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PRINTING INDUSTRY FACILITY ASSESSMENTS

Taiwan
January 9 - 17, 1995

Prepared for:

US - ASIA ENVIRONMENTAL PARTNERSHIP

WEC™

WORLD ENVIRONMENT CENTER

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I. EXECUTIVE SUMMARY

om January 9 to 17, 1995, Gary Jones, Manager, Environmental Information ffice for the Graphics Arts Technical Foundation (GATF), and Jeffrey Adrian, nvironmental Director for the John Roberts Company, traveled to Taiwan to articipate in an Environmental Business Exchange (EBE) arranged by the World nvironment Center under the auspices of the United States-Asia Environmental artnership (US-AEP). The purpose of the visit was to present a pollution revention workshop to members of the printing industry in Taiwan, conduct actory assessments, and suggest appropriate pollution prevention activities and echnologies.

the course of the EBE, the participants attended a series of informational and trategy meetings held with representatives of the United States Agency for nternational Development (USAID), the Industrial Development Bank (IDB) of aiwan, and China Technical Consultants, Inc. The contents of the pollution revention workshop and objectives of the plant visits were reviewed.

he focus of the workshop was on pollution prevention opportunities for the thographic printing industry. Areas covered in the workshop included:

- pollution prevention program development and implementation;
- air pollution emissions;
- wastewater discharges;
- solid waste disposal;
- hazardous waste management; and
- employee training.

he remainder of the visit was dedicated to a series of site visits at printing actories with the purpose of reviewing current equipment, technology, and work ractices. Following the site visits, the participants suggested applicable pollution revention techniques and technologies.

fter visiting several printing facilities, the EBE participants concluded that there xist a number of ways in which each facility could reduce their current pollution oad. While some pollution prevention opportunities require considerable nvestment of time and resources, other opportunities remain unattainable at this ime because the necessary infrastructure services are lacking in Taiwan.

unding for this project was provided through a Cooperative Agreement between the World Environment Center (WEC) and the United States-Asia Environmental Partnership (US-AEP), the U.S. Agency for International Development (USAID).

II. INTRODUCTION

From January 9 to 17, 1995, Gary Jones, Manager, Environmental Informatir Office for the Graphic Arts Technical Foundation (GATF), and Jeffrey Adria Environmental Director of the John Roberts Company, a commercial printer locate in Minneapolis, Minnesota, traveled to Taiwan to participate in an Environment Business Exchange (EBE). The purpose of the EBE was to present a pollutio prevention workshop for the members of the printing industry in Taiwan, conduct series of on-site factory assessments, and suggest appropriate pollution preventio activities and technologies.

The opportunity for this exchange of information and technology was the result of visit by C.T. Cheng of China Technical Consultants, Inc. of Taiwan to the Unite States. On this visit Mr. Cheng, whose firm is contracted by the Industri Development Bureau (IDB) of Taiwan to pursue pollution prevention opportunities i the printing industry, met with representatives of the John Roberts Company During this visit to the John Roberts Company, it was proposed that pollutio prevention experts visit Taiwan to address the printing industry in Taiwan o opportunities for pollution prevention. The visit was then arranged through th U.S.-Asia Environmental Partnership (US-AEP)/World Environment Center (WEC Environmental Business Exchange Program.

This report details Messrs. Adrian and Jones' EBE to Taiwan, their pollutio prevention workshop, and the results of their on-site assessments.

III. MEETINGS HELD AND FACILITIES VISITED

January 9, 1995 - American Institute in Taiwan (AIT)

rsons met with included:

Ms. Jennifer Huang, Representative, US-AEP/Taiwan
Mr. Robert A. Barnes, Business Representative, US-AEP/Taiwan
Ms. Chia-Sung Lee, China Technical Consultants, Inc.

order to prepare for their workshop presentations to be held January 10-11, the 3E participants met with two officials of US-AEP/Taiwan. Mr. Barnes aided them developing effective communications techniques for the workshop. The articipants also reviewed Taiwan printing industry concerns with Ms. Lee from 'hina Technical Consultants, Inc.

January 9, 1995 - Industrial Development Bureau (IDB) of Taiwan

ersons met with included:

Mr. Jerry Huang, Section Chief, IDB, Ministry of Economic Affairs
Mr. Lin Chih-Sen, Division Director, IDB, Ministry of Economic Affairs
Mr. Chun-Lang Tsay, Researcher 7th Division, IDB, Ministry of Economic Affairs

'he Industrial Development Bureau (IDB) is a governmental organization operating inder the auspices of the Ministry of Economics which helps Taiwanese industries ipgrade their technology. IDB working through China Technical Consultants, Inc. CTC) has been responsible for work in the areas of pollution prevention and waste nanagement in the printing industry in Taiwan. Accordingly, the participants met with IDB's representatives to discuss their basic trip objectives.

C. January 9, 1995 - China Technical Consultants, Inc. (CTC)

The EBE participants met with Mr. C.T. Cheng, Deputy Director, CTC for final preparations for the upcoming pollution prevention workshop.

D. January 10-11, 1995 - Workshop Presentation

The workshop was held at a meeting facility in the Taipei National Railway train station and was attended by approximately 50 representatives of the Taiwanese printing industry. Workshop topics covered all environmental media: wastewater,

air emissions, solid and hazardous wastes, energy conservation, noise, and environmental management.

An outline of the workshop presentation in included as Appendix G.

E. January 12, 1995 - Flower Queen Enterprise Company, Ltd. (Flower Queen

Persons met with included:

Mr. Hwa-Yen Chiu, President, Flower Queen
Mr. Liu Hao I, Vice President, Flower Queen
Mr. Wen-Chen Liu, Administration Manager, Flower Queen
Mr. Simon Chow, Internal Auditing Office, Flower Queen
Mr. C.T. Cheng, China Technical Consultants, Inc.
Ms. Chia-Sung Lee, China Technical Consultants, Inc.
Mr. Edward L. Cho, China Technical Consultants, Inc.
Mr. Yuh-Chang Wei, Ph.D., Chinese Culture University

Flower Queen is a 27-year old company which has received numerous awards fo their printing excellence. The company has been at the same location for the pas 21 years and specializes in high-quality multicolor printing of cartons, books magazines, posters and labels, utilizing sheet-fed offset lithography. Flower Queer has both prepress and finishing operations in a 25,000 square foot facility anc employs 135 persons. Major environmental concerns currently facing Flowe Queen include prepress and pressroom wastewater, cleaning solvent and waste rag disposal, maintenance of indoor air quality (because of solvent odors and spray powder dust), and solid waste (ink containers) disposal.

Like many other printing facilities visited during this EBE, cleaning operations were accomplished with solvent and rags -- the latter being used only once before disposal as a solid waste. The solvent used appeared to be a low-grade kerosene. Compared to other solvents, kerosene has a relatively low vapor pressure and volatility. There also appeared to be no industrial laundry service available for use of recycled shop towels.

Prepress and press wastewater concerns are significant as the Taiwanese Environmental Protection Agency (EPA) has regulations on wastewater. Sewers also exist, but there currently is no wastewater treatment capability though the participants were notified that this is forthcoming in approximately five years. Silver and fixer from film development are the prime pollutants from prepress operations. However, developer and system cleaners must also be recognized as significant pollutants. Isopropyl alcohol (IPA) containing press fountain solution is the major pressroom pollutant. Current IPA concentration is rather high at 12 percent and storage of IPA creates a safety concern.

essroom ventilation was found to be above adequate standards and likely explains ıe minimal odor problems the participants experienced during their visit. Under ımid and hot weather conditions, odor from fumes might become a greater oblem than was detected during this site visit. Offset spray powder, said to be f concern, was not considered to be a significant issue. Taiwan's humidity may rk in favor of keeping this under some control.

ecommendations needed to be tempered to what was technologically applicable iven Taiwan's somewhat limited environmental infrastructure. Technology uitable in the U.S. may be structurally unworkable in Taiwan. Appropriate ecommendations for pollution prevention measures at this facility include the ollowing:

- Lowering fountain solution IPA concentration to three to five percent rather than devoting the considerable effort required to use alcohol substitutes for IPA; (Also, the addition of better fountain solution filtering and cooling to extend life and to minimize evaporation is likewise recommended.)

- Enacting good housekeeping steps such as covering soiled rug containers, replacing open solvent containers with self-covering safety cans, vacuuming up spent offset spray powder on a regular basis, covering outdoor solid waste bins to prevent rainwater contaminated runoff, and covering of paper trim waste stored outside;

- Increasing recycling measures through supplier take-back of packaging (ink cans), or recycling these cans for their metal content, or using returnable and reusable packaging;

- Processing in-house spent fixer for silver recovery which will then allow for pH neutralization of combined spent developer and fixer prior to waste water discharge; using fixer recycling technology to extend fixer life - which costs approximately US $4000; and using water-mixing to extend washwater life and recover carryover silver; and

- Adopting water-based coatings to replace solvent-based coatings used in the bindery finishing operation.

F. January 12, 1995 - Shen's Art Printing Company, Ltd. (Shen's)

Persons met with included:

Mr. Hsi Chen, General Manager, Shen's
Ms. Anne A.R. Wu, Manager Customer Services Office, Shen's
Mr. Jefferson J.J. Wang, Supervisor Prepress Department, Shen's
Mr. Steven J.M. Hwang, Assistant Manager, EPS Center
Mr. Leo K.L. Lin, EPS Center
Mr. C.T. Cheng, China Technical Consultants
Ms. Chia-Sung Lee, China Technical Consultants
Mr. Yuh-Chang Wei, PhD., Chinese Culture University

Shen's Art Printing Company (Shen's) was the largest and most modern facilit visited by the participants during this trip. Employing 152 people, this printer use: sheet-fed offset lithography for the production of books, magazines, catalogs posters and artistic publications. They are located in a new facility and use Heidelberg presses less than three years old.

It is evident that this company is quite advanced in their pollution prevention efforts to date -- most notably in both the pre-treatment of incoming water and the treatment of all wastewater in their own system built in the sub-basement. The participants observed very effective pollution minimization practices, such as:

- raised (off the floor) drains for discharges from film and plate processors in prepress;
- a well ventilated and safe chemical storage facility;
- epoxy coatings used in the building construction to reduce noise; and
- paper inventory kept wrapped to reduce spoilage.

However, the participants observed some minor housekeeping practices that car contribute to the pollution problems in the facility. These included:

- open containers of cleaning solvents;
- lack of absorbents for spill control;
- lack of secondary spill control trays under film and plate processors;
- lack of a floor drain in the chemical storage room;
- lack of a self-closing fire door to the chemical storage room;
- lack of drip pans under chemical spigots; and
- lack of grounding strips in the storage room.

Use of IPA in this pressroom occurs in concentrations between three to five percent, and fountain solutions were both filtered and cooled.

ecommendations for this facility were to consider on-site silver recovery in repress, mainly to extend fixer life and to also conserve water use through 'ashwater carryover of silver and fixer in processors. Given that this facility has s own wastewater treatment facility, there is much more that can be done in the ay of waste management.

. **January 13, 1995 - Scala Printing Company, Ltd. (Scala)**

ersons met with included:

Mr. Wei Tsung-Chin, President, Scala
Mr. Huang, Deputy General Manager, Scala
Mr. Hou, Manager, Printing Department, Scala
Mr. C.T. Cheng, China Technical Consultants
Mr. Yuh-Chang Wei, PhD., Chinese Culture University

cala Printing Company, Ltd. (Scala) was founded in 1975, and has relocated four imes before moving to its present location. This commercial printer has 28 mployees and operates within a 7,500 square foot facility -- a size very typical of ther printing firms in Taiwan. Scala produces brochures, catalogs, posters, books nd other publications. This company no longer does any prepress operations in its own facility and instead shops these services outside. Several factors contributed to this decision, among them, lack of a qualified labor force, stringent wastewater discharge standards for this particular industrial park, cost of labor -- specifically, highly skilled strippers, and a strategy of utilizing electronic prepress to minimize the need for film intensive prepress. Printing plates are also made off-site.

Scala's president, Mr. Wei, expressed strong opinions on environmental responsibility, and sees himself as a leader in this area. The approach of this firm is to plan before the installation of new equipment, allowing for proper construction of flooring and extended training of personnel. This facility utilizes preventative maintenance as a tool to reduce environmental impact of operations. The company also utilizes an air recirculation and conditioning system that is serviced (filter changed) every three days.

Good segregation of paper trim wastes and kraft wrappings maximize paper recycling, and the company expressed its willingness to expand on the use of recycled printing paper stocks in the future. Waste printing plates are currently recycled for their aluminum content. The company uses both pre-sensitized plates for color work, and more economical wipe-on plates for black only printing. Unfortunately, waste ink cans, cloth wipers, pallets, waste ink and solvent waste are all disposed of in the solid waste stream (trash). Mr. Wei mentioned, however, that the personal protection program for noise has not worked (a very loud radio

was evident in the pressroom). Use of IPA varied from none on one press to a much as 12 percent on another.

Recommendations for this facility included:

- Lowering the concentration of IPA in press fountain solutions from 12 t between 3 and 5 percent, a more attainable goal given the resource available in Taiwan, than devoting time and effort needed in order to lear how to use alcohol replacements; (Interestingly, it was at this facilit that Mr. Adrian spotted labels for the very company (British) tha manufactures the alcohol substitute used at the John Roberts Compan and there appears to be a local distributor for Hydrodynamic Product (HDP).)

- Allowing wipers used with plate preserver chemistry to air dry befor disposal;

- Instituting improved housekeeping practices would include: coverin solvent dispensing cans and soiled rag containers, periodic vacuur collection of spray powder dust, absorbing of small spills observed on th floors, and keeping trash both contained and covered; and

- Hanging sound absorbing egg-crate foam in panels supported from the ceiling, or by placing this material on walls to control noise pollution. (The use of a radio (very loud) should be banned by policy. Sound is additive, playing the radio only makes matters worse. Getting the employees involved in some type of a safety committee was recommended as the best way to modify employee attitudes and thereby increase the use of hearing conservation aids such as ear plugs and mufflers.

