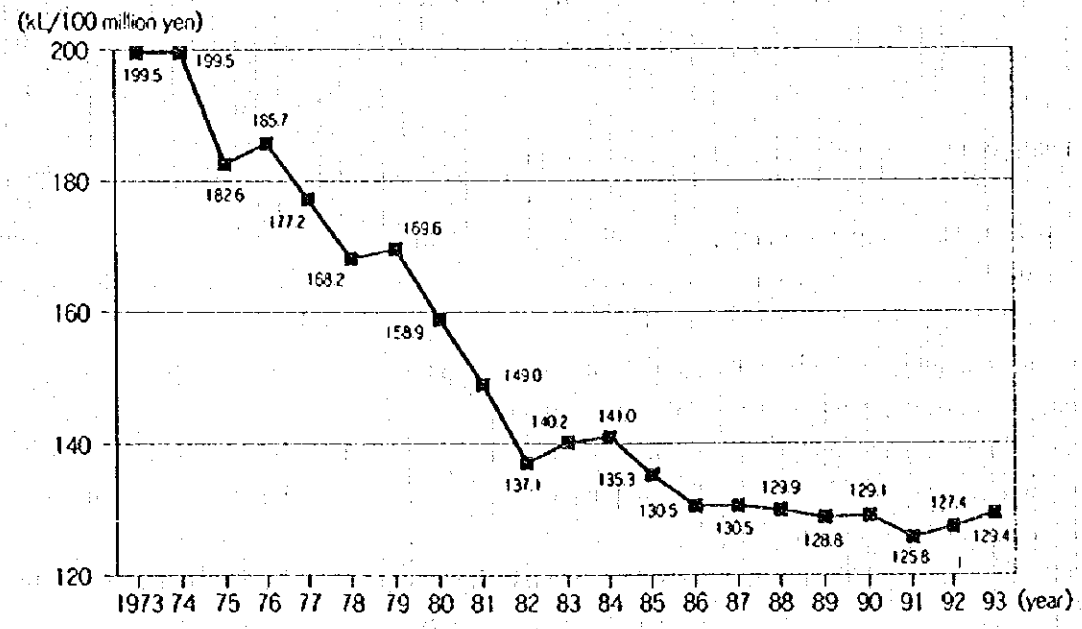
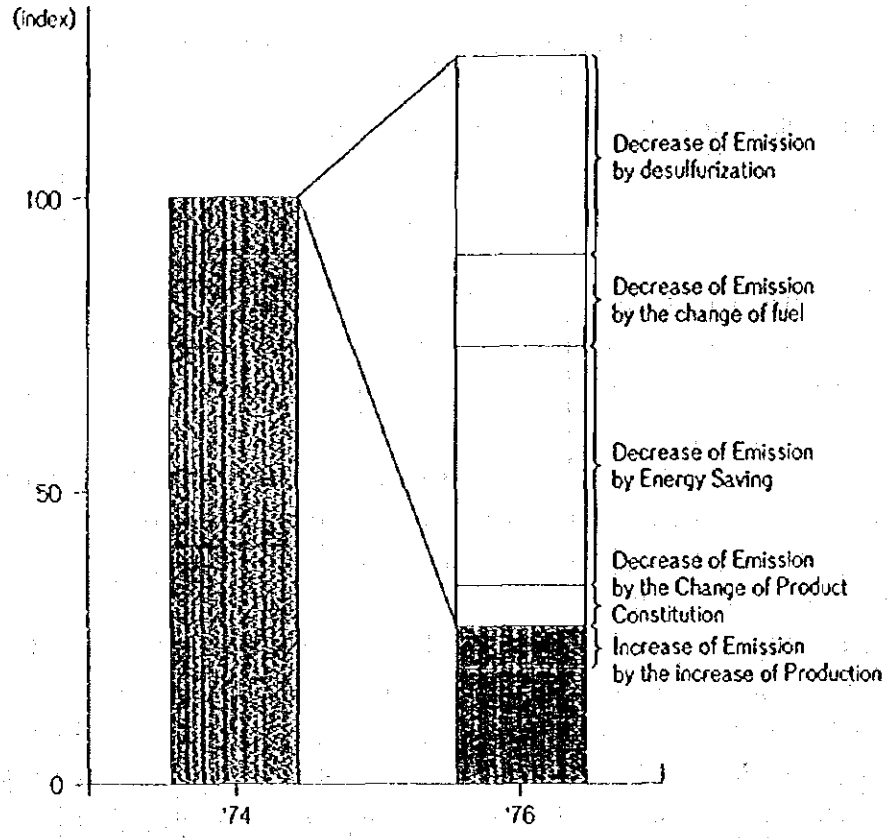


Fig. 11 Energy Consumption against GNP unit in Japan



(Remarks) 1. Surveyed by the Environment Agency

Fig.12 amount of SO_2 Emission and its change

(4) Competition power and the role of eco-business

In 1970's, the pollution prevention technology had drastically developed in Japanese industries. The backgrounds are 1. people's awareness to the pollution problems 2. appropriate control and guidance by the national government and local governments based on the feasibility of technology and technical support 3. technological development in industries to comply with the regulation and guidance.

Development of the pollution control technology helped enterprises not only to keep the production as it had been while complying with the severe pollution regulation but also improve enterprises' management.

In the automobile industry, the majority predicted that if anti-pollution device is attached to the car for complying with the most strict automobile exhaust gas regulation in the world, it caused the rise of car price, the decrease of fuel consumption efficiency and running efficiency, the decrease of demand for cars and then the drastic decrease of production in Japan. With a great effort, however, the development of environmental conservation technology improved the technology of fuel consumption efficiency and running efficiency.

The regulation of automobile exhaust gas contributed the pollution control and improvement of combustion control and quality control and we succeeded in the production of cars with good fuel consumption efficiency and less exhaust gas emission. Therefore, in spite of the strict exhaust gas emission control, automobile industry and Japanese economy enjoyed the prosperity.

As for the anti-pollution equipment manufacturing industry, the strict pollution control raised its production amount drastically, 34.1 billion yen in 1966, seventy billion yen in 1976, one thousand and eight hundred billion yen in 1992. The anti-pollution equipment manufacturing industry became one of the biggest in industrial machine manufacturing industry (17 % of industrial machine industry). Air pollution control facility (23 % of production) , wastewater control facility (43 % of production), waste treatment facility (33 % of production) and noise/vibration prevention facility (1 % of production) are manufactured in about 100 companies with 15,000 employees.

2. Compensation cost by the air pollution of sulfur oxides and control cost

(In case of Yokkaichi)

Environment Agency published a paper named Japanese Pollution Experience in 1991 based on the economic comparison study of actual cases on which is better, economic development with environmental conservation or without .

The history of air pollution by sulfur oxides in Yokkaichi City and its overcoming are described in chapter I.

The comparison study of compensation cost and control cost in Yokkaichi by Environment Agency is as follows and it concludes 'it is far economical to take pollution control before the occurence of pollution problems than after.'

(Compensation cost)

The average annual compensation cost after 1974, when compensation for lost benefit was started by the enactment of Pollution-related Health Damage Compensation Law, is considered as health damage compensation cost (See note 1). It is 1,331 million yen (at the rate of year 1989).

(Control cost)

The average annual investment for pollution prevention facility in private companies after 1971, when pollution control plan was implemented, is consider as the average depreciation. Then operation cost implemented in a fixed rate, payment of interest rate, cost for monitoring system in public organizations, and other expenses such as establishment of greenery buffer zone are added. The total is considered as annual air pollution control cost

(See note 2) , which is 14,795 million yen (at the rate of year 1989).

(Evaluation)

In Yokkaichi area, the plants has been operated under the sufficient air pollution control with the annual budget of 14,795 million yen. However, the annual compensation cost of 1,331 million yen (See note 3) should be paid because the control had not been sufficient at the early stage of the operation.

Taking some actions for pollution control had prevented more serious pollution from occuring, and if the control was not taken even after the pollution had occurred, the compensation cost should be bigger. We, therefore, assumed the situation that no measures were taken even after the occurence of the pollution. The compensation cost was calculated under the assumption that in Yokkaichi City the rate of recognised patients (the ratio of recognised patient to the total population in the area) was the same as that of Isozu area whose pollution was the worst in 1975. The assumed cost was 21,070 million yen (at the rate of year 1989) , much higher than the air pollution control cost.

The assumption result indicates that financially it is better to spend full investment for preventing health damage.

- Note -

1. Health damage compensation cost was calculated as follows.
   Total compensation cost in Yokkaichi area for 16 years from 1974, when the Pollution-related Health Damage Compensation Law was enacted, to 1989 was converted to the rate of year 1989 and divided by 16. Then the compensation cost based on the verdict in 1972 (88 million yen) was converted to the rate of year 1989 and annual redemption money in the case that the principal and interest have been refunded equally for 30 years (interest rate 7 %) was added.

2. The annual air pollution control cost is the sum of cost by private companies (14.6 billion yen) and cost by local government.
   The cost by private companies was calculated as follows. Total investment cost for 19 years from 1971, when pollution control was taken under the pollution prevention plan, to 1989 was converted to the rate of year 1989 and divided by 19. Then consumption cost like abolishment of deteriorated facility is added and 4 times of the total is considered as investment stock cost. Operation cost which is predicted to be 30 % of investment stock cost, and interest payment cost that is assumed to be 7 % of that were added.
   The cost by the local government was calculated as follows. Total cost for purchasing and installing monitoring equipment for 19 years from 1971 to 1989 were converted to the rate of year 1989 and divide by 19. Then 4 times of the cost is considered as the investment stock cost. This cost, operation cost that is assumed to be 8 % of investment stock cost and cost for greenery buffer zone from 1971 to 1973 were converted to the rate of year 1989. Then annual redemption money in the case that the principal and interest have been refunded equally for 30 years (interest rate 7 %) was calculated. The total of these costs are the cost by the local government.

3. The annual compensation cost when the ratio of recognised patient in Yokkaichi area is assumed 7.27 % is the compensation cost if there were recognised patients in Yokkaichi at the same rate with Isozu district whose ratio was the highest in 1979 (7.27 %). Total population, 279,342 in 1991 in Yokkaichi was multiplied with 7.27 % . Then it was multiplied with the average compensation cost per person in Yokkaichi in 1975.

