CEMED
Centre for Environmental Management Education and Development

CEMED
The Hong Kong Polytechnic University

Sustainable Enterprise Program
A program of the World Resources Institute

Dunwell Industrial (Holdings) Ltd.

It has been proven that the re-refined lubricants perform as good as those virgin lubricants and are widely used by international corporations.

In 1969 Chow Cheng started a firm that introduced new mold and die techniques, machinery, tool steel and finishing materials into the Hong Kong market. At that time Hong Kong was a manufacturing center, and Dunwell served that market by being a leader through innovation and the introduction of new products. For instance, it was the first local firm to use high speed stamping dies for video cassettes, in the 1980's and introduced chemical resistant epoxy flooring in the 1990.

Gradually, Dunwell added more and more product lines. In 1993 Dunwell Industrial (Holding) Limited was incorporated to manage the growing list of subsidiary firms. It was also at that point that the firm moved into a 100,000 square foot facility in the Yuen Long Industrial Estate, which is located in Hong Kong's New Territories (See Exhibit 1). Today, Dunwell has the largest independent waste oil treatment and disposal plant in Asia, is the world's largest manufacturer of metal component parts for the magnetic media industry, and was the first company accredited by the Hong Kong Institution of Engineers to train professional Scheme "A" environmental engineers.

In 2000 the firm formed Dunwell Enviro-Tech (Holding) as a way of allowing customers to access all of their environmental products and services as part of a "one-stop" strategy for serving customers' environmental needs. Exhibit 2 depicts Dunwell's current organizational structure. Dunwell Industrial (Holdings) Ltd., serves as the holding company that manages all the subsidiaries, although Dunwell Enviro-Tech (Holdings) Ltd., is charged with managing and developing the group's current and future environmentally related businesses. Exhibit 3 describes and outlines Dunwell's businesses and holding companies.

As the firm grew, its founder Chow Cheng was joined by his four sons in the management of the growing and increasingly diversified firm. Daniel M. Cheng, who studied engineering, serves as the Group's Managing Director. Each of Chow Cheng's other sons also studied, lived and worked in the U.S. before returning to Hong Kong to join Dunwell's senior management. Ricky M. Cheng studied accounting , Alvin M. Cheng has a graduate degree in economics, and James M. Cheng, studied engineering. Each is a member of the Board of Directors and Chow Cheng now serves as the Chairman of the Board. The firm currently has over 100 employees at its Yuen Long facility, was well as sales representatives in China.

Although the Cheng brothers have varied academic backgrounds, the firm is managed through consensus, rather than on the basis of functional specialty. The Board is actively involved in the management of each of the operating companies, although individual members of the board are often more involved in one activity, or the activities of one company. This system appears to have been successful since the firm has achieved two Hong Kong Awards for Industry, one for productivity and one for technological achievement. The firm has also received awards for industrial engineering, environmental performance, as well as the ISO 9002 Certificate for quality control

Dunwell has been one of the most active firms in Hong Kong with respect to developing, publishing and publicizing its environmental policy (See Exhibit 4). The firm specifically is committed to achieving and maintaining a high standard of environmental care in conducting its business. In 1999 it celebrated receiving its ISO 14001 Certificate, together with its 30 year anniversary.

Legal Environment In Hong Kong

In the early 1980's toxic waste became a pressing problem for Hong Kong. There was an increase in public and corporate awareness of the dangers created by the production and disposal of chemical waste. Chemical substances were indiscriminately dumped into Hong Kong sewers and surface waters had become a heath hazard. The dumping was also causing serious damage to the environment.

The existing legislation, the Waste Disposal Ordinance, provided a legal

framework for waste management in Hong Kong. However, it failed to carefully define and control chemical wastes. As a result, chemical wastes including strong acids and alkalis, concentrated metal salts and organic solvents were discharged directly into the sewers or drainage systems or dumps into the municipal waste collection system, posing serious risk to sewer workers and marine life, and less directly the general public.