H. January 13, 1995 - Chinese Culture University

Persons met with included:

Mr. Yuh-Chang Wei, Ph.D.

Mr. Wen-Fa Yang, Director, Industrial Pollution Control Group, Chinese Culture University

The participants had an opportunity to visit the Graphic Arts Department of the Chinese Culture University. The University has approximately 600 students enrolled in the undergraduate program, and another 26 students enrolled in the graduate program for graphic arts. At the time, Mr. Yang was leaving for a four-month sabbatical to attend New York University. An invitation was extended for

im to visit both the Graphic Arts Technical Foundation (GATF) in Pittsburgh, ennsylvania and the John Roberts Company in Minneapolis, Minnesota.

January 14, 1995 - Printing Technology Research Institute (PRTI)

ersons met with included:

Mr. Charles C.Y. Chang, Managing Director, PRTI
Mr. Tony Tang, Director, Technical Support, PRTI
Mr. J.D. Shih, Director, Training, PRTI
Mr. Chiu-Pai Ho, Director, Planning, PRTI
Mr. C.T. Cheng, China Technical Consultants

'he PRTI is a government funded organization charged with the responsibility of eeking out technology advances in the graphic arts industry and providing this echnology through educational efforts in the printing industry of Taiwan. The PRTI acility has some of the very best test equipment for evaluating printing inks and rinting papers. They are also equipped with an excellent electronic prepress raining classroom facility. This organization is perhaps in the best position to ssist Taiwanese printers with the difficult task of alcohol substitution in press ountain solutions. Much of the discussion centered on the need for development of the environmental infrastructure that would facilitate identified pollution revention recommendations.

n the afternoon, the participants had an opportunity to visit PRTI's new press raining facility. A brand new Komori four-color sheet-fed press was being installed ere, with a classroom training facility planned for upstairs. This facility was ocated in a garage stall type industrial building.

I. January 16, 1995 - Hsing-Tai Color Printing Company, Ltd. (Hsing-Tai)

ersons met with included:

Mr. J.S. Chen, Manager, Hsing-Tai
Mr. C.T. Cheng, China Technical Consultants
Ms. Chia-Sung Lee, China Technical Consultants

'his was the first facility visit made without Mr. Gary Jones, GATF, who returned o the United States on January 15, 1995. Mr. J.S. Chen is also the chief of the xecutive Board for the Taipei International Graphic Arts Exhibition, the producer of rinters Magazine. Hsing-Tai began in 1945 as a letterpress printing operation -- the letterpress operations being dropped in favor of lithography in 1967. The company utilizes an extensive electronic prepress department with three Crossfield-brand scanners, a Scitex, and Postscript™ Chinese fonts developed at Peking

University. Hsing-Tai has the capability to do waterless printing, but chooses n to, primarily due to the following factors: the cost; short plate life; and th tendency for paper picking.

Like the other facilities visited, the environmental concerns are indoor air qualit wastewater and solid waste issues. In prepress, spent fixer is taken off-site f recovery of silver while waste developer goes directly into the sewer. One goo noise control step taken by the company involved the isolation of air compressor for vacuum frames in a small processor room. All film and plate processors lacke spill containment trays.

In the pressroom, the use of IPA in fountain solutions was very low approximately one percent -- with all fountain solution being recirculated, filtere and cooled. On one occasion during the visit, the fountain solution was treate with ultraviolet (UV) exposure as a biocide which dramatically extended the life c the fountain solution. Waste ink cans and soiled rag wipers were disposed of afte a single use in the trash. Like many printers in Taiwan, this company makes use c outside storage for waste paper, pallets, and trash, not all of which is covered b roofing or protected from stormwater runoff.

Recommendations for pollution minimization at this facility included:

- Processing spent fixer for silver on-site to allow the processed spent fixe to neutralize the pH of spent developer solution before severing; (Thi process would also make fixer recycling for extended life and som source reduction, as well as wastewater minimization throug wastewater recycling feasible, costly approximately US $4,000 an $5,000 respectively.)

- Expanding the UV biocide treatment to the remaining press fountai solution recycling systems in the plant;

- Implementing improved housekeeping procedures such as keepin cleaning solvent dispensing containers closed, replacing covers on all in cans with leftover ink as a means to reduce spoilage by minimizing ink and skimming and keeping out contaminants that would destroy the ink' usefulness;

- Replacing rags for cleaning with recyclable shop towels (when, and if, a service becomes available) and reactivating the use of large ink containers as a means to reduce generation of many small ink cans as waste; and

- Installing noise absorbent materials in panels in the pressroom to reduce noise pollution.

. **January 17, 1995 - Kao-Chang Printing Company, Ltd. (Kao-Chang)**

ersons met with included:

Mr. Mike Kao, President, Kao-Chang
Mr. C.T. Cheng, China Technical Consultants
Ms. Chia-Sung Lee, China Technical Consultants

ıe Kao-Chang Printing Company employs 110 people in a 57,000 square foot cility that does both sheet-fed lithographic printing and web printing. The ımpany has both cold-set web and heat-set web capabilities, the only web printer en during the EBE. Indeed, this company was the first to have web presses in ıiwan. Kao-Chang also has a printing facility located in Taipei County with 100 nployees as well as a facility on mainland China. The primary products of this inter are textbooks, tool manuals, and phone directories.

ıe company's environmental concerns are similar to many other facilities visited -- e one difference being that this facility was the only one to be using a heat-set eb press, which emits heat and particulates from perfect binding operations (grind f).

Surprisingly, this facility does have air emissions controls on its heat-set web press n the form of a rudimentary fume incinerator. There were no visible emissions from the stack. Use of IPA in fountain solutions was a low three percent concentration, considered to be quite good. The cleaning solvent was determined to be kerosene which has a low vapor pressure and is not quick to evaporate, though the dispensers should be covered for good housekeeping. Particulates from perfect binding grind off were collected through a pneumatic system and delivered to a covered collection bin. There was some leakage evident in the system. There was no spill containment for film and plate processors. A loud radio played in the pressroom, adding to overall noise level.

Pollution minimization recommendations included:

- Implementing improved housekeeping practices with regard to cleaning solvents and wipers, covering of recirculation tanks for press fountain solutions to minimize evaporation and to keep out contaminants that shorten solution life and vacuuming up offset spray powder residue regularly;

- Incinerating perfect binding grind off dust; and

- Eliminating loud radios, installing sound absorbing panels, and implementing hearing conservation measures (ear plugs and muffs) through the emplyee safety committee for noise control.

IV. RECOMMENDATIONS AND CONCLUSION

The physical examination of the printing factories revealed many pollutio prevention opportunities. These areas include air emissions, wastewate discharges, and solid waste disposal. Since most of the pollution preventio recommendations are common to all of the facilities visited, they will only b described in detail once, and are presented in the order of greatest pollutio prevention potential.

The priority of the pollution prevention recommendations is based on th perspective of the U.S. printing industry's experience as well as the participants limited knowledge of the Taiwanese printing industry. Since Material Safety Dat Sheets (MSDS) for products are not required in Taiwan, many of the printers visite did not know the composition of the materials they were using. Therefore, it wa difficult to suggest alternative chemistries without establishing a baseline.

Cost saving estimates for each suggestion could not be developed because basi information on purchase volume, purchase price, waste generation volumes, utilit costs and consumption, and disposal costs were not available.

The following recommendations address air, water, solid waste, and indoor ai pollutants and pollution prevention opportunities.

A. Air Pollution Issues

The replacement or reduction of isopropyl alcohol (IPA) as a wetting additive to the fountain solution can produce several environmental, health, and safety benefits. It can reduce the amount of volatile organic compound (VOC) emissions by up to 15-20 tons per year each from both Flower Queen and Scala Printing. Shen's Art Printing could reduce their VOC emissions by four tons per year via this method.

With the use of a wetting additive other than IPA, the health of the employees will be better protected because they will not be exposed to dangerous vapors. Overexposure to IPA vapors can cause symptoms similar to intoxication by ethanol, such as slowing the reactions of workers, and causing headaches and nausea. These vapors also dry out and irritate the eyes and mucus membranes leading to burning, stinging, and nose bleeding.

IPA's low flash point of 53°F presents storage and handling problems as well. It should be delivered and stored in safer containers. While there may not be an opportunity to alter the delivery containers, the IPA could be transferred into a drum, once delivered. At a minimum, it should be stored in an explosion proof

abinet and larger quantities in a properly constructed solvent storage room. ypically, storage of more than 110 gallons should be in a solvent storage room.

properly constructed solvent storage room involves a self-closing fire door, econdary containment accomplished through a four inch sill or entrance ramp, xplosion proof lights and wiring, ventilation that provides for six room air changes er hour or one cubic foot of air per minute for each square foot of floor space, einforced walls except for one blow out panel, and a fire suppression system like sprinklers. All isopropyl alcohol containers should be grounded with a natural ground. In addition to providing fire and explosion protection, cabinets and rooms provide a form of secondary containment to help contain any spills so that they could be cleaned up while protecting the environment.

Both Scala and Flower Queen were not using a solvent storage room or an explosion proof cabinet to store their isopropyl alcohol. During the visit at Flower Queen, it was observed that several of the containers were dented or otherwise damaged and leaking isopropyl alcohol. The isopropyl alcohol was being stored under the steps leading up to the second and third floors. It was suggested that eaking containers should not be accepted for delivery and that the isopropyl alcohol be stored in a safer location. Proper handling and storage will help prevent the unnecessary evaporation of isopropyl alcohol and help prevent a fire or explosion.

Shen's Art Printing was storing its IPA and cleaning solvents in a solvent storage room. Several suggestions were made to enhance the protection offered by this room. A raised ramp, self-closing fire door, drip pans, grounding, and blocking of the open floor drain would provide for a properly constructed solvent storage room.

The conversion and/or reduction of isopropyl alcohol to substitutes and substitute free fountain solution chemistry is not easy, but can be accomplished. Many lithographic printers in the United States have successfully made the conversion or dramatically reduced the amount of IPA consumed and subsequently released. The conversion needs to be undertaken in systematic and logical approach.

In some cases, it has taken printers several years to completely eliminate isopropyl alcohol, while others have had an easier time. There are many factors that influence the chemistry of lithographic printing like roller settings, roller hardness, incoming water quality, ink, fountain solution etch concentrate, paper, and type of damping system. The influence of each of these can not be described in this report. Some technical information on this subject will be made available to C.T. Cheng of the China Technical Consultants for distribution.

Based on the observations made at the facilities, there are several actions that can be taken to reduce the amount of VOC emissions and solid waste generated from equipment cleaning activities. Recommended changes involve the revision of

solvent and cleaning cloth handling practices and substitution of less toxic cleanin solvents.

Every factory visited seemed to employ the same solvent and shop towel handling practices in that all press-side containers were open and the dirty and contaminated cleaning cloths were disposed of as trash. One easily implemented change would be to store and dispense all press-side cleaning solvents from closed containers. The larger volume chemicals like blanket wash are best stored and dispensed from self-closing safety containers. These containers are equipped with a flash suppresser screen and a plunger-type delivery system. This type of container allows the solvent to be dispensed and the excess to drain back into the container. The advantage to these containers is that they are explosion proof and they keep solvent evaporation to a minimum.

Minimizing evaporative loss can dramatically reduce the amount of VOC emissions released to both the pressroom and the atmosphere. This will help protect the environment and improve the indoor air quality, as well as conserve quantities of solvents.

There are several other options which will reduce VOC emissions that should also be considered. The first would be to begin a program to substitute current cleaning solutions. To reduce emissions and purchase volumes, the printer will need to focus on the vapor pressure of the solvent or solvent blend. Printers who have substituted highly volatile solvents with less volatile ones have cut their consumption and subsequent emissions by up to 70 percent. In these cases, the printers substituted solvent blends with vapor pressures of 70 millimeters Hg at 20°C with ones having vapor pressures of three to five millimeters Hg at 20°C.

The problem with exploring this approach is that there is currently very little information on the composition of available cleaning solvents. Since Material Safety Data Sheets (MSDS) or a similar product information is not required in Taiwan, the printer is severely hampered in his effort to evaluate alternative solvent blends. To better determine the potential of this opportunity, additional composition information needs to be made available.

One of the least costly options to implement would be to store all dirty solvent laden cleaning towels in closed containers. In every print factory visited, the storing of dirty, solvent laden cleaning towels in open boxes or similar containers was observed. Covering these containers minimizes evaporative loss and increases the amount of liquid that could potentially be recovered from the cleaning towels.

Recovering the liquid cleaning solution from the cleaning towels offers many pollution prevention advantages and reduces the amount of solution being released to the environment via the discarded cleaning towels. The recovered solution can

ıe reused as is, or possibly distilled for reuse. Some printers have used :ontaminated reclaimed solvent for less critical cleaning operations, like cleaning of ık wash up trays, thereby reducing the amount of solvent purchased. For more ritical operations, some printers have found it economical to either purchase a istillation unit and recover solvents on-site, or if their usage volume could not ıstify on-site recovery, send the liquid off-site for reclamation. Depending upon ıe original blend of the distilled solvent, some components may have to be re-dded.

etting up a cleaning solution recovery and reuse program can be easily ccomplished. One simple low cost method is to have the operators hand-wringing ıe towels and collect the solution in a closed container. The hand-wringing can be ombined with the construction of false bottoms made of mesh or screen in the ontainers used to store the shop towels. This would allow the solution to drain by ravity, for collection.

o maximize the volume of recoverable solvent, it is possible to extract solvent om the cleaning towels. This can be accomplished several ways. The most ficient method is to employ a centrifuge to extract the solvent. Depending upon ıe vapor pressure of the cleaning solution, this type of recovery can yield a 95 percent recovery rate of the solvent contained in the cleaning towels. While the recovery rates are very impressive, these types of industrial centrifuges are expensive, costing approximately US $15,000 to 20,000.

The next most efficient method is to use a wringer, much like the ones used in older clothes washing machines. This method can result in a 50 to 60 percent recovery rate of the solution contained in the cleaning towels. The exact costs of these units are unknown, but can range between US $5,000 to $10,000.