QUESTIONNAIRE TO THE PARTICIPANTS NOMINATING GOVERNMENT （技協窓口機関用）

1. Please tell us the processes of nominating the participants after you received the Information(GI) on Group Training Courses in Technology for Industrial Exhaust Gas Treatment and Energy Saving sent from the JICA Office in your country, and also the time required until a nomination is made.
   Your office - related organizations - your office
   1)more than 2 months _____ 2) Less than 2 months_____

2. Do you finalize the nomination on the baisis of GI(1) or of the related organization's criteria(2)? (1)_____ (2)_____

3. Do you think the GI of these courses are clearly described about the objectives,contents and level? (1)YES_____ (2)NO_____

4. How long does it take for a participant to finish all the procedures needed for departure after he received the information of his nomination?
   (1) More than 1 month __ (2)More than 2 weeks__ (3) Less than 2 weeks __

5. Does the participant report to your office after he finishes his training
   (1) Usually yes_____ (2) Usually no_____

6. Concerning on the Technology for Industrial Exhaust Gus Treatment and Energy Saving, do you have a chance to get an assistance from donors other than JICA (Japan Internationl Cooperation Agency)
   Yes,_____ No,_____
   If yes,what kind of assistance are they?

7. If you have any opinion about this course in comparison with other similiar courses inside or outside your country,please state below;

_____

_____

_____

_____

_____

Thank you very much for your cooperation

QUESTIONNAIRE TO THE ORGANIZATION OF THE EX-PARTICIPANTS

(帰国研修員所属機関)

(The team will be very happy if the following questions are replied)

The group training courses (Technology for Industrial Exhaust Gus Treat-- ment and Energy Saving) has been conducted annually by JICA. Recent Training curriculum is attached as reference. (Annex 1)

Name of organization (with location)

I . Nomination

1. Please let us know the necessary processes to nominate candidates, after you receive the General Information (GI) of the Group Training Course in Technology for Industrial Exhaust Gas Treatment and Energy Saving sent from JICA office, and the time required for each process.

2. Mark one item matched with the selection of the applicants for the participants in this Group Training in your country.
   1) _____ Difficult to select one, due to the large number of applicants
   2) _____ Easy to select one, due to the small number of applicants
   3) _____ Others (list other reasons)

3. What is your policy in selecting the candidates.

   _____

   _____

   _____

4. Please explain the procedures from the time your organization receives the notice of participant's acceptance, until they leave the country for Japan, and the time requirement for each process.

5. Do you have sufficient time requirement for completing the procedures described in Item 4?
   Yes, _____ No, _____
   If No, state the time required.

II .Effect of Training

6. Is there a duty for ex-participants to report to your organization when he/she returns to your country after finishing the training in Japan?
   Yes, _____ No, _____
   If yes, what kind of report are they? If no, skip to the question 7.

   _____

7. What extent do you think the curriculums of the course correspond to the needs in your country? Indicate by an(×) mark in the corresponding box. (Please refer to the Annex 1,2 as a reference.)

full 75% ～100%	Major 50%～75%	Partly 25～ 50%	Slightly 0～ 25%

8. In what specific area in your organization have you gotten the most beneficial effect from the training courses in Japan ?
(Please refer to the Annex 1)

_____

_____

_____

9. Among the following technologies in the training course in Japan, what have been practically applied to the work in your organization ? Please refer to the annex 1.

_____

_____

_____

How are they utilized ? Give some examples.

10. Which methods have you used to transfer technologies into your organization ? Please explain in detail on each category below. (Content, duration, the number of people trained, e.t.c.)

1) On the job training

2) Formal training sessions

3) Written materials of technology learnt

4) Others (Please explain them.)

Ⅲ. Present Situation

11. Indicate any probable problems which impede the development of the Technology for Industrial Exhauset Gas Treatment and Energy Saving in your country ?

12. Please describe the training mathods and staff development systems for officials and engineers who are in charge of technology for industrial exhaust gus treatment and energy saving in your organization. (place, equipments, number of instructors and students, kinds of class, duration of training, e.t.c.)

13. Considering the present situation on Technology for Industrial Exhaust Gus Treatment and Energy Saving introduced in your country, are you satisfied with the number of engineers and officials who are in charge of planning ,operation and installation.

Yes,_____ No,_____

If no,in what specific area of engineers are lacking in ?

Ⅳ.Others

14. Please attach the pamphlet,or organization chart which shows the activities of your organization.

15. Request or Suggestion to Japan International Cooperation Agency (JICA), if any.

Thank you very much for your cooperation!

(帰国研修員用)

Questionnaire for ex-participants

NAGOYA INTERNATIONAL TRAINING CENTRE (NITC)
JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)

No.73,2-chome Kamenoi,Meito-ku,Nagoya 465
Japan

Q U E S T I O N N A I R E

I. Personal Data:

1. Name in Full: _____ Date of Birth_____
(Please underline family name)

2. Name of institution where currently employed: _____

_____

Address: _____
(Street and Number) (City) (State/Country)

_____
(Zip code) (Cable/Telex) (Telephone)

3. Current home address: _____
(Street and Number) (City)

_____
(State/Country) (Zip code) (Telephone)

Remarks: page 1 - 5 帰国研修員 用
6 技協窓口機関用
6 - 10 所属機関 用

II. Educational data:

4. Have you ever attended any other training course sponsored by donors other than JICA?

Yes,_____ No,_____

If yes, which donor_____

5. Comment by comparing the above mentioned training course with the one sponsored by JICA, if any.

_____

_____

_____

6. Education/Training (Degree/non-degree) before attending training at JICA

Name, education/ training inst.	Location of institution	Years attended from~to	Certificate/Diploma/ Degree & Major in

7. Education/Training (Degree/non-degree) after attending training at JICA

Name, education/ training inst.	Location of instituion	Years attended from~to	Certificate/Diploma/ Degree & Major in

III. Present Work and Effect of Training:

8. Current position and your responsibility: Please describe briefly your current position and responsibility:

_____

_____

9. Nature of present job: Indicate by an (x) mark in the corresponding box.

Activities	Full aprox. 85%	Major aprox. 75%	Partly aprox. 50%	Slightly aprox. 25 %
Research				
Instruction				
Extension				
Administration				
Others, specify				

10. Were there specific objectives set before attendance of course?

Yes,_____ No,_____

If yes, who by_____

what are they_____

11. To what extent can you apply the knowledge/skills etc. acquired through the JICA training to your present job?

Full over 85%	Major aprox. 75%	Partly aprox. 50%	Slightly aprox. 25 %	None less 25%

Please explain your answer briefly

_____

12. Which part of your training held by JICA was most useful to you in relation to your subsequent position and responsibility?

_____

_____

_____

13. If there is any personal improvement in your job/work after the JICA training, please indicate below;

_____ (yes) improved(____ a lot) (_____ some what)

_____ (no) improvement

If yes, please check below where applicable;

_____ work conditions
_____ responsibility
_____ for future prospects
_____ salary
_____ for other(better)Job
_____ content of work
_____ professional recognition
_____ international contanct
_____ promotion

IV. Technological Knowledge Transfer

14. Now that you have returned to your home country, do you intend to transfer any technology/knowledge learnt during the training course to others in your organization?

Yes,_____ No,_____

If yes, please answer the question 15.

If No, skip to the question 17.

15. Which methods have you used to transfer technology/knowledge within your organization? Please explain in detail on each category below. (content, the number of people trained, duration e.t.c.)

a) On the job training

b) Fomal training sessions

c) Written materials of technology learnt

d) Others (please explain them.)

16. What are the main obstacles to be overcome in transferring technology /knowledge to others within your organization?

_____

_____

_____

V Problems

17. What do you consider to be the biggest problems in the performance of your present job with regard to environmental conservation? (Check 4 or less in each row below;)

Lack of

_____ trained personnel	_____ support of supervisor
_____ equipment	_____ technical literature
_____ funds	_____ national training institutes
_____ foreign experts	_____ transport facilities
_____ research facilities	_____ career perspective
_____ other, specify;	

Please explain the reason briefly.

_____

_____

_____

_____

Various constraints:

____economic situation	____brain drain
____poor management	____promotion structure
____too much foreign influence	____no suitable training
____political situation	____poor maintenance of equipment
____other, specify;	

Please explain the reason briefly.

_____

_____

VI Request or Suggestion

18. What subjects do you think supposed to be added to the training course you attended.

19. Request or suggestion to Japan International Cooperation Agency (JICA), if any.

_____Retraining	_____Technical informations
_____JICA publication	_____others, please mention below;

_____

_____

_____

_____

Thank you very much for your cooperation.

4．持ち帰り資料

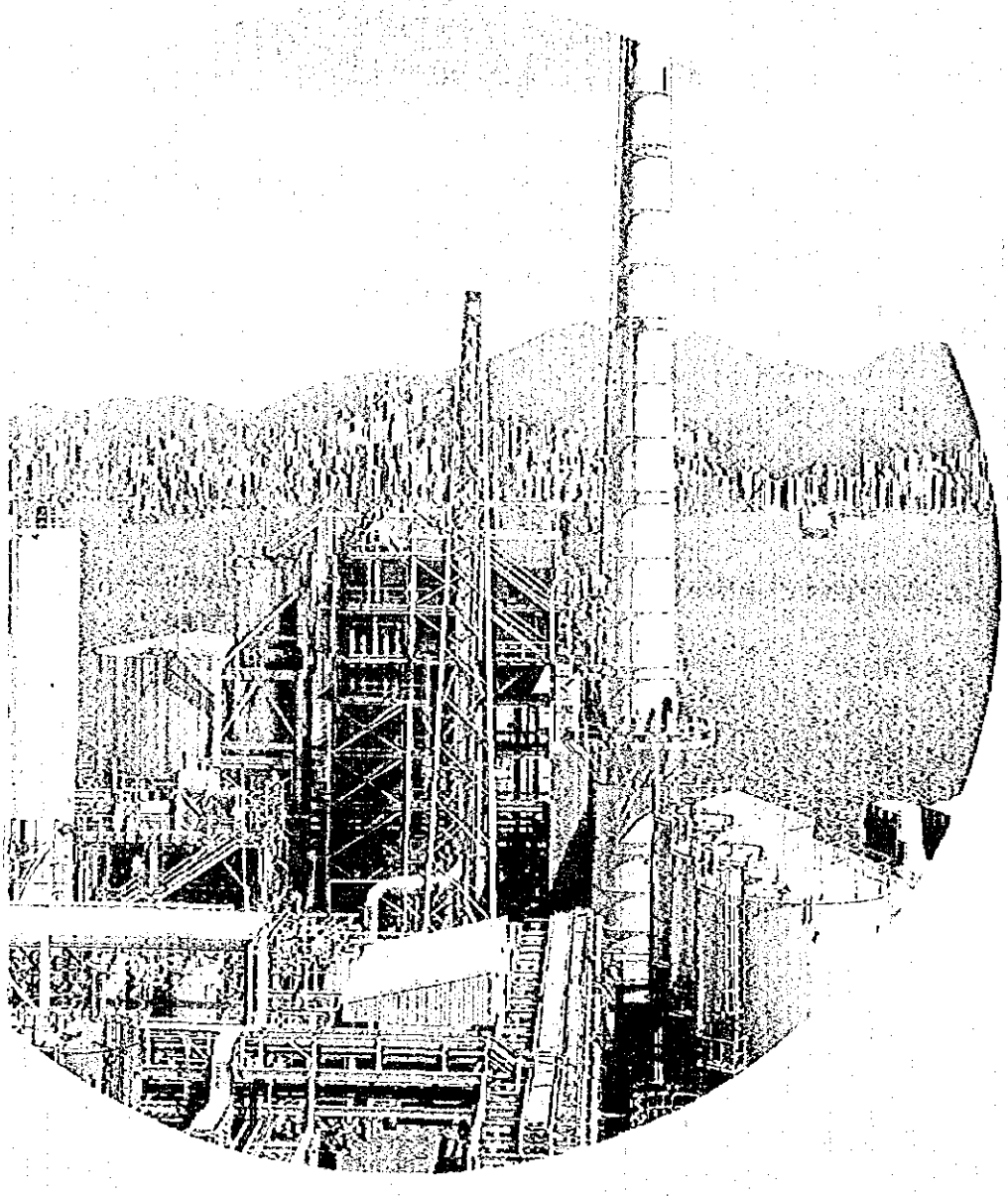
エンバイロベース社（香港）資料

Enviropace Limited is committed to improving the environment of Hong Kong. We are contracted by the Environmental Protection Department of the Hong Kong Government to design, build and *operate the territory's* **Chemical Waste Treatment Centre (CWTC).**

Our goal is to improve our environment by helping you properly handle and dispose the chemical waste you produced. Our services will assist you in complying with Hong Kong's chemical waste regulations.