In June 1989 a white paper was published entitled "Pollution in Hong Kong - A Time to Act", which outlined a comprehensive ten year programme to combat the escalating pollution problem within the territory. One of its main thrusts was to ensure the provision of environmentally acceptable, but cost-effective waste disposal facilities. The paper also suggested that supporting legislation was needed to safeguard the health and welfare of the community from any adverse environmental effects associated with the storage, collection, treatment and disposal of wastes.

As a result of this study and growing pressure, in 1991 the Hong Kong Government recognized the need to tighten and control the production, storage, transportation and disposal of chemical waste, as well as reducing the amount of toxic waste produced within the Territory. The Waste Disposal Ordinance was amended with a new classification scheme for chemical waste.

Manufacturing in Hong Kong tends to be done in small factories that are located in multistory buildings. These buildings generally have no treatment or disposal facility. Thus the acids, alkalis, cyanides, heavy metal solutions, solvents, and mineral oils they use are disposed in the communal drain. These waste are corrosive, flammable, and poisonous, which posed a health threat to Hong Kong's citizens. However, what may have had an equal impact on the government's decision to act was that these wastes also upset the sewage treatment processes, creating sewage treatment problems and damage to sewer systems.

In order to regulate the disposal of dangerous waste, the government decided it needed a way to track the use of various products. Thus, the 1991 legislation also included a registration scheme that enabled the Environmental Protection Department to identify the producers, transporters and disposers of certain chemical wastes such as asbestos, solid tannery waste, and polychlorinated biphenyl. By late 1992, 6196 chemical waste producers out of an expected 8000 had registered. Letters were sent to those who had failed to register, warning that a failure to register would result in prosecution with a maximum penalty of $200,000 fine and a six-month prison sentence. The letter warning resulted in almost complete registration compliance by May 1993.

One month later the first integrated Chemical Waste Treatment facility to be built in the Asian Pacific Region, operated by a company called Eviropace began operation on the southern side of Tsing Yi Island (See Exhibit 1). Eviropace burns waste and is subsidized by the government who makes up the difference between their variable operating costs and the actual fee that firms pay. For instance, Eviropace current changes customers HK$570/barrel for waste oil, but procedures are in place for fees to be raised to HK$1600 in the future, which will eliminate government subsidies. The Centre contains state-of-the-art technology which consists of nine separate processes for treating chemical waste, including an oil/water separation system, various physical and chemical treatment systems and a high temperature incinerator system. Oil is only one of the products processed but in 1999 land-based waste oil accounted for 9.082% (i.e. 7342 tonnes) of the chemical waste composition

treated at the chemical waste treatment plant.

The Effect of the Waste Disposal Regulation

The new Regulation imposed a duty on all those persons who were responsible for the production, storage, transportation, and disposal of chemical waste, and provide procedures to monitor and control the process. The duties can be outlined as follows:

Duties of the Waste Producer:

- To understand the constituents and nature of his waste. To store it safely, clearly labeled with words and symbols.
- The storage area should meet the requirements of the Regulation.
- Engage the services of a licensed waste collector when removing or transporting the waste.
- Issue a signed trip ticket to the waste collector, together with two copies and any information that is required for the safe handling of the waste.
- Certify that the waste is correctly classified, described, quantified, labeled and consigned to the Waste Collector.
- Keep a copy of the trip ticket for at least one year.

Chemical waste must be stored safely so as to avoid spillage, fire or safety hazards. If any stored waste is likely to threaten public health and safety or cause pollution the Environmental Protection Dept. can order its removal. To control the transportation of waste the government requires licensed contractors to carry out its collection and transportation. Enviropace Ltd. has a fleet of specially designed lorries and tankers to collect the waste for its plant. It also has a specially built MARPOL collection barge for the collection of oily and noxious wastes, from local vessels, and ships using Hong Kong's port facilities.

Duties of the Waste Collector

- To give any information required by the trip ticket.
- Check the information given by the Waste Producer is correct.
- Reject any consignment that is incorrectly packaged for labeled, or has an incorrect trip ticket.
- When transporting chemical waste he must ensure that he has a copy of the original trip ticket in his possession.
- Deliver the waste to the waste disposal facility or its destination within 48 hours.
- Give the original trip ticket to the reception point manager at the waste disposal facility.
- Keep a copy of the trip ticket for at least one year.