Although only Flower Queen was observed using solvent-based coating and drying, there is an opportunity for them to dramatically reduce the emissions associated with that process. They should explore the use of reduced solvent (high solids) or water-based coating material.

3. Water Pollution Issues

Since the prepress area produces the largest amount of wastewater, this area has the greatest potential to reduce water discharges. In the prepress area, film processors consume the largest amount of water. One of the most cost-effective approaches is to make sure the equipment is properly adjusted and cleaned.

There are two pieces of equipment that can be attached to film processors to reduce both chemical and water consumption. Several companies offer

wastewater recycling units. These units collect the water from the processor, filt it, and recover the silver that is carried over from the fixer solution. Althougl these types of units do release a small amount of wash water, they can reduc washwater consumption by up to 90 percent.

To conserve fixer chemistry, several companies offer fixer recyclers. Thi equipment recirculates the fixer solution, filters it, recovers silver, and meters th proper amount of fresh fix back into the processor. This type of equipment ca reduce fixer consumption by up to 50 percent.

One method to dramatically reduce both film and chemistry consumption is t modernize the prepress operation by upgrading to a total electronic prepres system. This approach computerizes many of the steps involved in the preparatio of a given job. While these types of systems are expensive and require extensiv employee training, they can reduce film and chemistry use by up to two-thirds.

In order to reduce the discharge of heavy metals from the prepress area, the use o chrome-based cleaners should be eliminated. These cleaners come in two parts an when mixed together, form chromic acid. While chromic acid is an excellent filn processor cleaner, it is highly toxic.

C. Solid Waste Issues

One method that can be used to reduce the amount and toxicity of some of th solid waste generated by all the printing operations visited is to use reusable sho towels. The current observed practice involves using disposable towels (commo rags). Once the disposable towels are contaminated beyond use, they are throw into the trash and landfilled. While reusable towels eventually must be eithe recycled or disposed, they can be used multiple times before they become unusabl due to wear.

A problem inherent in this option is the fact that it was not known if any businesses exist that offer this kind of service. In the United States, industrial laundries typically offer this service to printers. It is important that printers' shop towels be laundered separately from other types of businesses shop towels in order to prevent printers from receiving towels that may be contaminated with oils, greases, and small slivers of metal.

All of the printing factories visited inquired what could be done regarding empty ink containers. This particular waste stream also presents problems for printers in the United States. One option would be to segregate the containers and find a scrap metal recycler that would be willing to take them.

Other options would be to explore the possibility of having the ink manufacturer take empty ink containers back. If the ink purchase quantities are large enough, the use of larger reusable containers should be explored. These larger containers can be furnished with insert plastic liners to facilitate the reuse of the containers.

It was observed at Flower Queen that the outside solid waste storage area was exposed to the elements and that the stormwater draining from this storage area was contaminated. A significant amount of residue had built up in the storage area and on the ground around it. The storage area was filled with empty ink cans, trash, and other chemical containers. Covering the storage area with a roof to protect it from the rain will help prevent the spread of contamination into the ground water and soil.

All of the factories visited employed very little secondary containment practices. The concept embodied by secondary containment involves providing a means to prevent the spread of chemicals, once an accidental spill or release occurs. The areas requiring secondary containment include, but are not limited to, all process equipment using liquid chemistries, chemical storage areas, and all areas with open floor drains. It was observed that none of the factories visited had any spill clean up materials available. All facilities should assemble and maintain spill clean up kits.

D. Indoor Air Pollution Issues

All factories visited had problems with offset spray powder. While spray powder does not present an emission problem, it does present a safety problem. Spray powder is classified as a nuisance dust and does not present a human health hazard. However, the dust does present a fire and explosion hazard, especially if it becomes suspended in air. To reduce this potential, it was suggested that all printers cut back on the use of spray power, use vacuum rather than compressed air for clean up, and establish regular periodic cleanup as a part of normal maintenance procedures. An alternative, but more expensive, option would be to purchase hoods and vent the exhaust to a filter. The filter can be cleaned and reused.

Noise, both internal and external, seemed to be problematic, although actual noise readings were not taken. However, there are several simple steps that printers can take to reduce the level of noise generated by the production process. These measures include the use of baffles strategically placed above and near the production equipment. These baffles can reduce noise by up to two to five decibels. The use of sound absorbing material in and around the equipment can also dramatically reduce the noise levels. Centralized compressor and vacuum pump rooms can isolate a significant source of noise. If the compressors and

vacuum pumps can not be easily moved, simple enclosures lined with sounc absorbing materials can be built and placed over them.

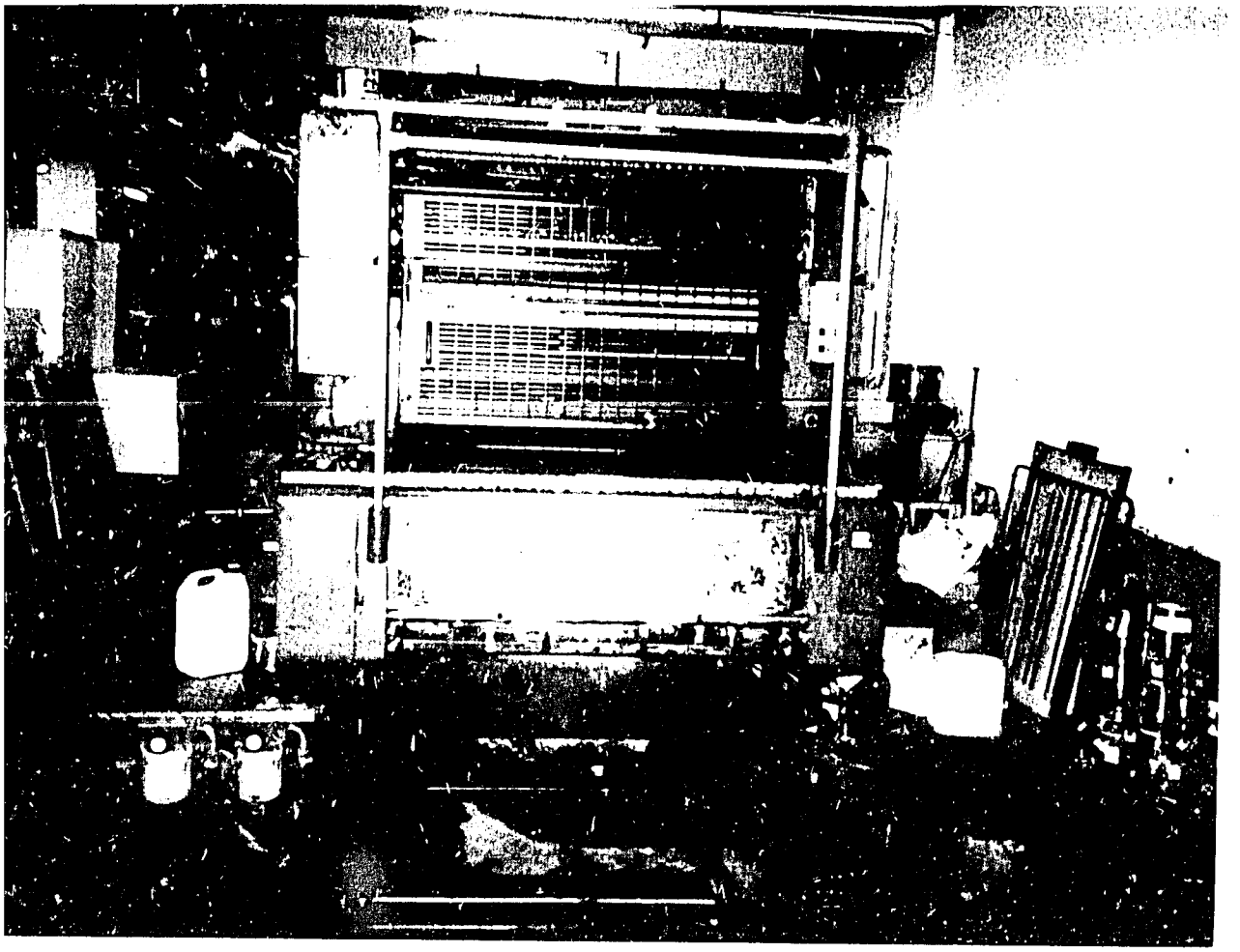
E. Conclusion

In conclusion, there is ample opportunity to work with the lithographic printinc industry in Taiwan to reduce pollution. As outline above, some of the pollutior prevention practices can be performed by the printer, while others require the support of an infrastructure that may not exist. There are many pollutior prevention activities that are low cost, while others may require significant investment.

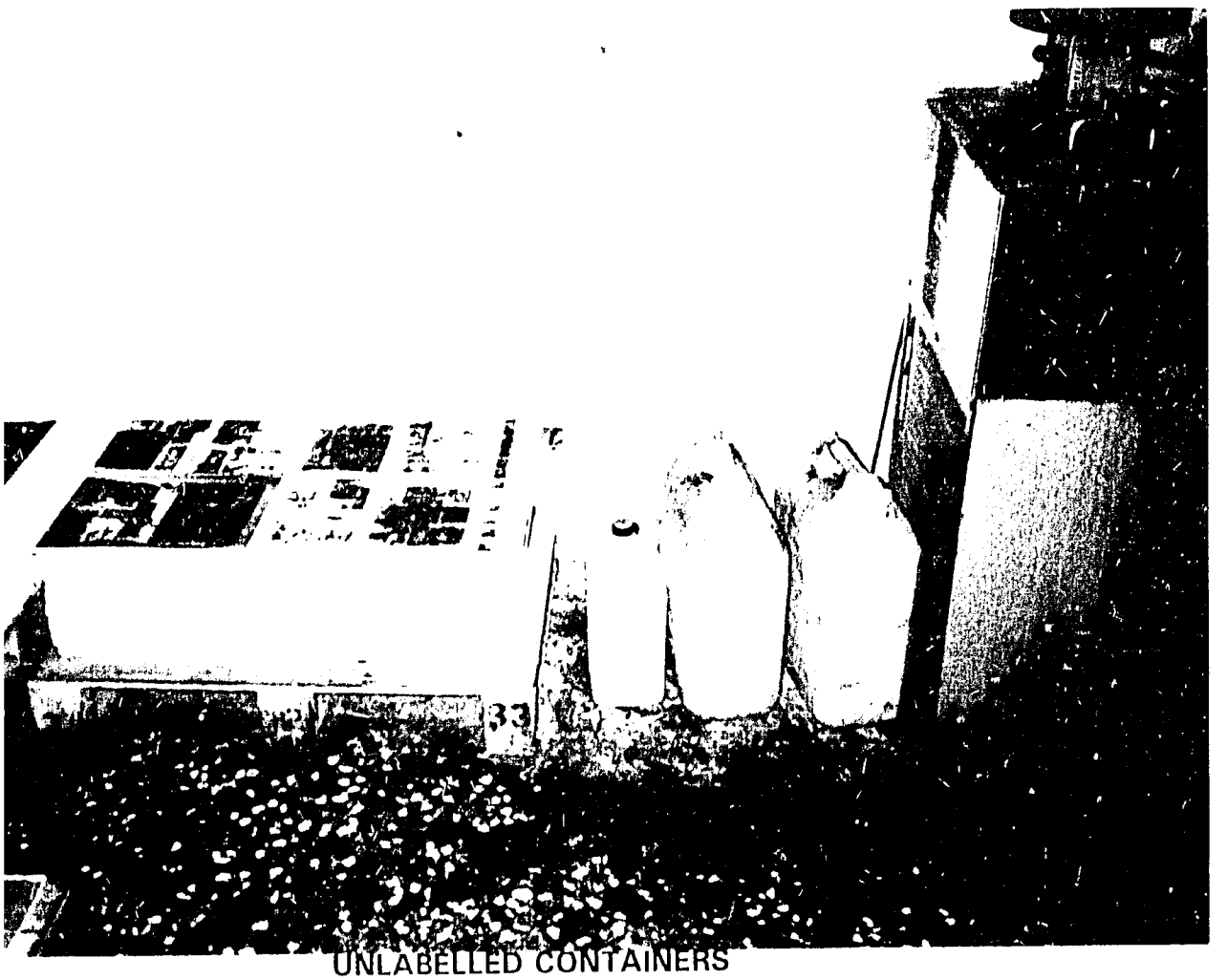
Recommendations for future actions include: increased educational efforts and training activities, which can be accomplished through seminars, workshops and guidebooks; and further development of infrastructure support services and continuation of site-specific reviews.