衛和化學廢料處理有限公司是香港政府環境保護署的合約承辦商，負責設計、興建，及運作全港首間化學廢物處理中心。

衛和爲本港的工商各界提供專業的化學廢物收集及處理服務，宗旨是協助本港廠商以簡單有效而正確的方法處理化學廢物，使客戶能滿足化學廢物管制規例中的各項要求，從而改善香港的環境。



香港環境現況

Hong Kong's environment, and Victoria Harbour in particular, has been deteriorating for some time. This deterioration is partially the result of improper disposal of chemical wastes. Such wastes, which can be highly toxic, were discharged directly into sewers and surface waters. This posed a serious threat to the environment and to public health.

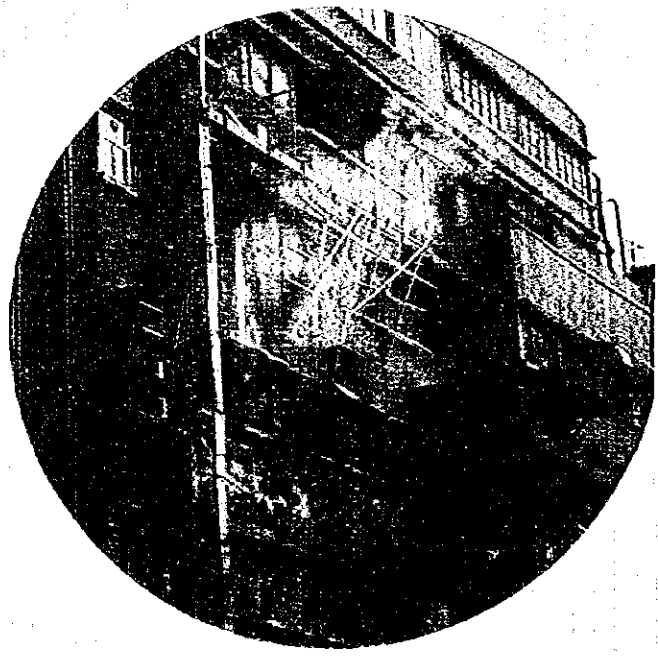
In the past, Hong Kong industry had limited disposal options for chemical wastes. This has changed. Today there is a well defined regulatory framework to ensure the control of chemical wastes, a state-of-the-art treatment facility and an excellent service and collection system.

香港的環境污染情況日趨惡劣，尤以維多利亞港最爲嚴重。化學廢物爲造成污染的一個主因。每天直接排放至去水道的大量化學廢物，不少是含有劇毒的，若不經適當處理而流入香港水域，對環境及公眾健康均會構成嚴重威脅。

過去，香港工業界因爲沒有足夠的化學廢物處理方法及設備，故對此一問題束手無策；然而，現時情況經已改善。本港已有一套嚴格的「由始至終」式化學廢物監管程序，一所先進的化學廢物處理中心，及完善的化學廢物上門收集服務。

These changes are positive steps towards a clean environment. We are confident that our expertise will enhance the efforts of government and industry as they address the challenges of creating a better environment.

這些轉變，都是本港保護環境工作的新里程。我們深信，衛和的專業知識和豐富經驗，將會令到香港政府及本港工商業，更有效地解決污染問題。



Enviropace Limited is a joint venture established specially for the CWTC project. We are entirely dedicated to the territory and its environment. The three partners are: Pacific Waste Management, Ltd (70%), CITIC Pacific Limited (20%), and Kin Ching Besser Co., Ltd (10%).

Pacific Waste Management, Ltd. is a subsidiary of London-based Waste Management International plc., which in turn is a member of the WMX Technologies Inc. group of companies, U.S.A. The WMX group is the world's largest provider of comprehensive environmental services, including solid waste collection and disposal, hazardous waste treatment and disposal, waste-to-energy, recycling, waste reduction and environmental engineering services. Enviropace has drawn heavily on the extensive expertise of the WMX group to provide a state-of-the-art chemical waste treatment programme suitable for the territory.

CITIC Pacific Limited is a public company listed on the Hong Kong Stock Exchange. The company has diversified business interests with an emphasis on infrastructure investments including aviation, telecommunications and energy; property investments, property developments and trading.

Kin Ching Besser Co., Ltd. is a wholly-owned subsidiary of B+B Asia Ltd. The company manufactures concrete and quarry products, and is involved in construction and environmental engineering works.

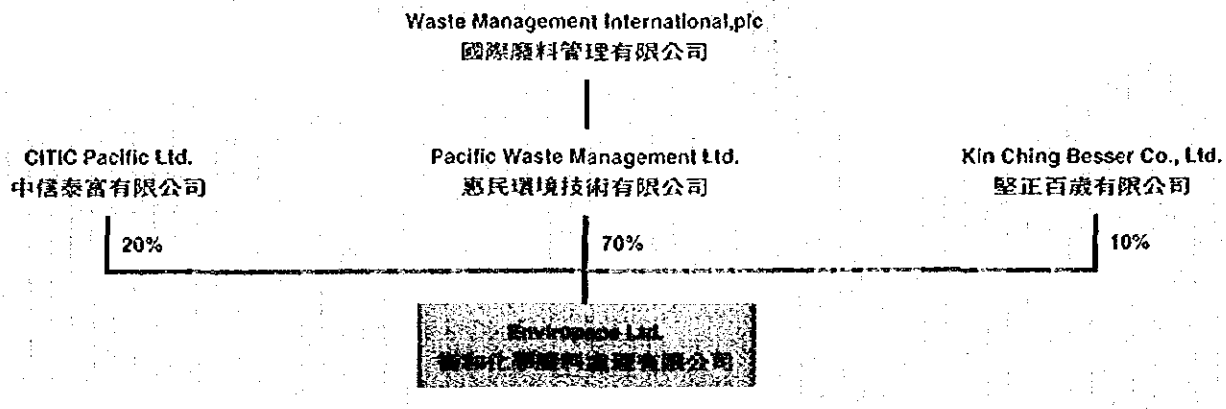
衡和化學廢料處理有限公司乃特別爲化學廢物處理中心整個計劃而成立的合資公司，全面致力於改善本港的環境污染問題。我們的三位股東分別爲：惠民環境技術有限公司（佔70%）、中信泰富有限公司（佔20%）和堅正百歲有限公司（佔10%）。

惠民環境技術有限公司爲設於倫敦的國際廢料管理公司的全資附屬公司。國際廢料管理公司乃美國WMX公司集團的成員之一，WMX是現時世界上規模最龐大的環保服務機構，所提供的服務包括固體廢物收集、有害廢物處理、回收及循環再用、廢物轉化能源、減少廢物及各項環保工程服務等。衡和在得到該集團的專業知識、豐富經驗和先進技術支援下，針對本港工商業所產生的各種化學廢物，設計了一套先進而高效率的化學廢物處理方案。

中信泰富有限公司是本港一間上市公司，其業務範圍廣泛，並以基建項目爲主，例如航空、電訊及能源工程、物業投資、地產發展與買賣等。

堅正百歲有限公司爲B+B亞洲有限公司的附屬機構，專門生產混凝土及石礦產品，同時亦從事建築工程及環保工程等業務。

Enviropace Shareholders
衡和化學廢料處理有限公司股東組合



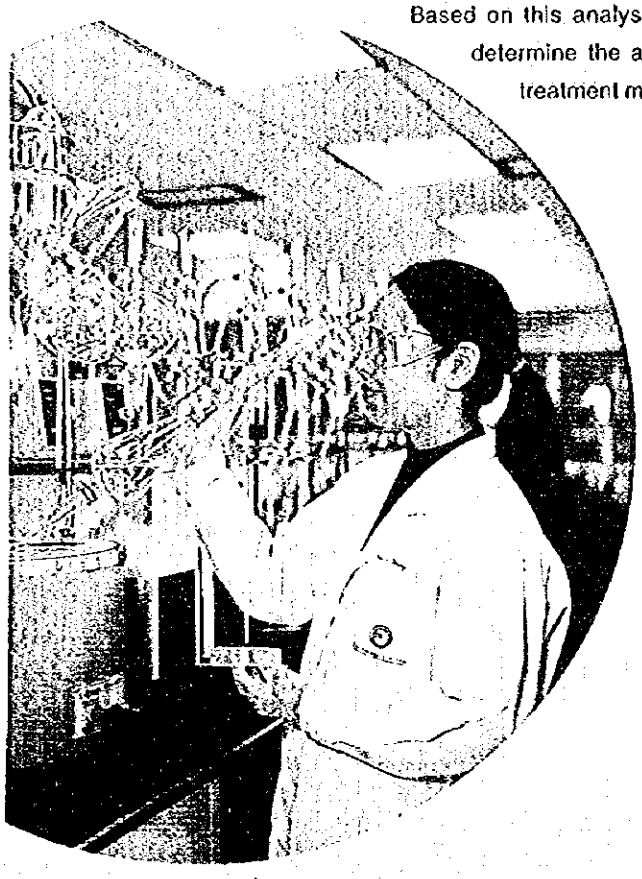
Business Development

Through the Business Development Representatives, Enviropace provides on-site consultation to help you better understand how you should handle your chemical waste problems and how you can use our service. Our Business Development Representative will:

- Assist you to identify your chemical wastes
- Answer your questions on chemical waste handling and storage
- Help determine the best mix of services including:
  - Type and number of containers
  - Frequency of collection

Laboratory Services

After identifying the potential chemical wastes you produce, Enviropace may have to secure a representative sample. These samples will then be analyzed at our laboratory, which is the most advanced of its kind in Hong Kong. Based on this analysis, we will determine the appropriate treatment method.