To deter illegal disposal the computerized trip ticket accompanies each waste consignment, and each person in the waste disposal chain must retain a copy. This helps to ensure that waste is not disposed of illegally, since each person must pass on the amount collected. This information system tracks the movement of the waste from its production to final disposal. This system is integrated with the computer system at the Chemical Waste Treatment Centre and allows the Environmental Protection Department to closely monitor those responsible for chemical waste management. Penalties range from 6 months imprisonment and/or fines from HK$50,000 to HK$100,000 for violations of the rules and procedures

Chemical Waste Disposal Charging Scheme

In addition to tracking waste, the Chemical Waste Treatment Centre provided its services free of charge to encourage waste producers to stop their practice of indiscriminately dumping such waste, until April of 1995. However, Government consultation with industry led

to a proposal to introduce a direct charging scheme to recover the cost of the waste treatment. Charges for the disposal of chemical waste at the Centre came into operation on 16th March 1995, by virtue of the Waste Disposal Regulation (LN30/95). Changes were subsequently revised in 1996 and 1997. For the purposes of charging wastes are split into two categories: Chemical Wastes and Special Chemical Wastes.

(1) Chemical Waste
This has the same meaning as that given under the Waste Disposal (Chemical Waste)(General) Regulation. The actual monetary charges are found in schedule 1 of the Waste Disposal Charges Regulation, and are as follows:

Special Chemical Waste
Such waste is given the following definition by the Waste Disposable Charging Regulation:
(a) wastes which contain PCB's,
(b) wastes which are or have become unstable for its intended purposes whether because:
(i) it does not meet the specifications for that purpose;
(ii) the date by which it may be used for that purpose has passed; or
(iii) it has been damaged or affected in a way which makes it unfit to be used for that purpose; or
(c) waste which has been imported into the territory for the purpose of disposing of it in Hong Kong.

The charges for disposal of such waste are found in Schedule 2 of the Waste Disposal Charging Regulation, which are outlined in Exhibits 5 and 6.

It should be mentioned that disposal of oily water and chemical waste generated by ocean-going vessels comes under a special charging regulation made under the Merchant Shipping (Prevention and Control of Pollution) Ordinance.

Implementation of a charging scheme has been slow in order to encourage the proper use of the Chemical Waste Treatment Plant. The payment charges for disposal of chemical waste are an economic incentive towards waste minimization encouraging waste producers to reduce waste and carry out technological upgrading and recycling activities. However, it is also viewed by some within the industry as a stick with which to drive the chemical manufacturing industry over the border into South China where regulation is minimal. In order to mitigate this outcome the initial charges for most chemical wastes were set at 20 per cent of the variable operating costs for each waste stream. The charges have since been gradually revised upwards in phases to recover full variable operating costs. This has given waste producers adequate time in which to adjust their production processes to minimize waste through recycling and upgrading of technology.

While there is now sufficient legislation in place, the fines set by the judiciary appear to be commensurate with the offender's ability to pay rather than at a rate totaling the damage caused together with abatement and rectification costs. Some critics feel that the fines have become an acceptable part of doing business in the Hong Kong SAR. They point out that despite the power to impose a 6 months term of imprisonment no prison sentences have been given under the regulation even where companies have had concurrent convictions.

Recycling Opportunity

In 1989 an Australian firm decided to build an oil recycling plant in the Yuen Long Industrial Park in Hong Kong. There proposal was especially attractive because they used different technology than that proposed by Enviropace, which

would permit the recycling rather than the incineration of oil waste. Since the government was beginning to monitor waste disposal, the firm assumed that it would be able to collect used oil cheaply, take out the impurities, reprocess it, and then sell it. From a chemical property perspective, recycled oil is just as effective as newly refined oil, but is generally much cheaper.