APPENDIX A

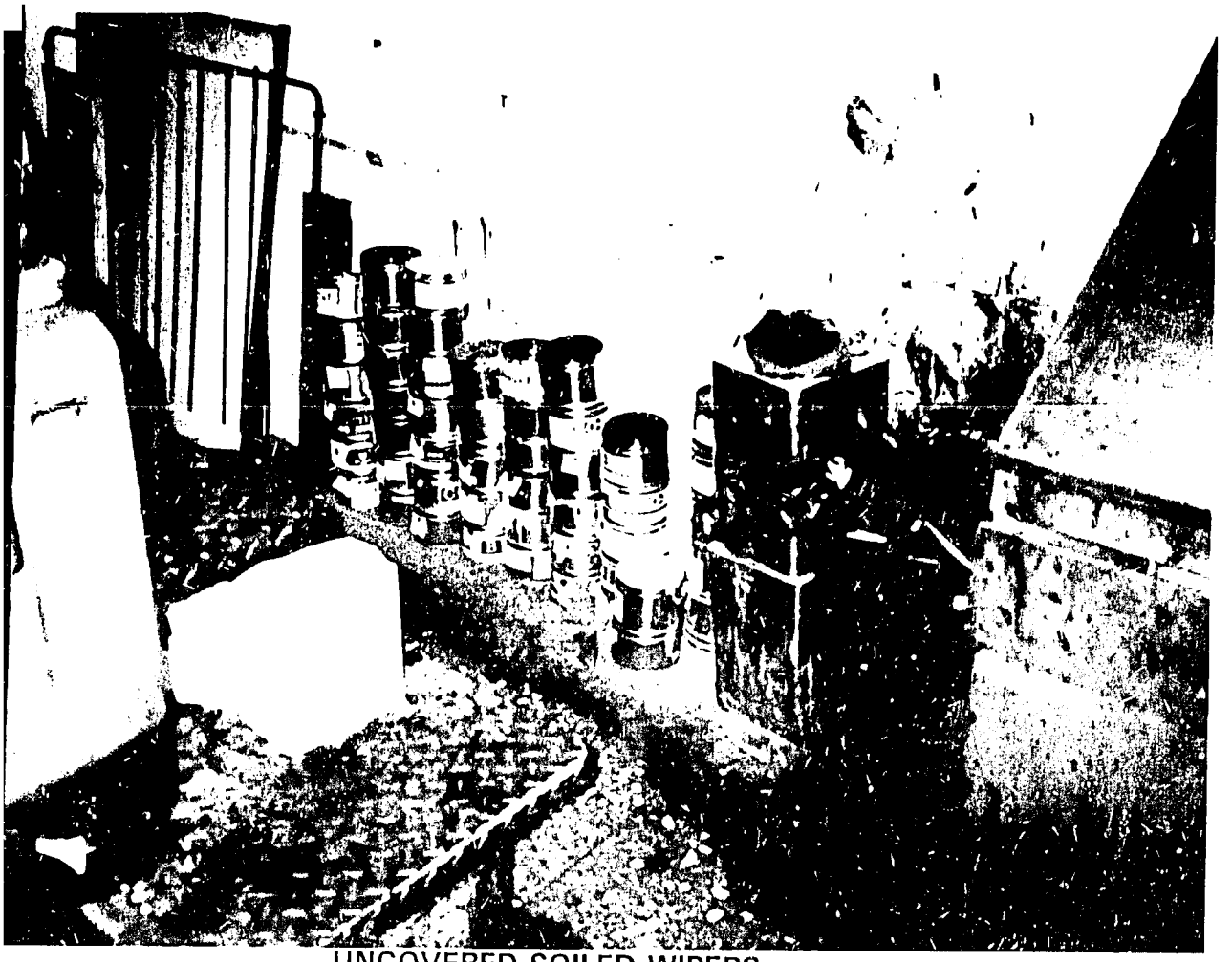
PHOTOGRAPHS



SPILL CONTROL



UNLABELLED CONTAINERS
No secondary spill control



UNCOVERED SOILED WIPERS

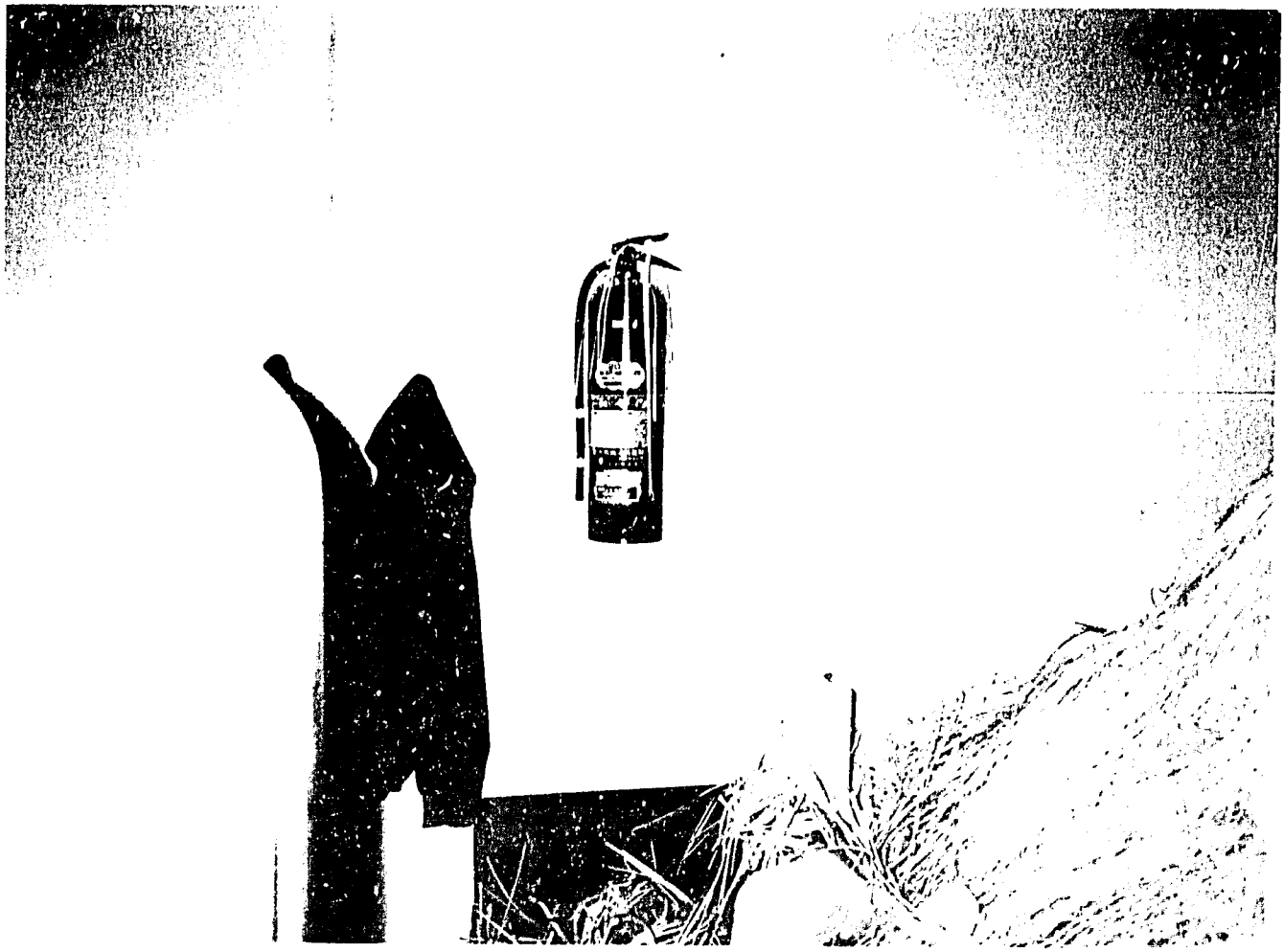
UNCOVERED INK CANS

UNLABELLED CONTAINERS

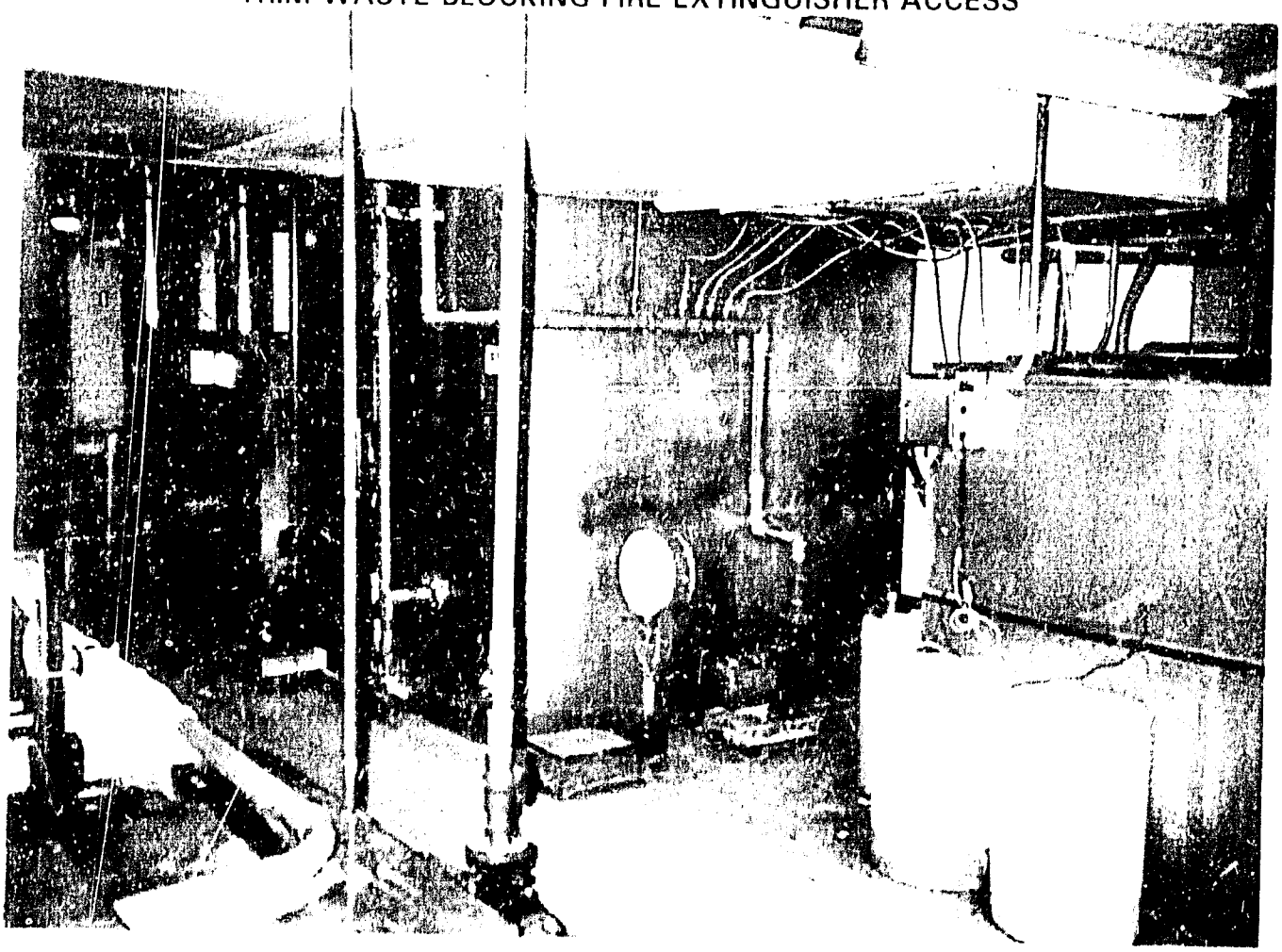
EXCESSIVE SPRAY POWDER

RECYCLING OF KRAFT WRAPPERS