業務拓展部

衛和通過業務拓展代表提供上門諮詢服務，幫助客戶詳細瞭解他們的化廢問題及我們的服務範圍。我們的業務拓展代表可提供以下服務：

- 協助客戶確定所產生的化學廢物的種類和數量
- 解答有關化廢處置及貯存的問題
- 爲客戶設計最適當的服務安排，包括：
  - 廢料貯存容器之數量及種類
  - 上門收集化廢的服務次數

化廢檢定服務

有需要時衛和的專業人員會就閣下所產生的化學廢物抽取樣本，交回化學廢物處理中心的實驗室進行分析化驗，而所得之分析報告，用以確定最適當的化廢處理方法。

Collection

Enviropace provides complete door-to-door collection service to assist you to comply with existing regulations. Our services include:

- Supplying approved containers of various types and sizes for storage and transport
  - 20 litre or 200 litre
  - Plastic, carbon steel or stainless steel
  - Open-top or closed-top
- Supplying completed container labels for those containers as specified in the Regulations
- Supplying a licensed chemical waste collection fleet of vehicles ranging from lorries to bulk tankers to barges
- Service frequencies based on your needs
- Trained drivers to deliver and remove containers

Customer Service

With just one phone call, our Customer Service system provides you with:

- Access to services offered by Enviropace
- Scheduling for container deliveries and waste pick-up
- Solution to problems which may arise during service

化廢收集服務

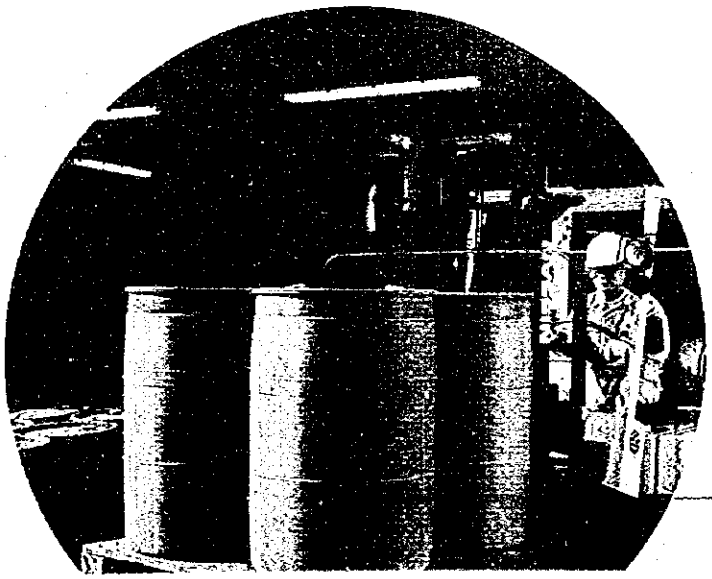
衡和確定適當處理方法後，隨即爲客戶安排妥善的上門收集化廢服務以協助客戶達到規例的要求。衡和的服務包括：

- 派發不同種類及大小的容器供貯存及運送化學廢物
  - 二十公升或二百公升
  - 塑膠、碳鋼或不銹鋼
  - 開口式或密封式
- 提供適當的標籤
- 各種領有專業化廢收集執照的運輸工具，包括桶裝貨車、缸槽車、躉船等
- 提供符合客戶需要的收集服務
- 所有負責上門收集化廢的司機及人員均經嚴格訓練

客戶服務部

客戶只需致電我們的客戶服務部，即可隨時得到妥善的服務，包括：

- 有關衡和各項服務的諮詢
- 安排收集廢料及更替容器
- 協助用戶解決有關化廢處理及運送的各種問題



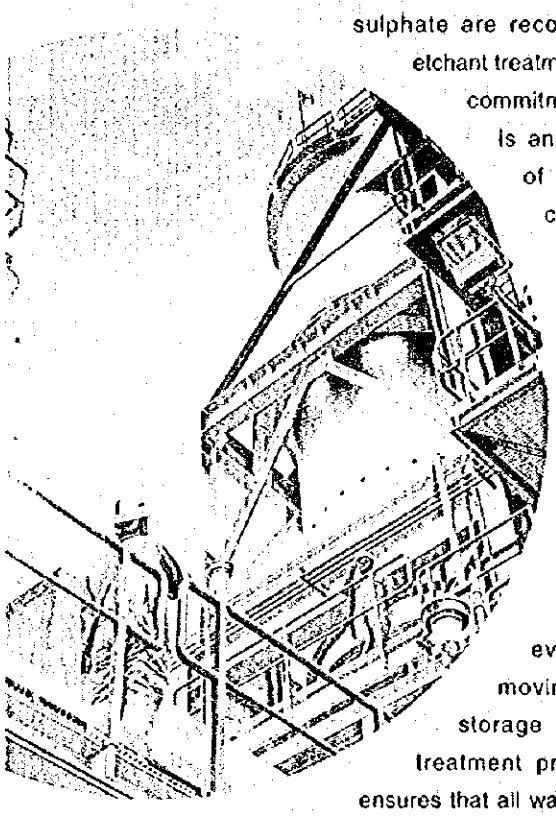
Treatment Services

The CWTC operates a variety of treatment systems including: oil/water separation, high temperature incineration, inorganic waste treatment and recovery, waste water treatment, and chemical stabilization.

This integrated treatment facility allows us to treat chemical waste such as:

- Acids and alkalis
- Solvents (halogenated and non- halogenated)
- Cyanides and sulphides
- Heavy metal bearing waste
- Waste lubricants
- MARPOL waste (Marine pollutants) from ships using Hong Kong's port facilities (MARPOL Annexes I and II)

Recovery is an important facet of the CWTC. Water, heat and energy are recovered at every available point. Copper oxide and ammonium sulphate are recovered from the etchant treatment system. This commitment to recovery is another indication of Enviropace's concern for environmental conservation.

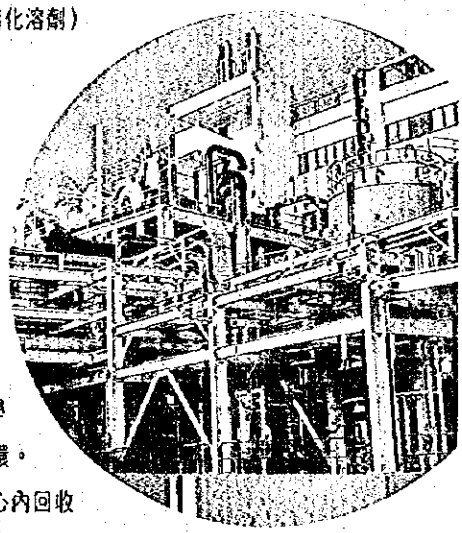


As your waste is received, it is mixed with compatible waste. The compatible wastes are monitored and evaluated while moving through the storage system and treatment processes. This ensures that all wastes are properly and completely treated. It also maintains our high environmental compliance standards.

化學廢物處理服務

化學廢物處理中心由多個系統組成，以配合不同的化學廢物處理需要。包括：含油廢水分隔系統、高溫焚化系統、無機廢物處理及資源回收系統、污水處理系統、化學及物理穩定系統等。這些綜合設備，能有效地處理下列化學廢物：

- 酸、鹼
- 溶劑（包括鹵化及非鹵化溶劑）
- 氰化物、硫化物
- 含重金屬之廢料
- 廢潤滑油
- 使用香港港口設施的船舶所產生的廢油及化學廢物 (MARPOL Annexes I and II)



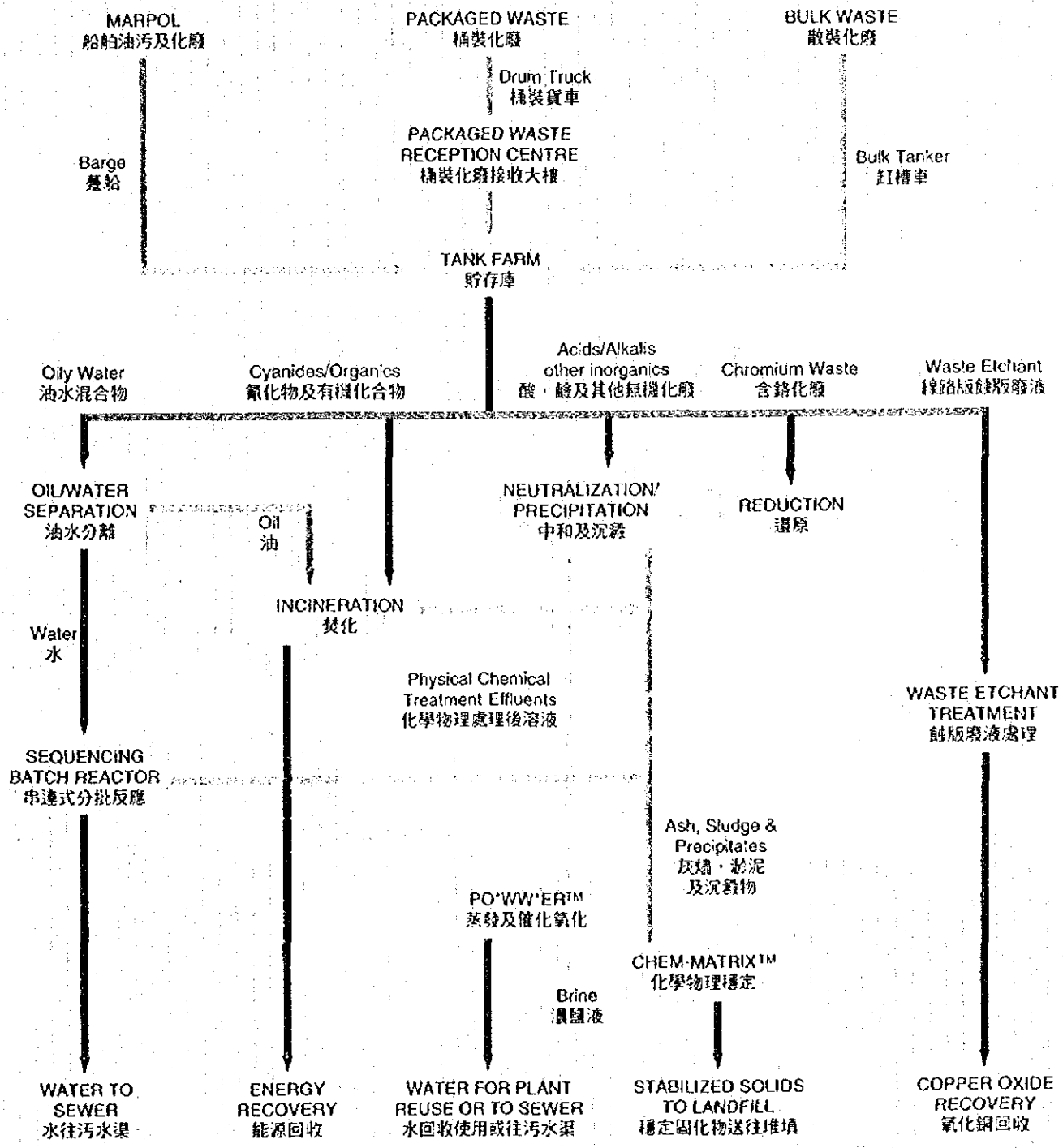
回收及循環再用是化學廢物處理中心的重要一環。水及熱能都盡可能在中心內回收及循環再用。氧化銅及硫酸銨兩種化工原料，則可在蝕版廢液處理過程中回收。衝和對回收及循環使用的重視，充份顯示出我們對環保的關注。

化學廢物運送至處理中心後，將與其他相容的化廢混合。混合廢物在貯存系統及處理過程中，會不斷受到監控，以確保所有廢物均經適當處理，並符合各項嚴格的環保規例和排放標準。

The CWTC is designed to provide an integrated system for the treatment of the wide variety of chemical wastes generated in Hong Kong. All processing systems in the CWTC are proven technologies used in different parts of the world.