The Australian firm was managed by expatriate managers who had high levels of technical expertise. They set up the plant and met their deadlines for beginning operations. However, they had little knowledge of the local market. When they attempted to buy used oil from local collectors, they were informed that supply levels were low. Actually, local collectors began to hold the used oil in inventory to try to get a higher price. Rather than waiting until the collectors needed cash, the Australian firm began to pay a premium for used oil because they wanted their plant to operate at a high a capacity as was possible. Thus, from the beginning the local oil collectors were able to extract a premium because the expatriate managers were unfamiliar with Hong Kong and assumed the manipulated shortage was a real one.

The firm probably could have survived the higher price it paid for used oil, but the same manipulation occurred on the demand side. Local suppliers understated the demand for recycled oil, which caused the firm to lower its selling price. There was also some genuine resistance to the idea of using recycled oil, but this had little to do with the price manipulations of local distributors. This put the firm in the worst of all possible situations. They were paying above the market price for waste oil, while selling the re-refined oil at below market price in order to reduce their finished product inventory. The squeeze on both ends resulted in the firm going out of business within nine months.

Dunwell to the Rescue

The government spent a considerable amount of effort to get a buyer for the Australian plant, but had little success until August 1993 when Dunwell agreed to acquire the facility and formed Dunwell Petro-Chemical Co., Ltd. Since the plant had been idle it took Dunwell more than a year to upgrade the plant and make necessary improvements. They were able to hire some of the employees who had worked for the Australian firm, which facilitated the transfer of knowledge needed to operate the plant. On March 16, 1995 Dunwell obtained a Waste Disposal License from the Environmental Protection Department, and became the first and only fully licensed used oil re-refinery plant in Hong Kong.

Another important factor, which was discussed earlier in the section on environmental legislation, helped Dunwell. Rather than having to buy used oil in the market, the government's tracking scheme required users of oil to prove they were properly disposing of the oil, and this scheme was become more efficient by 1994. Dunwell charges HK$200 per barrel to those disposing of used oil, rather than paying a similar amount as the Australian firm had. Since the Dunwell managers were all from Hong Kong, they also had a better understanding of the local situation and could not be misled about local demand and supply conditions. They also have established relationships with 16 local suppliers to bring the waste oil to Dunwell, which helps ensure a regular supply. Dunwell Environmental Management Co., Ltd. acts as the firm that is directly responsible for the collection and handling of used oil and other waste products.

The re-refinery process at Dunwell of up to 50 metric tons per day (1 metric ton = 1000 liters). Used oil undergoes the processes of de-watering; de-fueling, and Wiped Film Evaporation, which is the heart of the entire used oil re-refinery

process. At high temperature and under vacuum, oil will be evaporated and condensed as very pure distillate. Exhibit 7 contains a flow diagram of the process by which used oil is filtered and re-refined.

The government's regulations on recycling oil have been extremely effective. At present Dunwell believes that all the used oil available in Hong Kong is being recycled. Dunwell could re-refine much more oil than is available in Hong Kong. However, it appears unlikely that Hong Kong would permit waste oil from China to come into Hong Kong for re-refining. Daniel Cheng allowed that there might be some cities in China where re-refining of waste oil might be feasible but said the firm was not presently considering expansion into these locations and suggested it might be more feasible if they could find a local partner.

Products and Marketing

Once the oil is cleaned various additives are used to blend lubricating products, which are shipped to Mainland China, overseas and some local markets. While Dunwell has been very successful in getting some large organizations in Hong Kong to specify that re-refined oil be used, others resist because they worry that manufacturers will use the fact that they use re-refined oil to nullify warranty and other performance guarantees. This could become an issue if Dunwell could access new supplies of oil waste, but at present appears to be selling all it is re-refining.

Other Environmental Services

Dunwell's other two environmental divisions are more specialized. Dunwell Engineering Co., Ltd. is in the systems building business. This firm buys components, which are usually produced in other countries, links and modifies them so that they serve customers' needs. These include industrial wastewater treatment systems, emulsion breaking systems, sludge systems, and biological wastewater treatment systems.

Analysts (Asia) Ltd. helps customers by providing technical expertise. They advise on maintenance programs for lubricant users. The used oil analysis program helps determine excessive metal wear, fuel dilution, coolant contamination, dirt ingestion and operating conditions of machines. This helps customers reduce downtown, and plan equipment needs more effectively. At present this division handles over 50,000 tests per month for a variety of private firms as well as for governmental agencies.