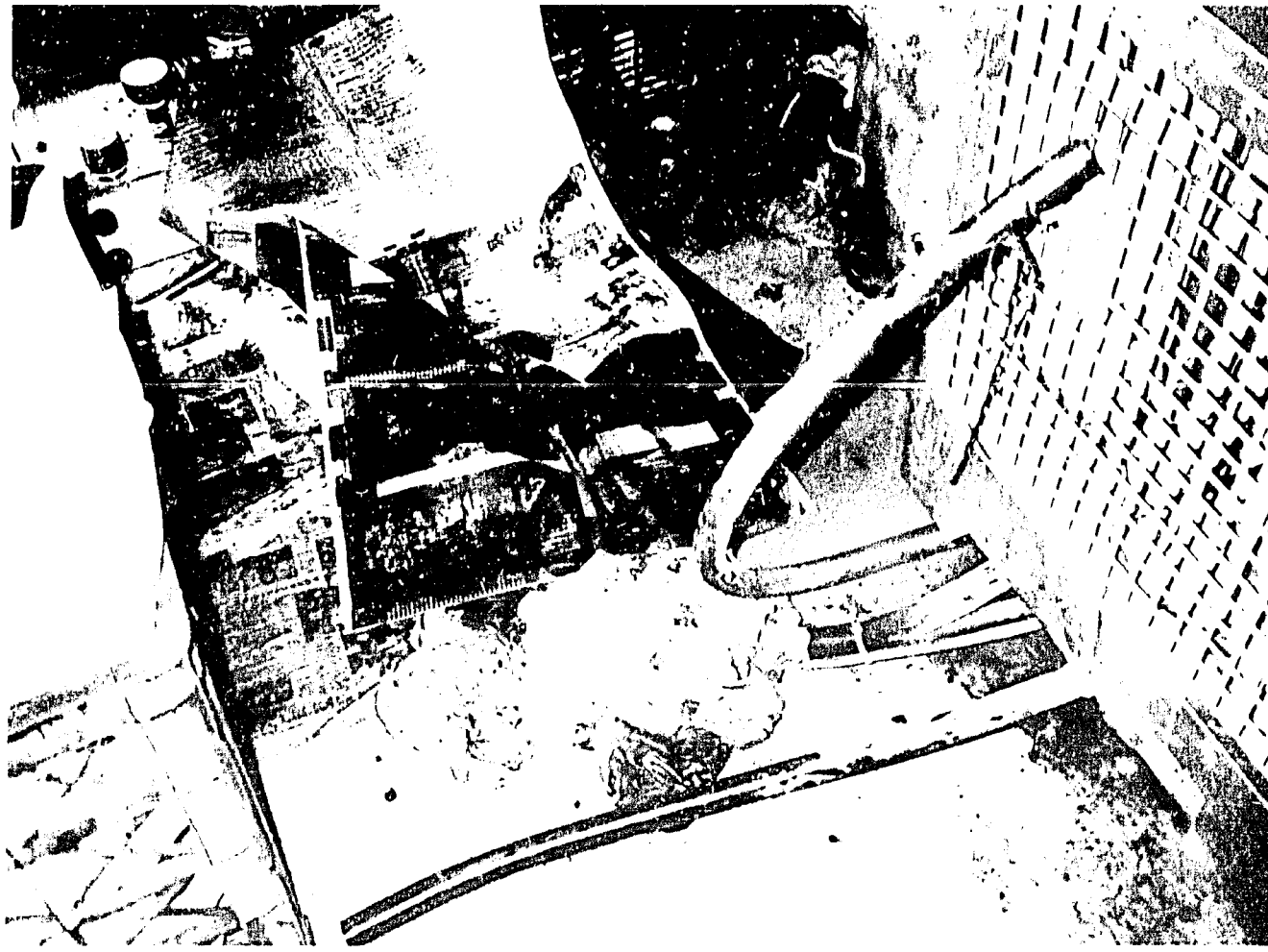
UNLABELLED ALCOHOL TINS



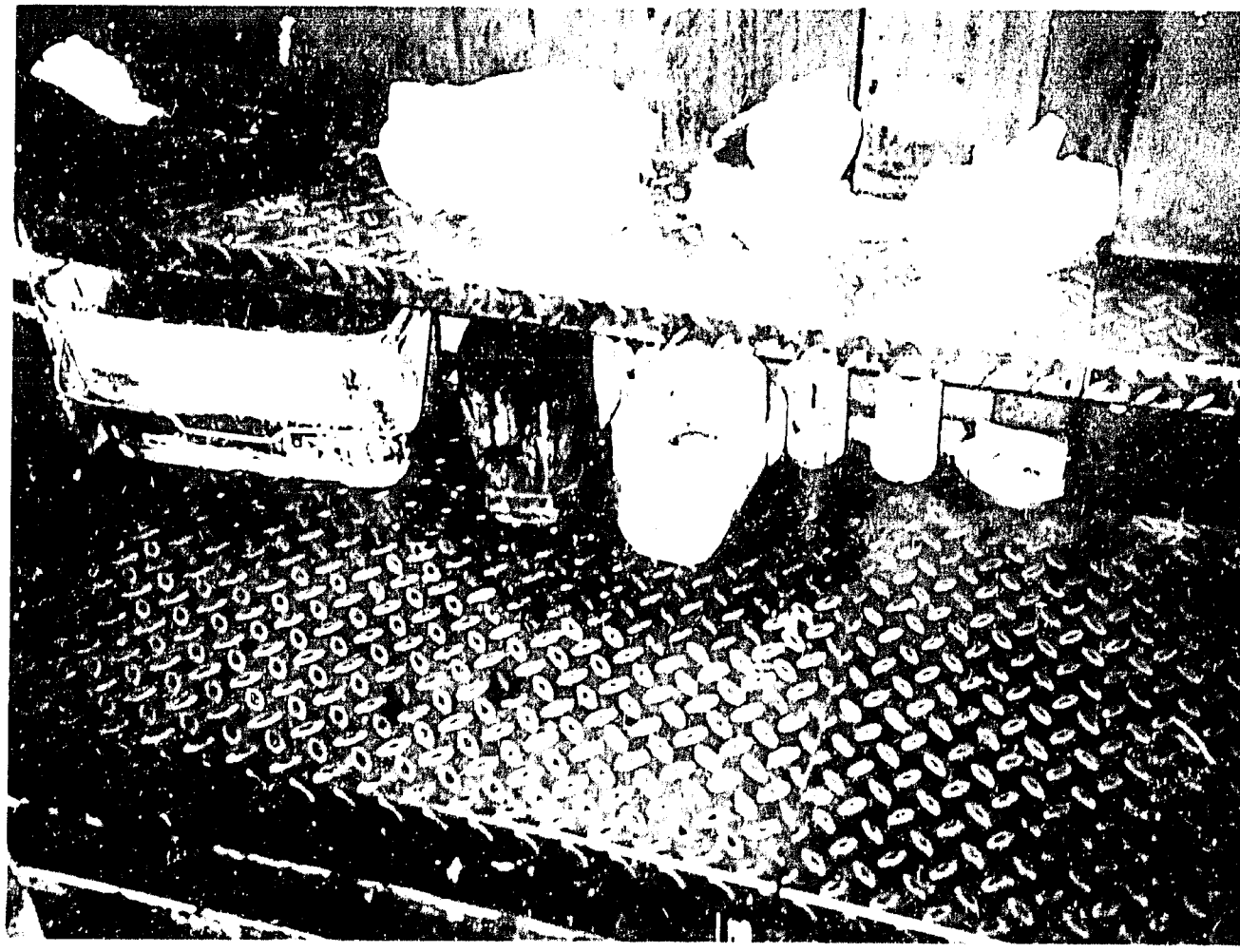
TRIM WASTE BLOCKING FIRE EXTINGUISHER ACCESS



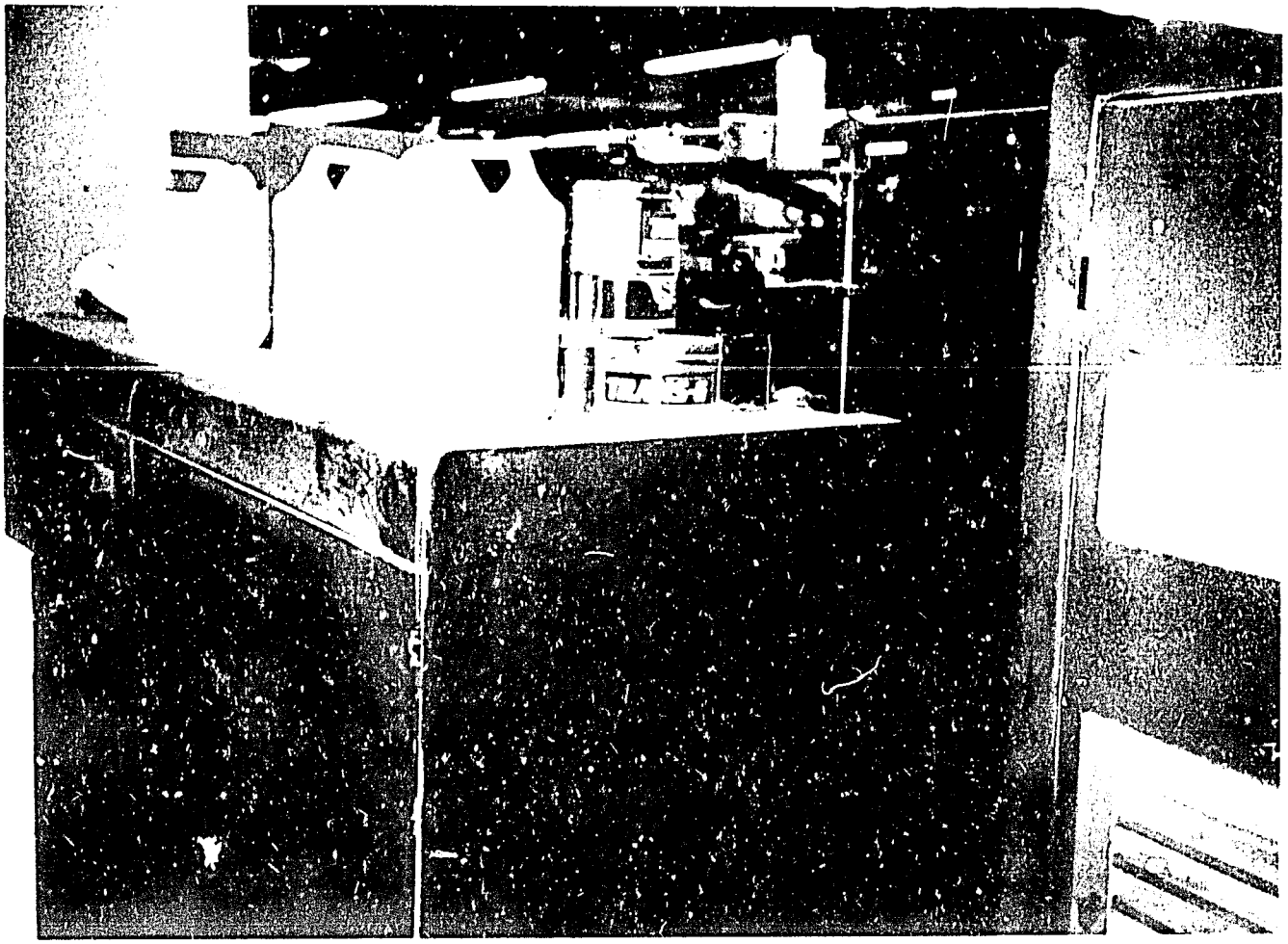
SHEN'S ART PRINTING
their own wastewater treatment on sight



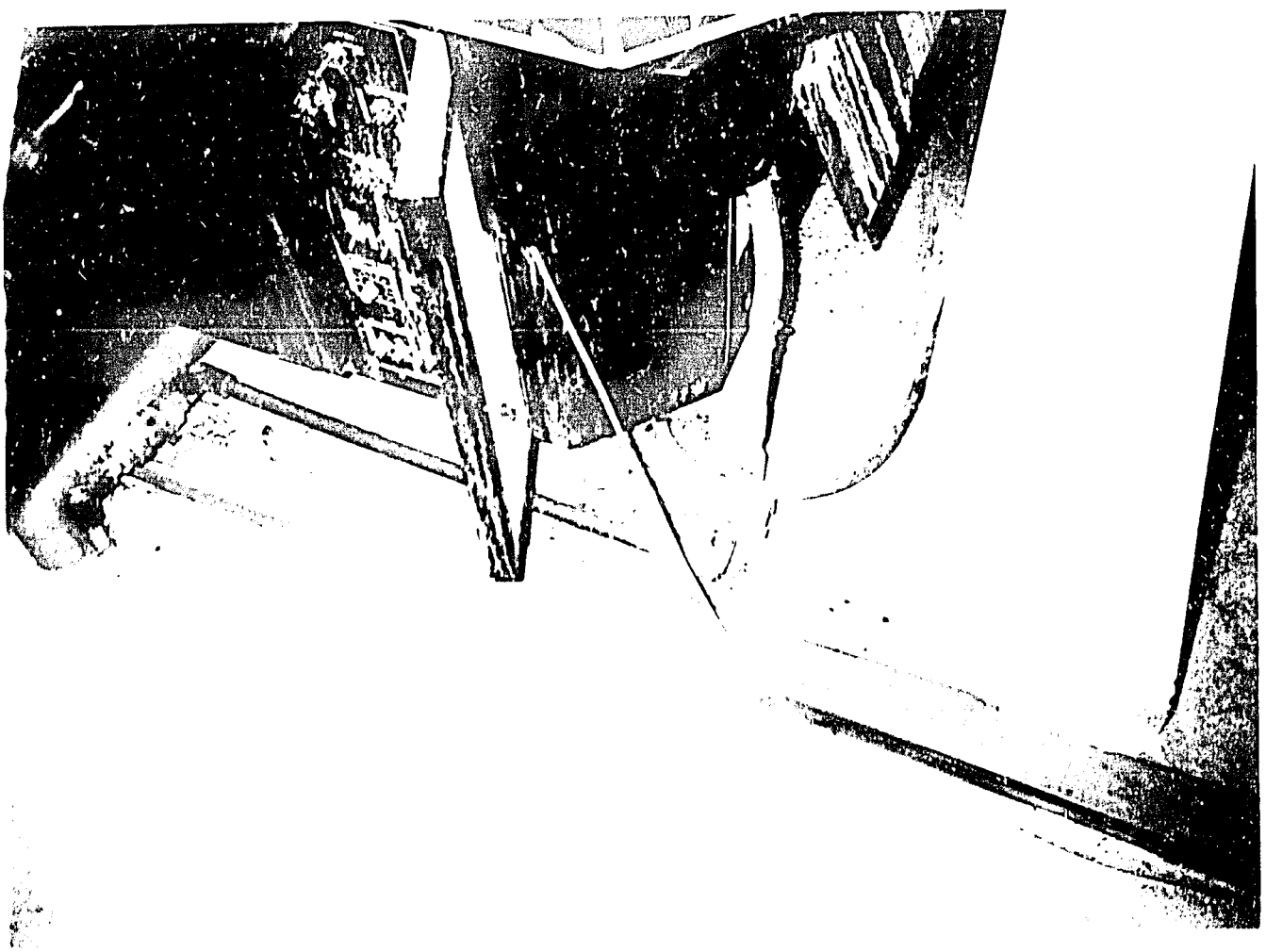
LEAKING LUBRICANTS (OILS)