化學廢物處理中心(CWTC)的設計目的，是爲香港所產生的各種化學廢物，提供一個綜合處理的設施。該中心採用的處理技術都已經過成功實踐，並正在世界各地廣泛應用。

CWTC OPERATION FLOW DIAGRAM
化學廢物處理流程



化學廢物處理方法

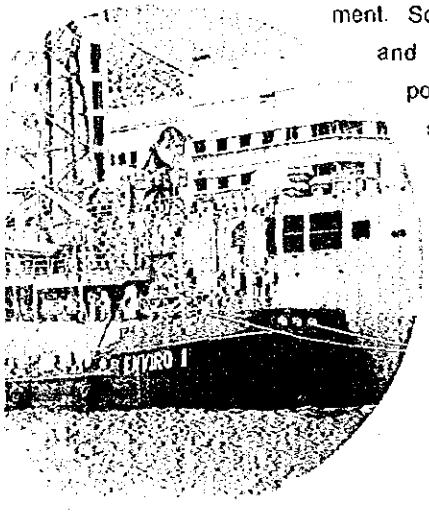
The following is a brief description of the CWTC's three main treatment processes and their ancillary systems :

1. Oily Water Separation

The oily water separation system is a treatment train for oil/water mixtures. The system is comprised of tanks and various physical treatment systems. Large tanks for MARPOL waste and smaller oily water tanks are used for bulk separation of oil from oily waste water. An API separator and DAF unit further recover entrained oils in the aqueous phase. The recovered oil from this system is used for fuel in the incinerator. The water is sent to the biological treatment system and the solid residual is then sent to the incinerator or the stabilization unit depending on its chemical make-up.

Biological Treatment

This system treats the water phase of the oily water system. It is composed of a feed tank, a Sequencing Batch Reactor (SBR), a dual media filter and a carbon absorption system. The waste water is conditioned in the feed tank. The aqueous material is then fed to the SBR for biological treatment. Organic components in the waste water are metabolized by activated sludge so that the discharged waste water will not deteriorate the marine environment. Solids are removed by the filter and the cleaned water is further polished in the carbon absorption system. The treated water meets all regulatory discharge limits.



下面簡述化學廢物處理中心所採用的三種主要處理方法及其輔助系統：

1. 含油廢水分離處理法

油水分離系統包括處理缸及各種物理處理設備。初步油水分離在大型的MARPOL處理缸及較小的含油廢水處理缸進行。然後，分出的水再由API分離器和DAF裝置除去夾帶的油質。回收的油，會用作焚化爐的燃料。經處理後的廢水則送至生物處理系統，所產生的固體沉渣則視其化學成份，送至焚化爐或作穩定過程處理。

生物處理

生物處理系統用來處理油水分離後的廢水。該系統由一個給水缸、一組順序分批反應器(SBR)、一台雙媒介過濾器及一套活性碳吸收器組成。廢水先在給水缸內調節至適當狀態，然後送至順序分批反應器，進行生物處理。廢水中的有機物經過活性污泥的消化後，排出時便不會污染香港周圍的海洋環境。由過濾器除去夾帶的污泥後，廢水在排放前，視乎其剩餘有機物之含量，更可被輸入活性碳吸收器加工淨化。經這樣處理的廢水，水質能達到所有規定的排放標準。

2. Physical/Chemical Treatment

Continuous Neutralization

This process serves two purposes: (i) to neutralize acid wastes; (ii) to serve as an alkaline precipitator for a number of metal containing waste streams. The feed streams to the neutralization tanks are:

- Acid wastes from bulk storage
- Alkaline wastes from bulk storage
- Miscellaneous inorganics from bulk storage
- Nonchelated ferric chloride etchant from bulk storage
- Reduced chromium solution from the reduction reactor

All residues resulting from the neutralization and precipitation process are dewatered and further treated in the stabilization unit. The treated water is sent onward for final polishing before discharge.

Waste Etchant Treatment

Spent ammonical chloride etchants and cupric chloride etchants are treated with caustic soda to recover copper oxide. The recovered copper oxide is a marketable product.

Ammonia is also produced as a reaction by-product which is recovered in a packed tower absorber. The ammonia reacts with an acid solution and the resulting ammonium sulphate is a marketable product.

2.物理及化學處理法

連續中和及沉澱程序

這個處理過程有兩個目的：

(1) 中和酸性廢料；

(2) 爲多種含有金屬之廢液作鹼性沉澱。送至中和缸的廢液包括：

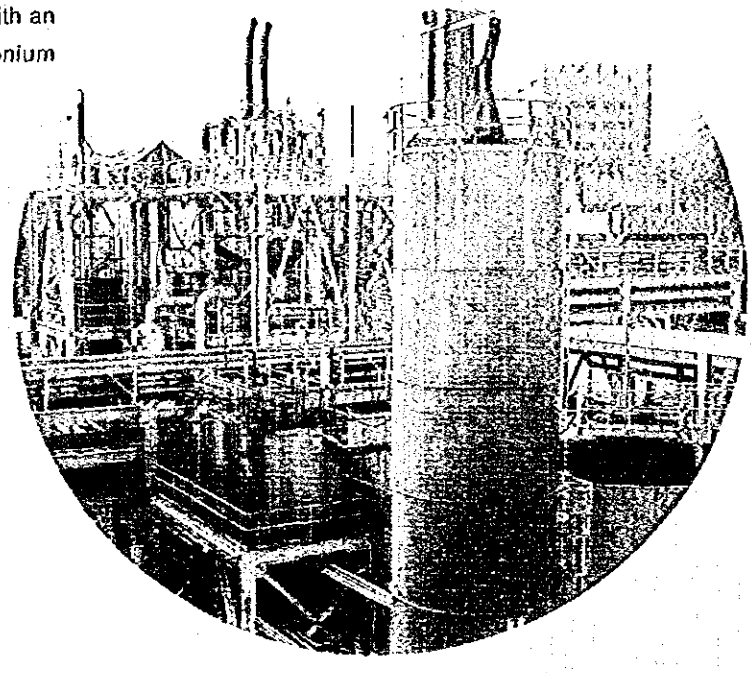
- 庫存的酸性廢料
- 庫存的鹼性廢料
- 庫存的無機混合物
- 庫存的非螯合氯化鐵蝕版廢液
- 來自還原反應器的三價鉻溶液

所有經中和及沉澱處理產生的沉渣，均先脫水，再作化學穩定處理。過程中產生的廢水，則會經過最後淨化程序，再行排放。

廢蝕版劑處理

用苛性鈉對廢氯化銨蝕版劑及氯化銅蝕版劑進行處理，可收回氧化銅。回收的氧化銅可用作工業原料。

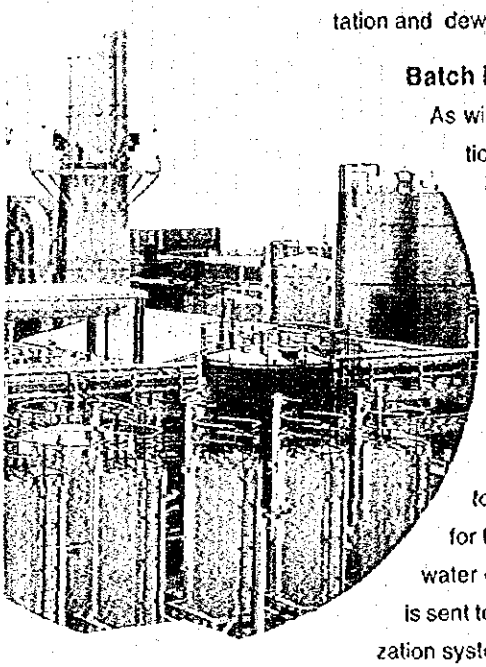
作爲反應副產品的氨氣會送進一台填充塔式吸收器被酸性溶液吸收，所產生的硫酸銨亦可用作工業原料。



化學廢物處理方法

Chromium Reduction

In the chromium reduction reactor, hexavelant chromium is reduced to a non-toxic trivalent state. The reduced material is sent to the "Continuous Neutralization" system for precipitation and dewatering.



Batch Neutralization

As with continuous neutralization, the primary treatment for chelated spent ferric chloride etchants is alkaline precipitation. The metal hydroxide sludge formed from the process is sent to a filter press for water removal and forwarded to the stabilization system for final treatment. All of the water generated by the system is sent to the continuous neutralization system.

Other Aqueous Treatment

Treatment processes for chelated zinc, copper, and nickel waste solutions are essentially the same as those for chelated ferric chloride etchants. Due to the multiple waste streams involved and a multitude of chelated compounds in these streams, two parallel treatment trains are used. The treatment trains consist of multi-reagent tanks, precipitators, and the filtration systems. Filter cake produced by these systems is sent to the stabilization unit and the filtrate is sent to the continuous neutralization system.