The Present and The Future

Most firms in Hong Kong are giving serious thought on how to fully exploit their proximity to the Chinese Mainland. At present, Dunwell sells large quantities of its re-refined oil products in China, as well as equipment and other products. The firm is also beginning to explore bio-diesel fuel and feels that it is capable of manufacturing this product. They recently experimented with oil removed from a fast food restaurant and effectively converted it into a bio-fuel that could be effectively mixed with existing petroleum-based fuels. This could be important if the government would require cleaner fuels. For instance, bio-diesel can be added to existing fuel to make it less polluting.

Environmental regulations are also being tightened in China. This means that Dunwell's expertise could be leveraged to open new facilities or expand their marketing efforts here.

Exhibit 1. Hong Kong, SAR, China

Exhibit 2. Corporate Structure of Dunwell

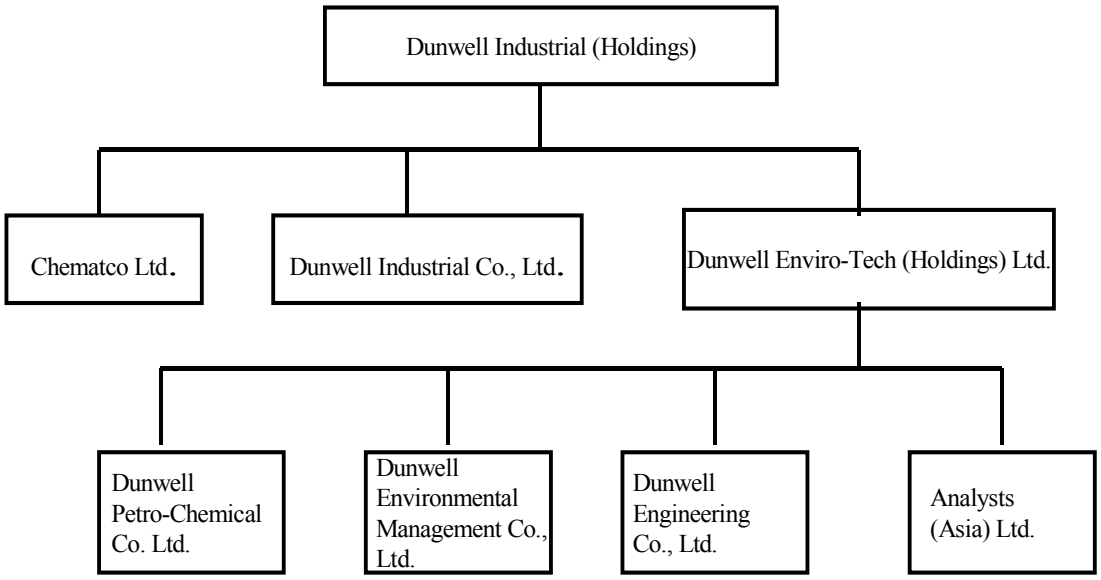

Exhibit 3. Description of Business Units and Holding Companies

DUNWELL INDUSTRIAL (HOLDINGS) LTD.
Holding company established to manage the following member companies:

DUNWELL ENVIRO-TECH (HOLDINGS) LTD.
Managing and developing the group's current and future environmental related businesses:

DUNWELL PETRO-CHEMICAL CO., LTD.
Used oil re-refinery, blending and marketing of lubricating oil products

DUNWELL ENVIRONMENTAL MANAGEMENT CO., LTD.
Collection and handling of used lubricating oil and oily contaminated wastewater

DUNWELL ENGINEERING CO., LTD.
Consult, design and installation of industrial wastewater treatment system; and marketing of environmental technologies

ANALYSTS (ASIA) LTD.
New / used oil, fuel and grease analysis service.

CHEMATCO LTD.
Manufacturing of formulated epoxy compounds, Hi-POLY® epoxy flooring, and the marketing of specialty chemicals and dispensing equipment.