OPEN SOLVENT CONTAINER UNLABELLED



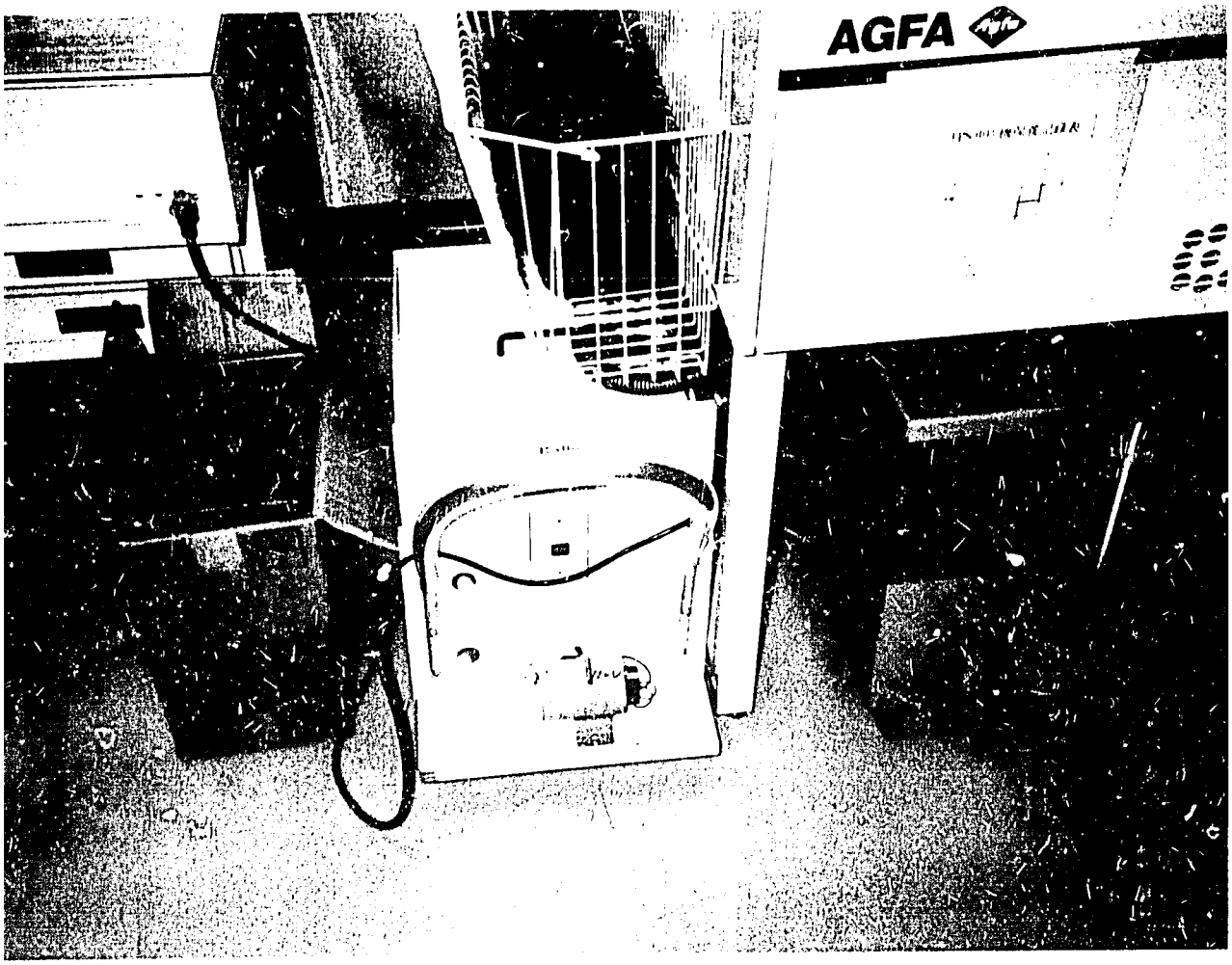
OPEN INK CANS



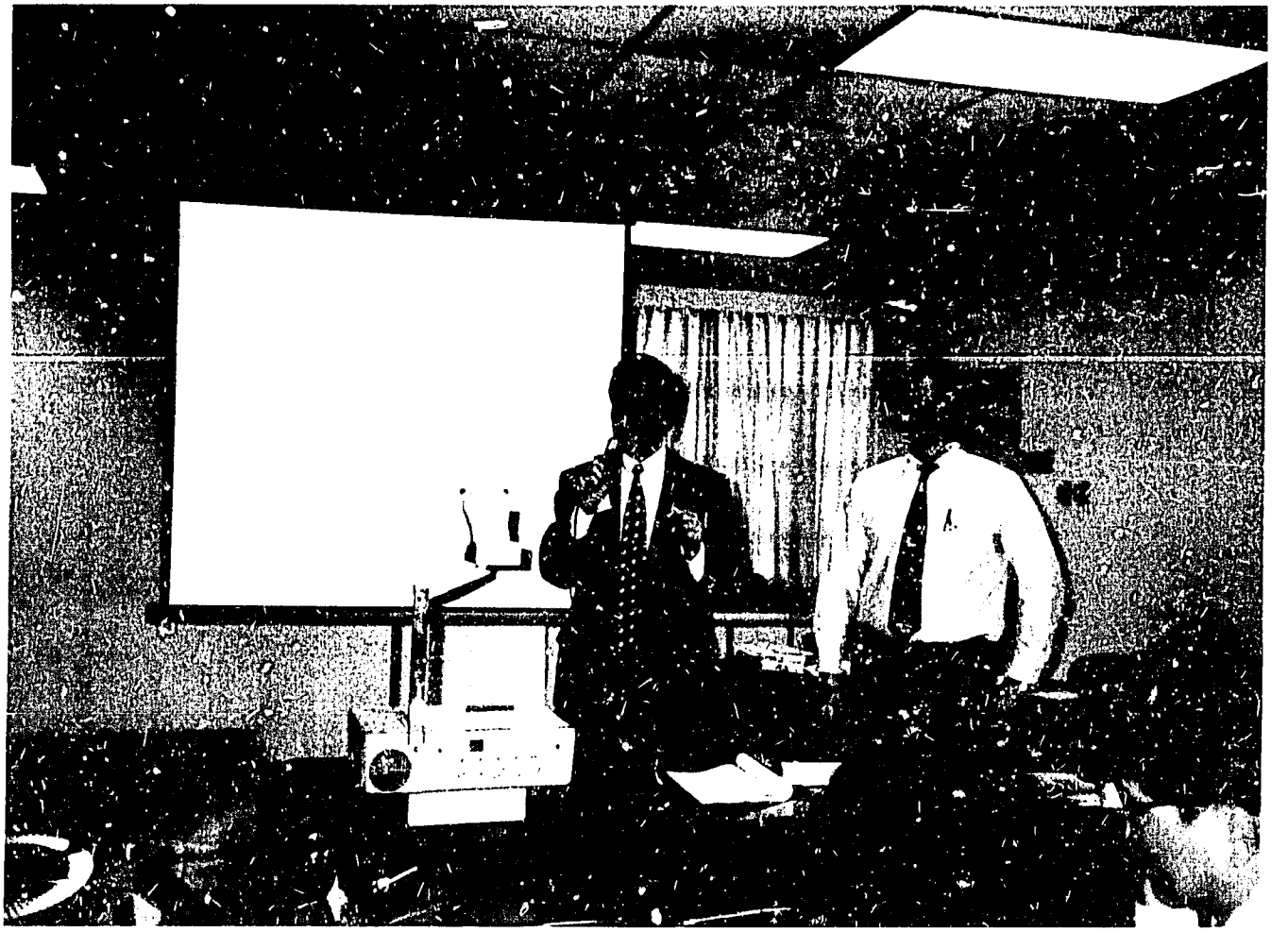
NO SECONDARY SPILL CONTAINMENT

LEAKING FILM/PLATE PROCESSOR

SHEN'S ART PRINTING
good: raised drain pipe (gray)
bad: proximity to electrical strip



SHEN'S ART PRINTING
good: wastewater recirculations saves water and reduces wastewater



Jeff Adrian (lft.) Gary Jones (rt.)

P2 Workshop Attendees (about 50 total)

APPENDIX B

ITINERARY

APPENDIX B

ITINERARY

January 9, 1995	0900 Visit Industrial Development Bureau (IDB) 1400 Visit China Technical Consultants, Inc.(CTCI)
January 10, 1995	0900 Workshop
January 11, 1995	0900 Workshop 1400 Attend Enprotech Exhibition (at World Trade Center)
January 12, 1995	0900 Factory Excursion: Flower Queen Enterprises, Ltd. 1400 Factory Excursion: Shen's Art Printing Co., Ltd.
January 13, 1995	0900 Factory Excursion: Scala Printing Co., Ltd. 1400 Visit China Culture University
January 14, 1995	0900 Visit Printing Technology Research Institute
January 15, 1995	Day off
January 16, 1995	0800 Depart for Taichung (2 and a half hours by car) 1030 Factory Excursion: Hsin-Tai Printing Co., Ltd.
January 17, 1995	0730 Depart for Tainan (2 and a half hours by car) 0930 Factory Excursion: Kao-Ch-ng Printing Co. Ltd. 1330 Depart for Taipei (5 hours by car)

APPENDIX C

PERSONS AND ORGANIZATIONS VISITED

APPENDIX C

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Mr. Robert A. Bames, Business Representative, US-AEP Taiwan

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Mr. Lin Chih-Sen, Division Director, IDB, Ministry of Economic Affairs
Mr. Chun-Lang Tsay, Researcher 7th Division, IDB, Ministry of Economic Affairs

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photographer
likes U.S. n
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中華印刷科技學會
Chinese Association of
Graphics Science & Technology

陳 政 雄
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APPENDIX E

LIST OF DOCUMENTS RECEIVED

INDUSTRIAL WASTE MINIMIZATION IN TAIWAN

by

Jerry H. Huang

and

Chih-Sen Lin

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INDUSTRIAL WASTE MINIMIZATION IN TAIWAN

Introduction

Taiwan, located at the southeast edge of Asian continental shelf, shapes like a spindle. In the last four decades, Taiwan's economic and social changes have been drastic as shown in Table 1(Social and Economic Indices of Taiwan). Currently, Taiwan has high population density of 574 per km^2 (in 1992),which causes heavy environmental loading, rapid growth of mobile vehicles of 373 mobile vehicles per km^2 (in 1992), leading to increasing pollution volume. The increase of the number and density of factory is the inevitable result of industrial development, high factory density (3 factories per km^2 in 1992) causes rapid accumulation of total pollution. Pollution abatement in Taiwan has traditionally been undertaken only by conventional "end-of-pipe" waste treatment methods. These methods are generally deemed economically infeasible in terms of investment and operation, and still might not satisfy the environmental protection requirements.

In November 1988, Dr. Joseph T. Ling, Chairman of the American Institute for Pollution Prevention, and Dr. Thomas T. Shen, consultant of United Nations Environmental Project were invited to Taiwan as lecturers to promote the conception of Industrial Waste Minimization. This provided the Environmental Protection Agency (EPA) and the Industrial Development Bureau (IDB) of the Ministry of Econimic Affairs (MOEA) officials with a key strategy to facilitate economic development as well as environmental protection. The program was initiated in April 1989 with the formation of an Allied Task Force for assistance related to industrial waste minimization. The organization of the assistance system for industrial pollution prevention and control is demonstrated in Figure 1.

The Allied Task Force, as headed by the directors of IDB and EPA, has promoted industrial waste minimization according to a structure as shown in Figure 2. Great achievements have been made in areas include the completion of an integral planning of industrial waste minimization, the establishment of a waste exchange information center, the enhancement of industrial waste minimization dissemination, the fostering and promotion of industrial waste minimization demonstration plants, the undertaking of demonstration projects involving waste reduction, recycling, and regeneration, the achievement of applied technology research, the establishment of a resource regeneration technology service center, the selection of exemplary factories, groups, and individuals for outstanding performance in industrial waste minimization, the organization of domestic and international conferences regarding industrial waste minimization strategies and technologies, the development of a data bank for available waste minimization technologies and a current list of related professionals, and the compilation of an industrial waste minimization reference guide. These work are described as follows.

Completion of an Integral Scheme of Industrial Waste Minimization

To ensure success, the Allied Task Force authorized the integral scheming of industrial waste minimization to CTCI Corporation, US Argonne National laboratory and Waste Minimization Technology International Incorporation. Those practices derived from this integral scheme, despite limited funding, have been implemented. In less than three years since the completion of this integral scheme industrial waste minimization has become a dynamic

and relevant issue among a wide range of industries. A scheme for the implementation of industrial waste minimization is depicted in Figure 3.

The Establishment of a Waste Exchange Information Center

The Waste Exchange Information Center (WEIC) was established at Union Chemical Laboratories, Industrial Technological Research Institute (ITRI) in 1987. WEIC provides information related to waste produced and required, thereby enabling waste exchange activities among factories. 157 successful cases have so far been achieved which has allowed more than 160,000 tons of waste to be recycled as shown in Table 2 and about 37 million US dollars in revenue are generated. WEIC issues bimonthly 3000 volumes of *Industrial Waste Minimization Bimonthly* magazine, of which the subscribers include facories, businesses, engineering consultants, academia, and interested parties. WEIC also provides information regarding global cleaner production activities.

The Fostering and Promoting of Industrial Waste Minimization Demonstration Plants

The Foundation of Taiwan Industry Service (FTIS) and China Technical Consultants Incorporation (CTCI) have been authorized by Allied Task Force to foster and promote industrial demonstration plants. To attain this goal, FTIS and CTCI have selected thirteen industries, i.e., pulp and paper, dyeing and finishing, electroplating, printed circuit board, frozen aquatic product, edible oil and fat, food, leather tanning, agrochemical, fermentation, pharmaceutical products, rubber, and specialty chemicals. The procedure for the selection of plants for industrial waste minimization demonstration is shown in Figure 4. Results obtained from demonstration plants as well as aspiring factories in gaining experience from demonstration plants have indicated that the emissions and discharges to the three environmental media have been significantly reduced. Tha associated benefits include lower pollution control cost and more product revenues.

The Undertaking of Demonstration Projects Involving Industrial Waste Reduction, Recycling, and Regeneration

Most factories in Taiwan are medium or small, the amount of waste generated can not be treated in a cost-beneficial manner. The EPA and IDB have therefore undertaken a demonstration project on industrial waste reduction, recycling, and regeneration for selected six industries, i.e., leathering tanning, frozen aquatic product, printed circuit board, steel refining via an electrical arc furnace, electroplating, rubber, and electronic parts. EPA facilitates investiment for a construction of a central system of waste recycling and treatment. IDB focuses on the establishment of a treatment center for certain reusable wastes, e.g., such as sludges and dusts. IDB also provides land and a low interest loans to accelerate the undertaing of the demonstration project. The current progress of the above mention seven systems is indicated in Table3

The Achievement of Applied Technology Research

Applied technology research efforts have aimed at providing a solution for difficulties encountered in industrial waste minimization practices. The pilot plant studies are normally conducted in the laboratory during the first year, which is subsequently followed by scale up application. A new technology has recently been developed for oil and fat industry, a reduction of 96% of the waste water has been achieved. The aluminum anodizing process has also been developed, already having successfully recovered waste acid and alkali liquid and producing useful compounds i.e. zeolite and ammonia alum.

The Establishment of a Resource Regeneration Technology Service Center

The Resource Regeneration Technology Service Center was established in 1989 for regeneration of spent metals and reduction of the associated wastes. The recovery and purification processes which produce less contamination has been developed for zinc and aluminum. At least ten of these developed technologies have already been patented and provided more than 10,000 cases of service for the spent metal regeneration industry. These technologies also have a good transference among their owners and users.

The Selection of Exemplary Industries, Groups, and Indivisuals for Outstanding Performance in Industrial Waste Minimization

The selection of exemplary enterprise, factories, and indivisuals for outstanding performance has been held annually since 1991. This activity not only brings encouragement but also clarifies and promulgates the benefit of proper industrial waste minimization practices. Ten industries, four groups, and ten individuals were among the list and awarded in 1994. The selection procedure is based on a flow chart as shown in Figure 5. Those industries included petroleum, sugar, thermal power, tabacco and wine, watch, textile, computers, paper, and food. The four groups were two technical consultant firms and two research institutes of textile and sugar, respectively. Individuals included plant supervisors, a process foreman, engineers, a professor and a reporter.