鉻的還原

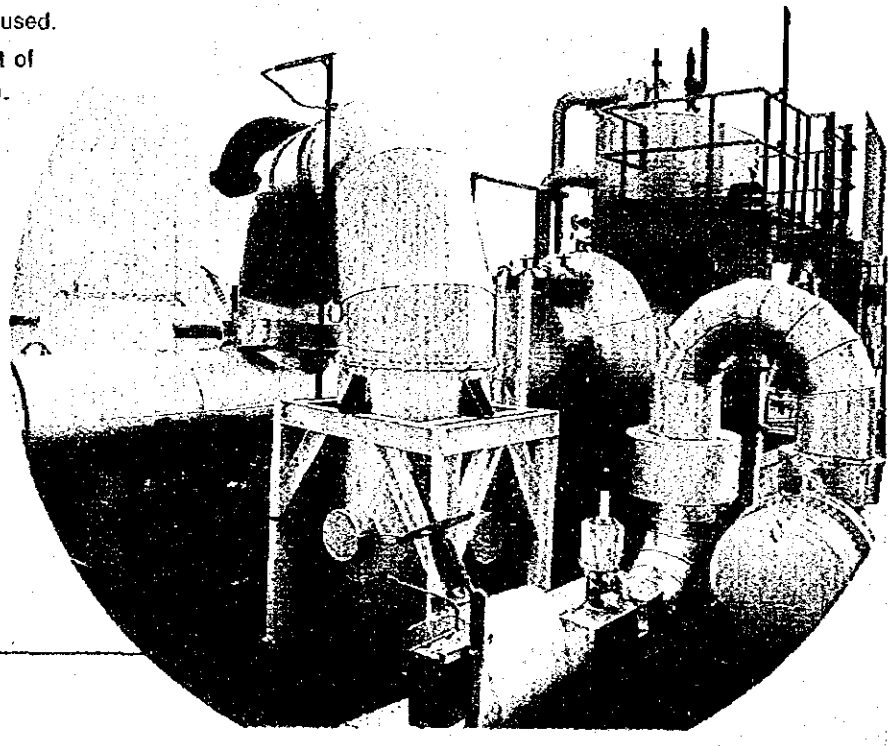
在鉻還原反應器內，六價鉻還原成無毒的三價鉻。還原後的含鉻廢液，再送到已介紹過的「連續中和」系統進行沉澱和脫水處理。

分批中和及沉澱

螯合了的氯化鐵蝕版廢液，會用鹼沉澱法進行分批式中和及沉澱。在此過程中產生的金屬氫氧化物污泥會用壓濾機，將水份除去，再送至穩定系統進行最後處理。所有此系統所產生的水，均送至「連續中和」系統處理。

其他溶液處理

用來處理螯合鋅、銅、鎳廢液的方法，基本上與處理螯合氯化鐵蝕版廢液的方法相同。由於涉及多種含有大量螯合物的廢液，因此採用了兩套並行的處理系統。系統由多種反應劑反應器、沉澱器及過濾裝置組成。這些系統產生的濾餅及濾液亦會分別送至穩定及「連續中和」系統處理。



PO'WW'ER™

The PO'WW'ER™ system is a two-step waste water treatment system comprised of evaporation followed by catalytic oxidation. Metallic salts in the incoming waste water are concentrated in the evaporation stage producing a brine slurry. This slurry is sent to stabilization. The waste water with volatile organics and inorganics is heated to a vapour state in the evaporator and forwarded to the catalytic oxidation unit. These materials are then oxidized to carbon dioxide and water vapour. The existing vapour from the oxidizer is then condensed to recover high quality water which meets the stringent regulatory discharge standards. The water is reused throughout the facilities for boiler feed water make-up, container rinsing, filter cake washing and chemical reagent mixing.

Stabilization

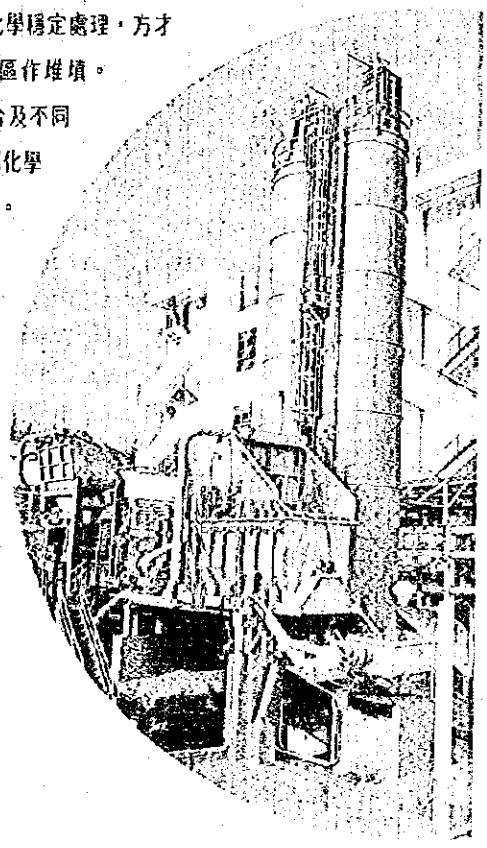
All solid residues, solid metal-bearing chemical wastes and some liquid wastes, including slurries, brine, and biological sludge are chemically stabilized in this system prior to disposal in an off-site landfill. The system utilizes a batch mixer and specific reagents to achieve chemical fixation or stabilization. The stabilization recipes are developed for all residues and wastes to ensure that the stabilized materials meet strict leaching standards.

PO'WW'ER™

PO'WW'ER™ 是一個包括蒸發及催化氧化兩個過程的廢水處理系統。廢水中的金屬鹽類在水份蒸發時會濃縮成濃鹽液，這種鹽液會送至穩定系統再行處理；揮發性有機物及無機物會與水份一同蒸發，並經過催化氧化過程氧化成爲二氧化碳和水蒸氣，這些蒸氣經冷凝後，成爲高純度的水，水質能達到最嚴格的排放標準。這些水會在化廢處理中心內用作補充鍋爐用水、沖洗容器、清洗濾餅及調和化學反應劑。

穩定系統

含金屬的固態化學廢物、其他處理系統產生的固態殘餘物質及部份液態泥漿、濃鹽液、生物淤泥等，均會送至這系統作化學穩定處理，方才運出中心外之堆填區作堆填。此系統利用分批混合及不同的化學反應，來達到化學固定或穩定的目的。我們已爲所有不同的殘渣及廢料研製出不同的配方，以確保經穩定處理後的物質，達到嚴格的滲濾指標。



3. Incineration

The incineration system consists of waste storage/blending and an incineration train. It is used for the destruction of organic materials and cyanide wastes. Chemical wastes received at the CWTC which require incineration are stored in tanks according to their chemical make-ups. The wastes are blended to ensure the proper feed to the incinerator.

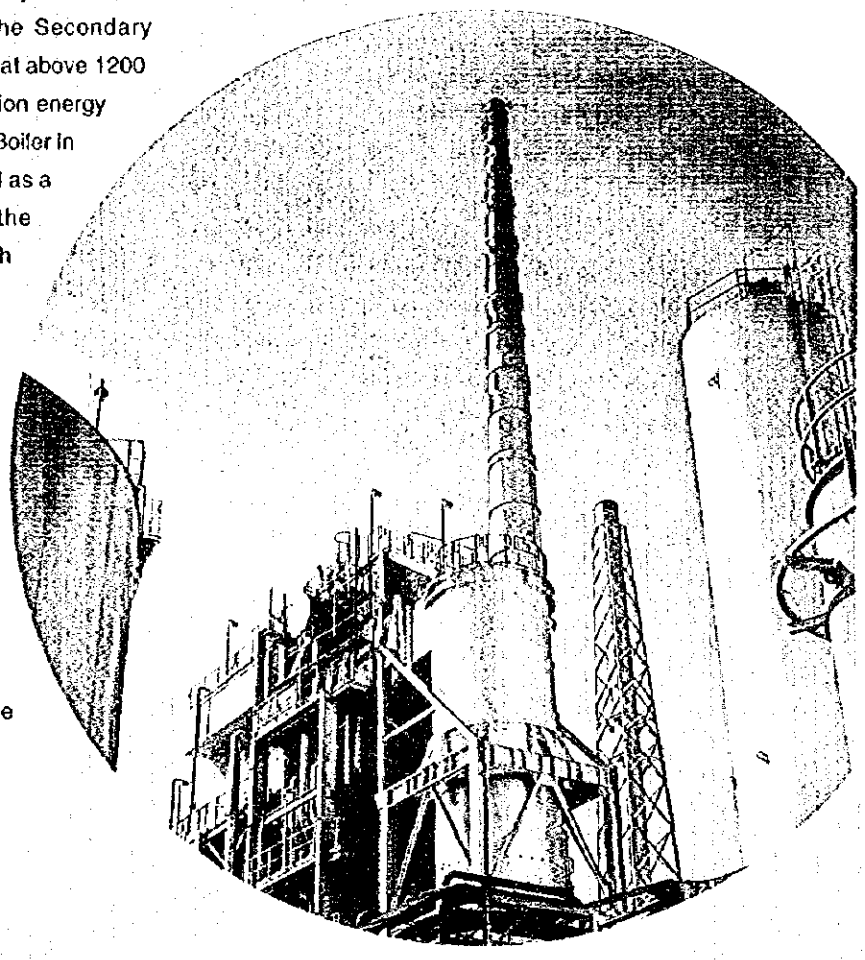
The incineration train is comprised of a Rotary Kiln, a Secondary Combustion Chamber, a Waste Heat Recovery Boiler and an Air Pollution Control system. The incinerator is designed to handle liquids and sludges from the blend tanks and solids in burnable containers. The Kiln and the Secondary Combustion Chamber operate between 700 and 1095 degrees Celsius. When wastes of special hazardous nature (such as Polychlorinated Biphenyls) are incinerated, the Secondary Combustion Chamber operates at above 1200 degrees Celsius. The combustion energy is recovered in the Waste Heat Boiler in the form of steam, which is used as a heating medium throughout the Plant. Contaminants which remain in the gas phase after the Waste Heat Boiler are removed in the spray dry absorber and fabric filter baghouses. The air at the stack is continuously monitored to ensure stringent emission requirements are met. The incinerator ash and scubber solids are then sent to the stabilization system for treatment prior to off-site disposal.

3. 焚化

焚化系統由廢料貯存和混合設施及一套焚化設備組成，用以消滅有機物質及含氰化物的廢料。

需要焚化的化學廢物送到化廢處理中心後，會按照化學成分，分別貯存，並加以適當混合，以確保焚化爐的進料合乎設計質量。

焚化設備包括旋轉窯、二級燃燒室、廢熱回收鍋爐及空氣污染控制系統。焚化爐可以處理經混合設施混配過的液體和淤泥，以及裝在可燃容器內的固體廢物。旋轉窯和二級燃燒室的工作溫度在攝氏七百度至一千二百度之間。燃燒後的能源在廢熱回收鍋爐回收成蒸氣，作爲熱能，在廠房使用。經二級焚化後仍留在氣體中的污染物，會通過一個乾式滌氣系統除去。煙囪排出的空氣會持續受到監測，確保符合嚴格的排放標準。焚化爐灰燼及滌氣系統所產生的固體物質，經化學穩定後，會送往堆填區堆填。



Ancillary Systems

The CWTC includes several systems designed to support the treatment processes previously discussed. The following is a summary of the key systems:

A.Waste Container Handling

The packaged waste reception is housed in a four storey building where wastes are received, sorted, staged, tested, verified, decanted, and pumped for treatment. The building and equipment are capable of processing over 3,000 containers per day.