DUNWELL INDUSTRIAL CO., LTD.
Manufacturing of high precision metal components for the magnetic media industry.

Exhibit 4. Dunwell's Environmental Policy

To help preserve the earth's natural resources and minimize adverse impact on our environment

It is the policy of Dunwell to achieve and maintain a high standard of environmental care in conducting its business as an environmental and industrial company.

Dunwell's approach to environmental management seeks to continuously improve its performance by keeping abreast of emerging environmental technology, changing customer needs and community expectations.

Specifically, it is Dunwell's policy to:

- comply with or exceed all applicable laws, regulations and standards; and minimize any adverse environmental impact resulting from its operations, products or services;
- ensure that its employees, contractors and suppliers of goods and services are fully informed of this policy and are aware of their environmental responsibilities in conducting business with Dunwell;
- continue providing personnel training to enhance employees' awareness of environmental protection;
- adopt 14000 Environmental Management Systems to identify, control and monitor environmental impact arising from its operations;
- conduct continuous research and establish or support programs to conserve and recover resources, minimize waste generation, use recycled products and improve processes;
- help educate local industrialists and the public at large their environmental responsibilities, and the proper means to dispose of wastes, to recycle and reuse precious resources

Exhibit 5. Charges for Disposal of Chemical Waste (Other Than Special Chemical Waste)

Disposal of Chemical Wastes	HK$ per Thousand Kgs of Chemical Waste
Incineration of Chemical Waste Basic Charge:	2,847
PLUS	
if any chemical contains calorific value of 15 Gigajoule/tonne or below:	174
PLUS	
if any chemical contains a halogen concentration of:	
(a) above 0% and below or equal to 30% by weight:	54
(b) above 30% and below or equal to 50% by weight:	896
(c) above 50% by weight:	1384
PLUS	
if any chemical waste contains a sulphur concentration of:	
(a) above 0% and below or equal to 20% by weight:	47
(b) above 20% and below or equal 40% by weight:	697
(c) above 40% by weight:	1394
PLUS	
any special handling	2491
Physical or Chemical Treatment of chemical Waste Basic Charge:	1027
PLUS	
if any chemical waste contains a chromium concentration of:	
(a) above 0% and below or equal to 20% by weight:	348
(b) above 20% and below or equal to 40% by weight:	7257
(c) above 40% by weight:	20319
PLUS	
if any chemical waste contains an ammonia concentration of:	
(a) above 0% and below or equal to 20% by weight:	1042
(b) above 20% and below or equal to 40% by weight:	8709
(c) above 40% by weight:	20319
PLUS	
special handling	2491
Oil/Water Separation of Chemical Waste	771

Exhibit 6. Charges for Disposal of Special Chemical Waste

Disposal of Chemical Wastes	HK$ per Thousand Kgs of Chemical Waste
Incineration of Chemical Waste: Basic Charge:	9183
PLUS	
if any chemical contains calorific value of 15 Gigajoule/tonne or below:	562
PLUS	
if any chemical contains a halogen concentration of:	
(a) above 0% and below or equal to 30% by weight:	174
(b) above 30% and below or equal to 50% by weight:	2891
(c) above 50% by weight:	4465
PLUS	
if any chemical waste contains a sulphur concentration of:	
(a) above 0% and below or equal to 20% by weight:	150
(b) above 20% and below or equal 40% by weight:	2249
(c) above 40% by weight:	4498
PLUS	
any special handling	8035
Physical or Chemical Treatment of chemical Waste Basic Charge:	3312
PLUS	
if any chemical waste contains a chromium concentration of:	
(a) above 0% and below or equal to 20% by weight:	1124
(b) above 20% and below or equal to 40% by weight:	23409
(c) above 40% by weight:	65545
PLUS	
if any chemical waste contains an ammonia concentration of:	
(a) above 0% and below or equal to 20% by weight:	3360
(b) above 20% and below or equal to 40% by weight:	28092
(c) above 40% by weight:	65545
PLUS	
special handling	8035
Oil/Water Separation of Chemical Waste	2488

Exhibit 7. Dunwell's Used Oil Refinery Process