The Organization of Domestic and International Conferences Regarding Industrial Waste Minimization Strategies and Technologies

The domestic conference is annually held in June, while the international symposium is held every three years. An ample amount of technologies and related experiences are exchanged through discussion or exhibitions. For instance, representative from 17 countries joined the 1992 international conference and 72 papers were subsequently published and discussed. These representatives were impressed by the accomplishements of industrial waste minimization attained in Taiwan over a relatively short period of time. The upcoming International Conference Industrial Waste Minimization '95 will be held on November 25 ~ 29, 1995, in Taipei. This meeting again serve the purpose to foster exchange and dissemination of

waste minimization strategy and technology information among researchers, adminimstrators and practitioners in the world for better environmental quality and sustainable development.

The Development of a Data Bank for Available Waste Minimization Technologies and a Current List of Related Professionals

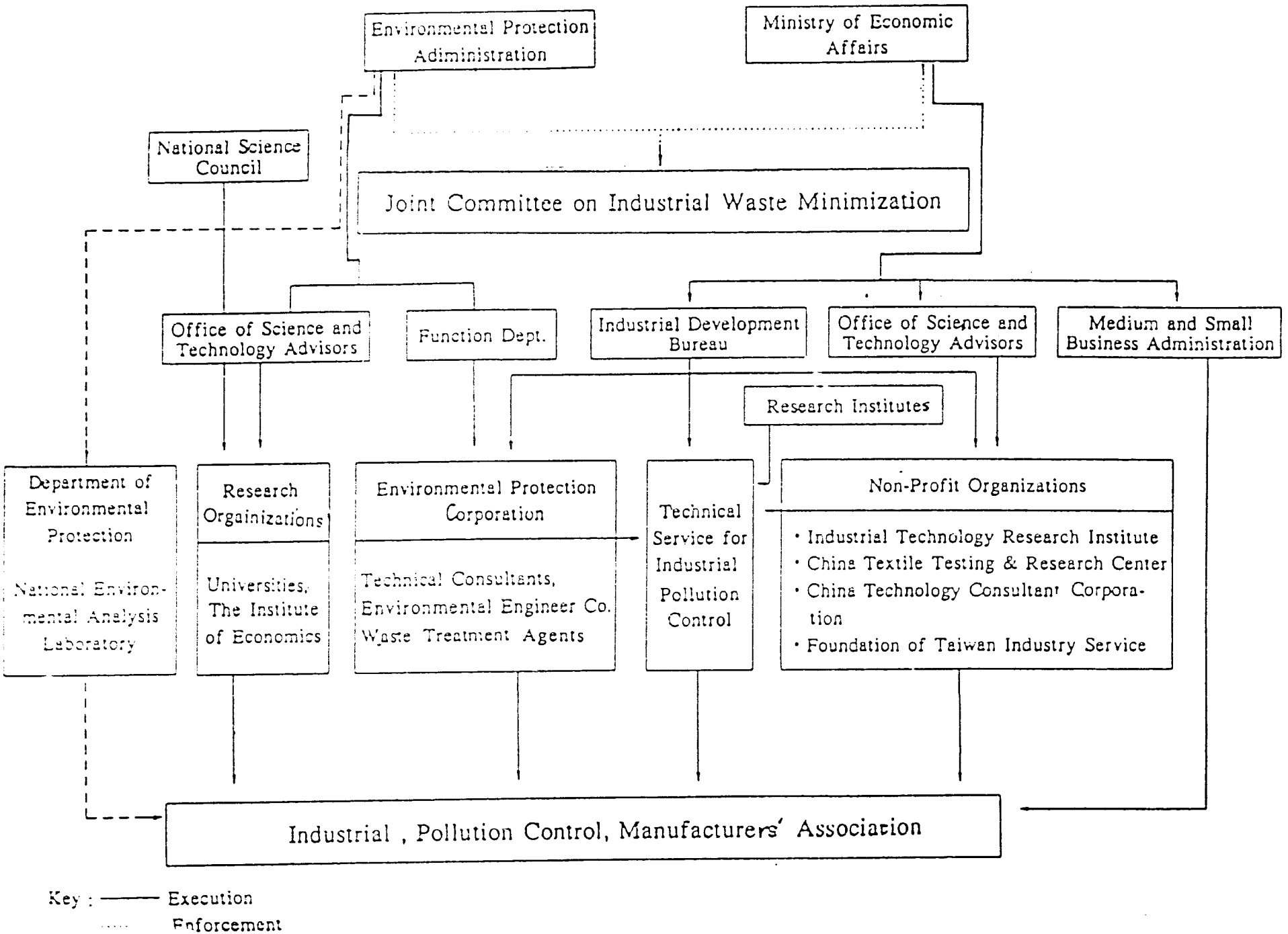
The Allied Task Force has developed a data bank which contains 12,000 files of technology information as well as information regarding professionals regarding a wide range of specialties. This information will strengthen the inquiry service and on site assistance.

The Complilation of Industrial Waste Minimization Reference Guide

In early 1993, a compilation committee was formed for the publishing of an industrial waste minimzation reference guide scheduled for June 1994. The contents of the reference guide include an executive summary, policies, strategies, regulations, implementations, effectiveness, and difficulties. The reference guide provides an evaluation for the performance of the past four years and directives for future efforts.

Conclusions

Industrial waste minimization has been proven to be a key strategy which facilitates economic development as well as environmental protection. Accomplishment of industrial waste minimization categorized into eleven areas have been achieved through a sound methodological approach and continuous efforts. Based on those solid foundation, we will continue to make our best effort to promote industrial waste minimization. We had already achieved the reduction of quantity and volume. In the next stage, we will focus even more on the reduction of toxics use, i.e. in-plant changes in production, processes or raw materials that reduce, avoid or eliminate the use of toxic or hazardous substances or generation of hazardous by-products so as to reduce overall risks to health of workers, consumers or the environment without shifting risks between workers, consumers or parts of the envrionment. Also, efficient usage of energy should be emphasized by better housekeeping, insulation and leak-plugging, and eventually an energy-efficient design and equipment. We will continue the industrial waste minimization practices for the purpose of pollution prevention and resouce conservation, and eventually in cope with the cooperative global pursuit of sustainable development.


Environmental Protection Adiministration
Ministry of Economic Affairs
National Science Council
Joint Committee on Industrial Waste Minimization
Office of Science and Technology Advisors
Function Dept.
Industrial Development Bureau
Office of Science and Technology Advisors
Medium and Small Business Administration
Research Institutes
Department of Environmental Protection
National Environmental Analysis Laboratory
Research Orgainizations
Universities, The Institute of Economics
Environmental Protection Corporation
Technical Consultants, Environmental Engineer Co. Waste Treatment Agents
Technical Service for Industrial Pollution Control
Non-Profit Organizations
• Industrial Technology Research Institute
• China Textile Testing & Research Center
• China Technology Consultant Corporation
• Foundation of Taiwan Industry Service
Industrial , Pollution Control, Manufacturers' Association
Key : Execution
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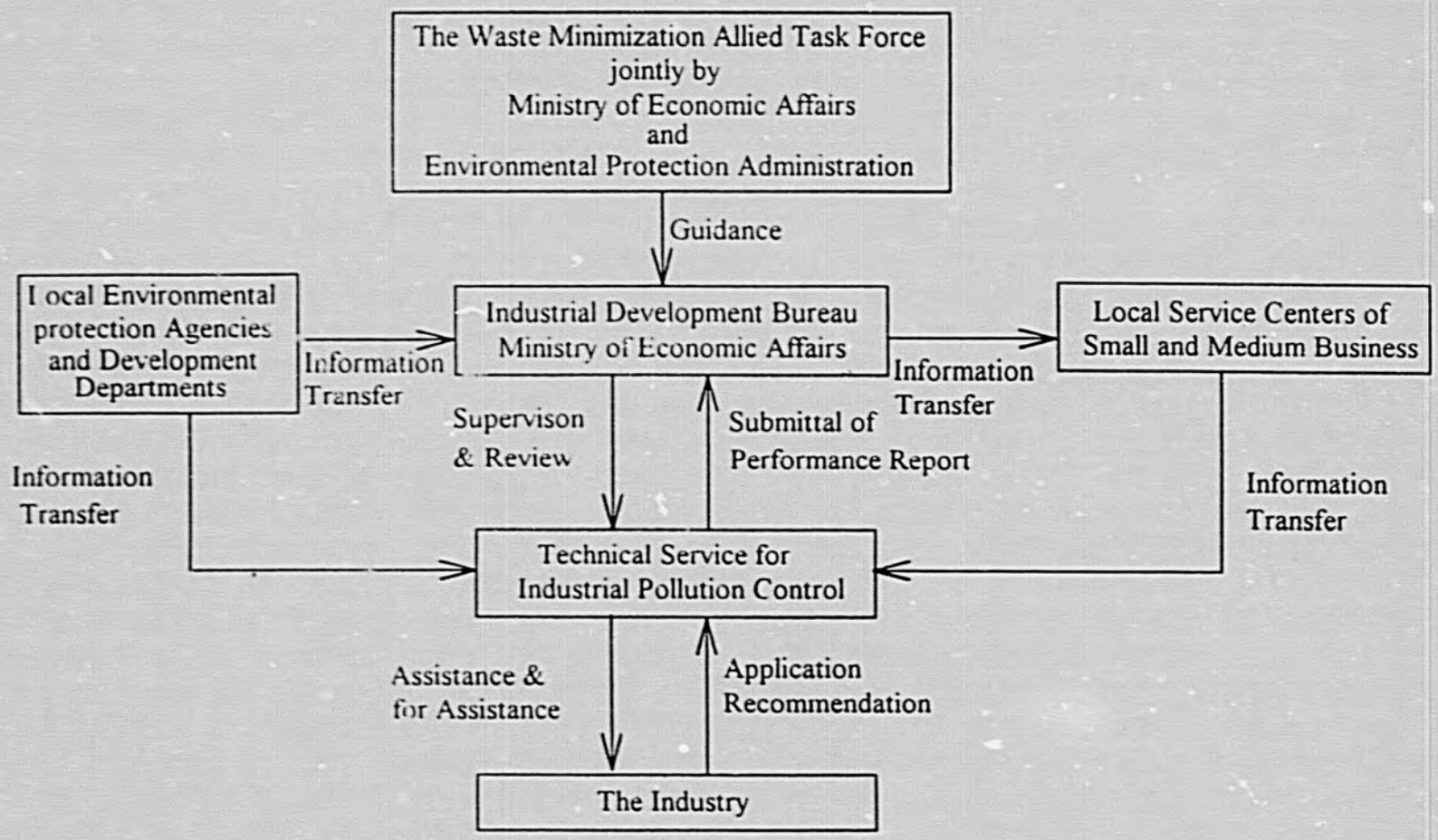

FIGURE 1 ORGANIZATION OF THE ASSISTANCE SYSTEM FOR INDUSTRIAL POLLUTION PREVENTION AND CONTROL

Item	Work Scope	Fiscal Year					
		1991	1992	1993	1994	1995	1996
1	Organizational Integration and Coordination						
2	Study and Recommendation on Policy & Regulation						
3	Public Awareness & Employee Training						
4	Data Collection & Information Services						
5	Technical Assistance & On-site Consultation						
6	Ecomonic Incentives						
7	Regulatory Enforcement						
8	Research and Development						