B.Storage Tank Farm

The CWTC is equipped with approximately 50 storage tanks that receive materials from the waste container handling building as well as bulk wastes and chemical reagents.

C.Laboratory

A state-of-the-art laboratory provides the analytical support for the operations of the CWTC. Chemical wastes are tested before and after they are received for verification and treatment determination. In-process wastes are monitored to assure proper treatment that meets the Environmental Control Standards. Ambient air and groundwater are periodically tested to ensure CWTC operation is environmentally safe and sound.

輔助系統

化學廢物處理中心並設有其他輔助系統，以支援上述各種處理過程。其中主要有：

A.化廢容器處理

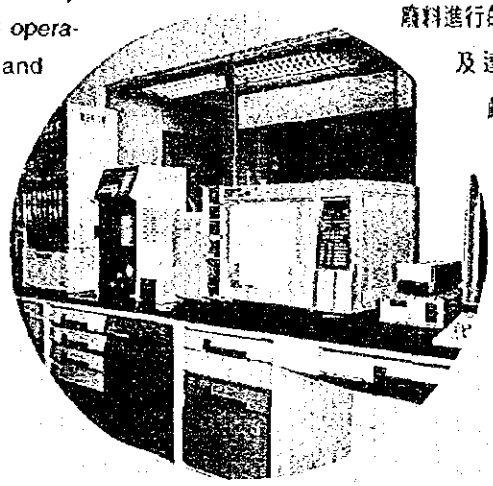
桶裝化廢運至化廢處理中心後，會在樓高四層的桶裝廢物接收大樓被接收、分類，並經簡單但準確的"指模"化驗確定其類別後，便會從桶中抽出，送到貯缸庫存或直接送往處理。該大樓每天可處理三千多桶廢料。

B.化廢貯存庫場

庫場內約有五十個貯缸，可貯存來自接收大樓的廢料，以及散裝廢料和中心所需的反應原料。

C.實驗室

化廢處理中心內現代化的實驗室，爲中心提供所需分析服務。化學廢物在送到處理中心之前和之後，均須進行檢測，以核實其成分和決定處理方法。實驗室亦支援處理過程中對廢料進行的監測，以確保處理適當及達到環境控制標準。此外，實驗室亦負責對周圍空氣及地下水作定期測試，確保化學廢物處理中心的運作對環境無害。

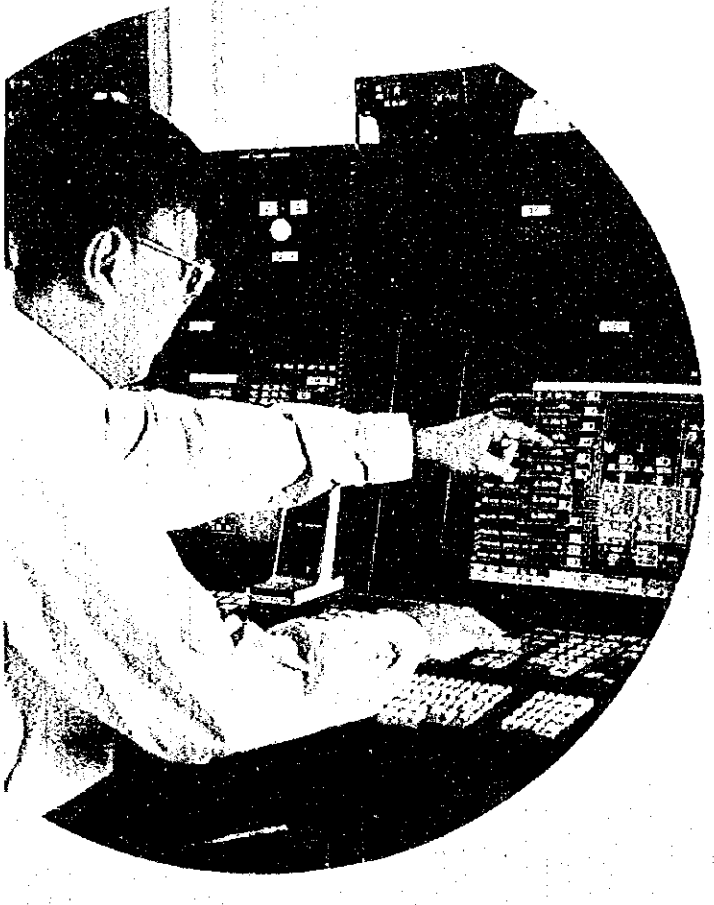


D.Computer System

The computer system provides the total plant operation control. It is composed of four computers tied via a data network. The Process Control and Monitoring System (PCMS) is designed to continuously monitor and control the various treatment processes in the Centre. The system also includes safeguards such as automatic shutdown in case of emergency or power failure. The analytical laboratory operation is monitored by the Laboratory Information Management System (LIMS) which also collects the data and analytical results. The central computer, Contractor's Computer System (CCS), provides the waste tracking function from "cradle to grave" monitoring control of the waste streams received in the CWTC. The Employer's Computer System (ECS), similar to the CCS, provides the Government with the means to continuously monitor plant operation.

D.電腦系統

電腦系統控制著全中心的運作。該系統由四個電腦系統，通過數據網絡相連所組成，其中，流程控制及監測系統(PCMS)會不斷的監測及控制中心內的各個處理過程，並負責控制中心內的安全裝置，例如在緊急情況下或斷電情況下自動關機的裝置等。分析實驗室的操作由實驗室資訊管理系統(LIMS)監控，該系統亦貯存收集後的數據和分析結果。四個系統的主系統稱為「承辦商」電腦系統(CCS)負責追蹤監控中心收到的所有廢料，直至處理完畢。「僱主」電腦系統(ECS)與CCS類似，由政府用來對處理中心的運作進行連續監視。



1. Air

Air emissions from the incineration system are closely monitored by a comprehensive management and monitoring programme to ensure that the system is operating safely and in an environmentally acceptable manner.

The incinerator is equipped with an automatic waste feed cut-off system. In the event of any upset, all waste feed will be stopped automatically. Furthermore, a continuous monitoring system on key parameters is installed in the incinerator stack to ensure combustion and air pollutant removal processes are functioning well. Independent stack gas analysis system acts as a cross-check monitor safeguarding against any possible malfunctions.

The monitoring system includes the assessment on the ambient air quality at three different locations: two on-site and one off-site. The ambient air quality is measured every six months with one of the tests conducted during the height of a south-westerly wind, and the other under north-easterly winds.

Fugitive emissions from wastes storage, handling and treatment processes are vented to either a gas scrubber, a carbon absorption system or the incinerator to prevent any possible pollution.

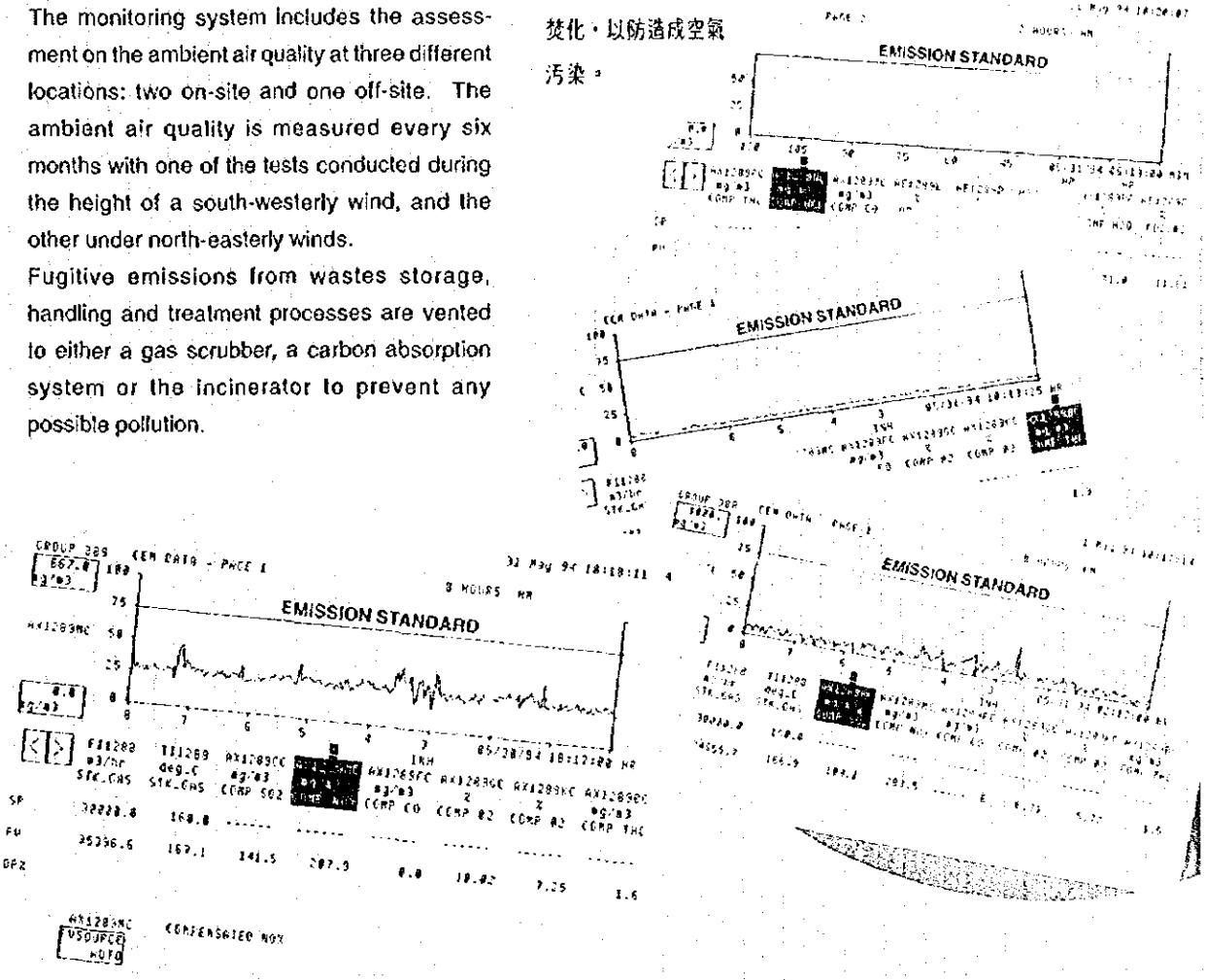
1. 空氣的監測

焚化系統所排放的氣體均受到持續監理，以確保中心操作正常及對環境毫無影響。

焚化爐設有自動停止廢料注入系統，當操作程序出現問題時，所有化廢即會自動停止注入。再加上設置在焚化爐煙囪內的監察儀器，均可確保燃燒和氣體除污過濾等程序操作正常，再配合以獨立煙囪氣體分析系統，則能進一步加強控制及防止任何可能出現的漏洞。

於化學廢物處理中心內及鄰近地區均設有儀器，收集空氣樣本，以監測附近之空氣質素。這些空氣測試，定期每六個月進行一次，其中一次需於西南風季時進行，其餘則於吹東北風時測量。

廢料在貯存和處理等過程中所排放出的少量氣體，則會被輸往排氣管，活性碳高效率排氣系統或焚化爐，予以焚化，以防造成空氣污染。



環境監測

2. Water

Effluent discharge from the CWTC treatment processes has to meet very strict discharge limits on pollutant concentration. Multiple processes are employed inside the CWTC to treat all liquid wastes to ensure a safe waste management system. Continuous automatic monitoring of pH, temperature, and flow rate, coupled with frequent sample analysis are conducted to facilitate immediate warning on any significant change detected in the composition of the effluent.

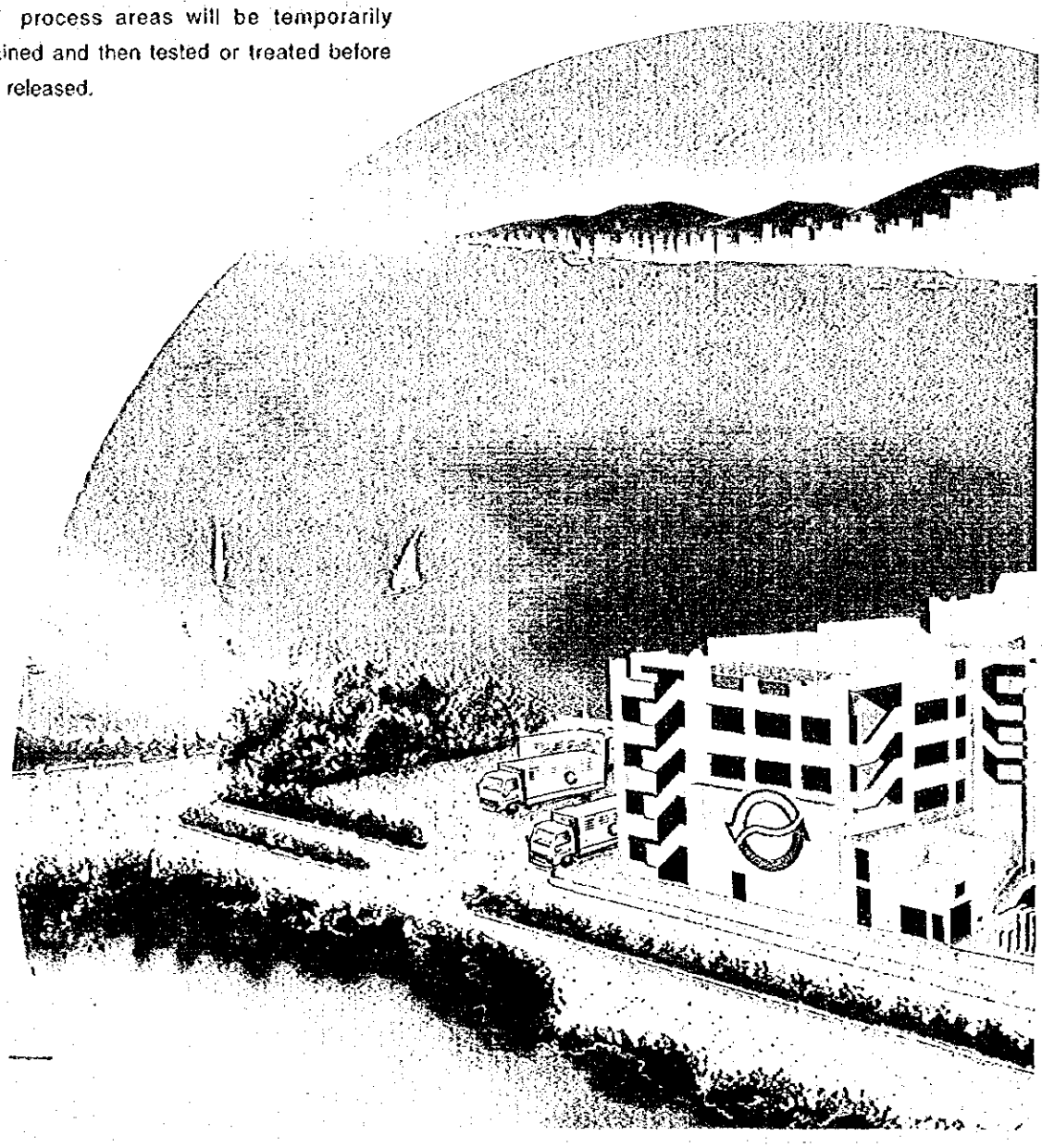
Moreover, the storage and process areas are bunded for secondary containment of accidental spillages. The floors and bund walls are coated to protect against corrosive attacks on the concrete. Rain water coming from process areas will be temporarily contained and then tested or treated before being released.

2.水排放的監測

化學廢物處理中心的污水排放程序均受到十分嚴格的限制。中心必須透過多重程序將液態廢料適當處理，以確保對人體及環境安全無害。

同時更有全自動設施，廿四小時不停監察其酸鹼度，溫度及流量，亦探測其內在成份是否有任何突變，以便即時作出警告。

除此以外，中心內所有化廢處理過程及貯存範圍均用密封式設計作為第二重保險。流經化廢處理區域的雨水，亦會被暫時收集起來，經測試或處理後，方才排放。



3. Solid Waste Disposal

All solid wastes and process residues at the CWTC will be detoxified, chemically stabilized and physically immobilized to an environmentally benign state. Samples of the stabilized materials have to pass a series of analytical tests and must be proven to be innocuous before being sent to an off-site landfill for final disposal.

4. Others

Regular maintenance on all the treatment processing units is conducted on a continuous basis, especially with critical instruments and equipment. A Preventive Maintenance Programme is adopted to ensure safe and efficient operation.

There is also an Emergency Response Plan to provide explicit description of the response procedures to minimize hazards to human health or to the environment from fire, explosions, or any unplanned release of hazardous waste constituents to air, soil, or surface water.

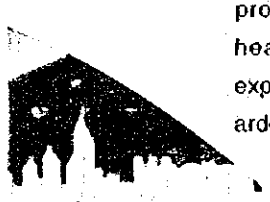
3. 經處理後之固體廢物的排放監測

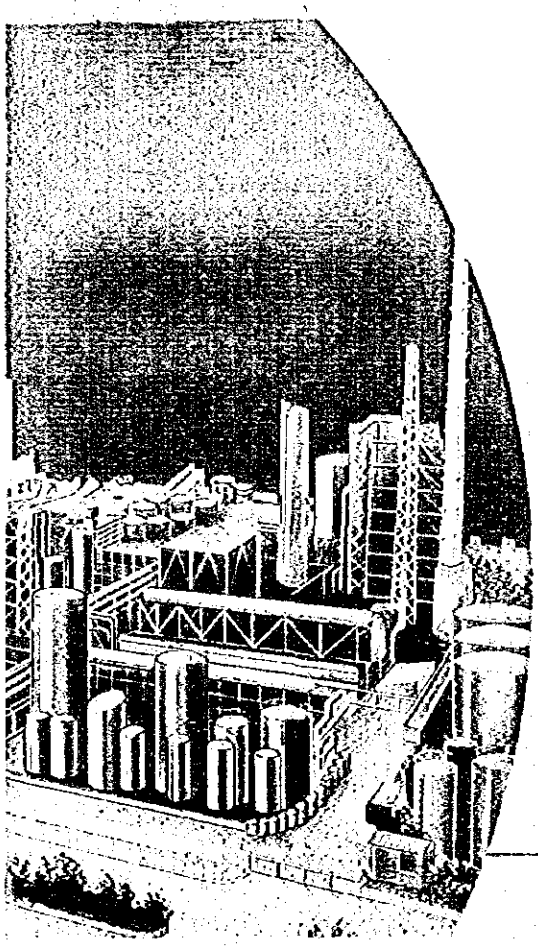
所有經過處理的固體廢物及沉渣，均需作除毒處理，並要經化學及物理穩定程序處理，以確保對環境絕無不良影響。經穩定處理後之殘渣樣本必須通過嚴謹的測驗及分析，証實絕對不會污染環境後，才會被送到指定堆填區作共同堆填。

4. 其他

中心內所有設施及儀器，均會作定期維修及檢驗。亦會定期爲機件及軸承添加適當的潤滑劑，以確保它們能運轉自如。中心更有一套「預防性維修保養程序」，以保障一切設施能安全有效地運作。

此外，更備有「緊急應變計劃」，提供明確清晰的緊急應變程序與訓練予工作人員，以應付任何突發事故，盡量減低發生此等事故時，對人體及環境可能造成之損害。





優點／展望將來

Enviropace's services will have a long term impact to improve the environment of Hong Kong. Our goal is to:

- Provide Hong Kong industry with a centralized system to meet their chemical waste disposal needs in compliance with the regulations.
- Decrease the level of pollution in Hong Kong, making the territory a healthier place to live.
- Reduce damage to surface water drains and the sewer system by providing an environmentally sound disposal solution.
- Improve the water quality of Victoria Harbour.
- Benefit industries which compete in the increasingly environmentally conscientious international market.

Every Enviropace service has a positive impact on industry. In fact, we are proud to say that our services will benefit each and every resident of Hong Kong.

The future of our environment depends on our commitment to a better environment. With our expertise and your co-operation, we can make a better and cleaner world for all our children.

衡和所提供的服務，在長遠上將能改善香港整體的自然環境。我們的宗旨是：

- 爲香港工業界提供處理化學廢物和遵守有關規例的統一途徑
- 減低香港的環境污染，使生活環境更加理想和健康
- 提供上門收集化廢及妥善處理服務，減低排水渠及污水系統所受到的破壞
- 改善維多利亞港水質
- 在日益關注環保的國際市場上，爲本港出口商構成有利的競爭條件

衡和的服務不但爲工業界帶來正面影響，更惠及每一個香港市民。

香港未來的自然環境有賴我們全力保護。衡和化學廢料處理有限公司以其專業知識與市民攜手合作，爲下一代提供一個更潔淨美好的生活環境。

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