Symbol: Major Job Period

Minor Job Period

FIGURE 3 SCHEDULE FOR THE IMPLEMENTATION OF INDUSTRIAL WASTE MINIMIZATION

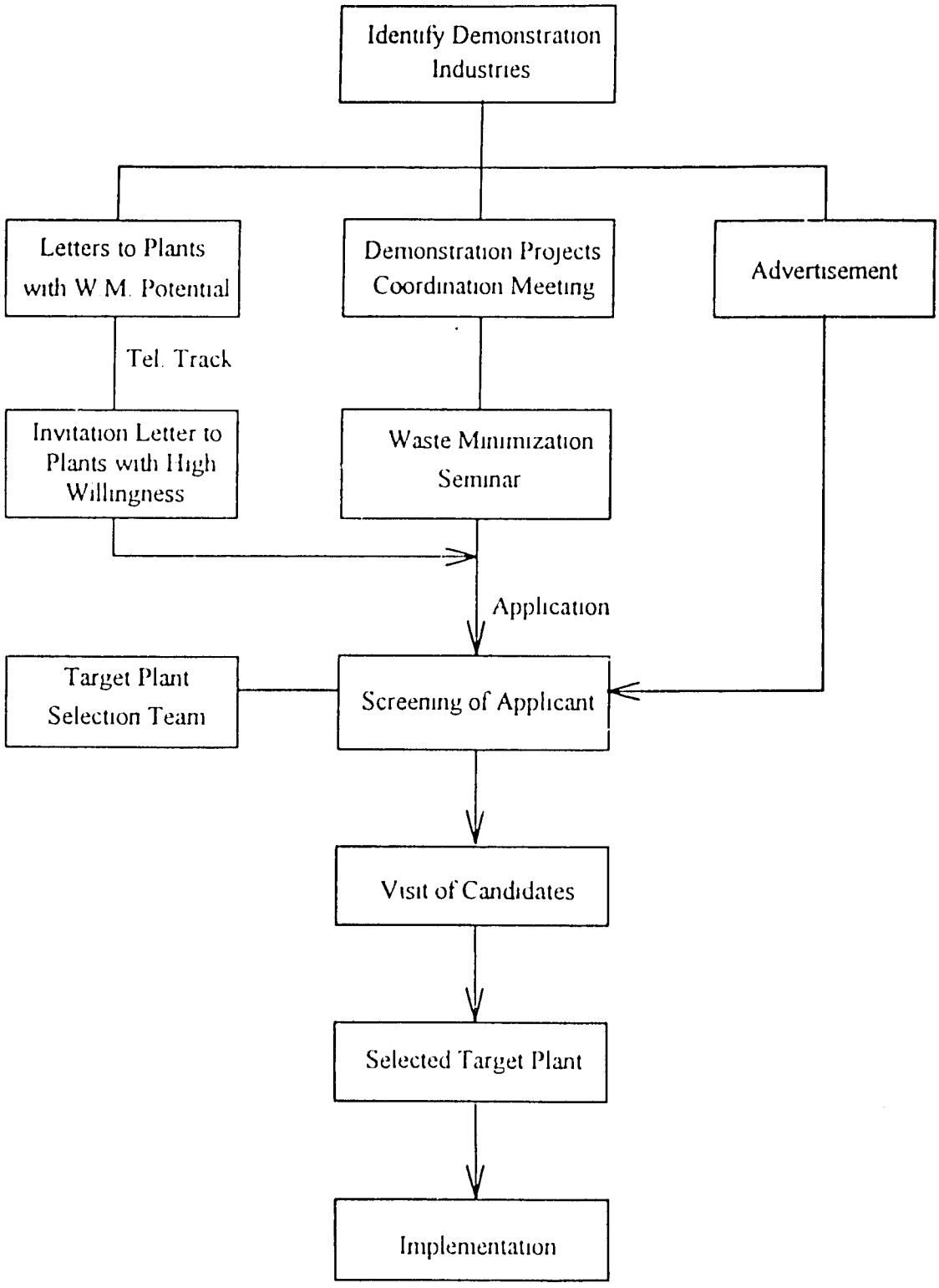

FIGURE 4. PROCEDURE FOR SELECTION OF THE PLANTS TO MINIMIZE INDUSTRIAL WASTE

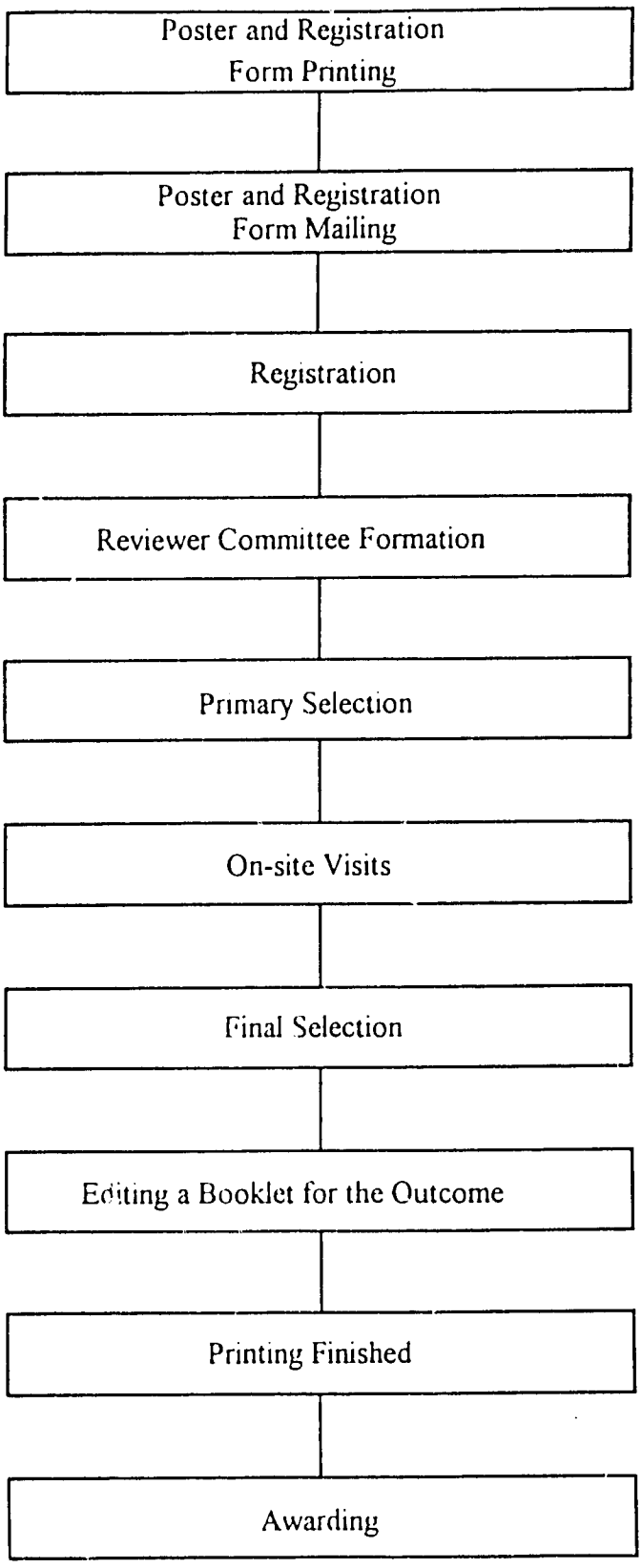

FIGURE 5. PROCEDURE FOR THE NATIONWIDE SELECTION OF OUTSTANDING PERFORMANCE IN INDUSTRIAL WASTE MINIMIZATION

ABLE 1. INDICES OF ENVIRONMENTAL BURDEN IN TAIWAN

Year	Registered Population (10,000 Persons) (The endof Year)	Population Density (Person /Km) (The endof Year)	Number of Registered Motor Vehicles (10,000 Units) (The endof Year)	Motor Vehicles Density (Unit /Km) (The endof Year)	Number of Registered Factory (1000) (The endof Year)	Factory Density (Unit /Km (The end of Year)	Number of Pig (1000 Head) (The end of Year)	Domestic Energy Consumed (1000 Kiloliter Oil Equivalent)	Average Energy Consumption Per Capita (Kiloliter Oil Equivalent-Person)	Waste Amount (10,000 Tons) (Year)	Average Daily Waste Amount Per Person (Kg/Person Year)
981	1813.55	503.76	541.34	150.37	60.28	1.67	4826	27431.4	1526.47	356.28	0.63
982	1845.79	512.72	604.53	167.92	59.77	1.60	5182	27959,3	1528.08	386.50	0.65
983	1873.29	520.36	667.41	185.39	63.22	1.76	5888	30992.8	1666.68	404.20	0.66
984	1901.25	528.12	734.28	203.97	61.01	1.69	6569	33083.7	1753.01	427.96	0.67
985	1925.81	534.95	795.00	220.83	68.15	1.89	6674	34450.3	1800.38	483.00	0.74
986	1945.46	540.40	869.60	241.56	77.46	2.15	7057	37631.7	1944.14	509.32	0.77
987	1967.26	546.46	770.22	213.95	84.16	2.34	7129	40551.2	2072.75	528.34	0.78
988	1990.38	552.88	893.09	248.08	90.61	2.52	6954	44922.1	2270.11	588.23	0.86
989	2010.74	558.54	1020.52	283.48	93.93	2.61	7783	47942.4	2396.46	625.87	0.90
990	2035.30	565.36	1146.53	318.48	92.98	2.58	8565	50726.6	2507.12	684.48	0.96
991	2055.68	571.02	1257.49	349.30	95.33	2.65	10089	54361.8	2657.10	723.90	1.00

urce: statistics reports from authorities concerned.

TABLE 2 WASTE EXCHANGED IN WEIC, TAIWAN IN FIVE YEARS

Waste	No. of registered wastes	No. of exchanged wastes	Exchanged Waste amount(T)	Exchanged Waste percentage%
Organics	84	23	109.4	27.3
Inorganics	100	15	17016.0	15.0
Solvents	126	18	414.6	14.2
Oil & Fat	61	12	45.7	19.7
Acid	110	16	20781.6	14.5
Alkali	58	14	47,079	24.1
Catalyst	15	4	1628.3	26.7
Metal	27	7	2135.0	26.0
Plastics	27	11	766.5	40.7
Rubber	10	4	391.7	40.0
Textile	14	5	3070.0	35.7
Leather	24	2	4080.0	8.3
Wood	17	4	8666.0	23.5
Paper	17	3	210.0	17.6
Ash	12	2	41.8	6.7
Mine-dregs	13	5	44,214.0	38.5
Sludge	67	0	—	—
Others	67	12	10,514.0	17.9
Total	839	157	161,163.6	

TABLE 3 CURRENT PROGRESS OF THE ESTABLISHMENT OF THE CENTRAL SYSTEM OF WASTE RECYCLING & TREATMENT

Catergory of Waste Management System	Title of Company	Variey of Waste for Treatmen	Product(s)	Treatment Cost	Interim/Design Capacity	Full (Economical) Capacity	Current St
Leathering Tanning	Huan-Shieh Ltd	• trimming • shaving	• Steamed leather powder	NT 500 - 1,000/ton	10,000 tons/yr	-	factory estab (ready for te
Frozen Aquatic Metal Finishing Food	Chia-Bow Ltd.	• waste form fish (e g. fish head, fish bond, shells)	• fish meal • fish soluble		33,000 /ton/yr (currently actual amount 12,000 tons/yr)	-	factory estab
Electroplating	Dah-Tuan Water Treatment Ltd.	• electroplating sludge	• soidum chromate solution	NT 8,000/ton	300 tons/yr (wet sludge)	2nd phase contruction under planning	Factory unde established
Electrical arc Furnace Wastes	Hsiao-Kang Industry Corp., Ltd.	• furnace slags • furnace fly ash	• iron scraps • graded material • brick	NT 6,500/ton slag or ash	furnace slag: 12,000 tons/yr furnace fiy ash: 45,000 tons/yr	urnace slag: 300 tons/yr furnace fiy ash: 500 tons/yr	process desig completed
Printed Circuit Boards	World Wise Printed Circuit Board Resource Recory Corp., Ltd.	• waste printed circuit board	• recovered metals	NT 10,000/ton-waste PCBs	300 tons/yr	1,800 tons/yr	pilot plant in operation
Waste Industrial Rubber	United Waste Management Preparatory Organization Established	• waste rubber	• gas • pyrolysis oil • carbon black	NT 6,000/ton-waste rubber	900 tons/yr	13,500 tons/yr	in planning
Electronic parts	Under planning	• waste IC or electronic parts	• recovered precious metals		590 tons/yr	839 tons/yr	in planning

APPENDIX F

CURRICULUM VITAE

JEFFREY R. ADRIAN

Jeffrey R. Adrian is Environmental Director for the John Roberts Company, Printers & Lithographers, Minneapolis, Minnesota. The John Roberts Company in 1994 celebrates its 43rd year as a commercial printer specializing in high quality printing for the national market using both sheetfed offset and heatset web offset technologies. The company currently employs more than 285 people and has annual sales in excess of $44 million.

His current responsibilities include assuring environmental regulatory compliance, development of new and alternate process methods and chemistries, enhancement of employee, customer and supplier involvement in environmental stewardship through the company's environmental task force, and community outreach and communications on environmental matters.

Mr. Adrian has been instrumental in the founding of the Printing Industry of Minnesota's Environmental Task Force, on which he served as Chair for 1991. In 1992, Mr. Adrian was involved in the establishment of the first industry-regulator partnership agreement between PIM and the Minnesota Pollution Control Agency. In 1993, he was privileged to address several international groups on pollution prevention methodologies utilized by his company. And in 1994, he worked with the state legislature to establish into law alternative funding replacing Superfund's third party contributory litigation, and with the Minnesota Pollution Control Agency to establish policy encouraging industry use of voluntary environmental auditing as means to go beyond mere compliance.

Currently, he also serves on the Minnesota Chamber of Commerce Environmental Audits Committee, and sits as a board member of the Industrial Council of Environmental Managers. He contributes regularly to the US Environmental Protection Agency's Office of Toxics Design for the Environment Special Printing Project, a collaborative effort between industry and regulator to find alternative chemistries for the printing industry.

Mr. Adrian has more than twenty year's experience in paper manufacture and printing, and holds a B.S. degree in Geology from Boston University. Before Joining the John Roberts Company, he served in technical sales for the S.D. Warren Division of Scott Paper Co., Kimberly-Clark Corporation, and Fasson Corporation.

GARY A. JONES

Gary A. Jones manages the Office of Environmental Information at the Graphic Arts Technical Foundation (GATF), Pittsburgh, Pa. He monitors and analyzes at all government levels environmental, health, and safety regulatory activities, especially those that affect the printing industry.

Specifically, he reports to the industry about air pollution control requirements, waste minimization and disposal, wastewater discharges, occupational safety and health legislation, regulations, and compliance issues in the "Environmental Alert" section of *GATFWORLD,* the GATF member magazine.

He provides individual technical environmental, health, and safety assistance to GATF members by phone, fax, and mail. Jones answers hundreds of such inquiries a year.

Jones also provides in-depth articles on specific environmental, health, and safety issues for *GATFWORLD* such as "The 1990 Clean Air Act Amendments: An Analysis for Printers, Part I and Part 2." It was subsequently reprinted as a GATF *SecondSight* technical report for widespread release.

He is author of the GATF publications, *Regulatory Concerns for the Printer: A Checklist,* which helps printers assess the environmental compliance status of a printing plant, and *Air Pollution Engineering Guide for the Graphic Arts Industry,* a joint venture between GATF and the Graphic Arts Association. Jones is the co-author of the Printing Industry of New York state's *Environmental Compliance Guide.* He also wrote the *Environmental Awareness and Solutions Manual* for Agfa Division/Miles Inc.

In addition, Jones is the co-developer of GATF's *OSHA Hazard Communication Standard for the Printing Industry* videotape, and the *OSHA LockoutlTagout Regulation and the Printing Industry* videotape produced by GATF, the Printing Industries of America, the National Association of Printers and Lithographers, and NPES - the Association for Suppliers of Printing and Publishing Technology.

Jones is a frequent speaker at industry conferences and meetings such as the annual ECB/GATF Environmental Conference, the Research and Engineering Council Annual Environmental Conference, and the Graphic Arts Association Annual Environmental Conference.

He also develops and conducts customized seminars for industry groups and environmental awareness sessions at GATF workshops and special programs such

as Orientation 1. Some seminar titles include "Compliance Today," "Beyond Compliance Tomorrow," and "Environmentally Responsive Print." He is co-presenter of GATF's workshop, "Environmental Compliance for Printers."

Jones is a member of the Board of Directors of the Environmental Conservation Board of the Graphic Arts Industry (ECB). He also chairs the ECB's Technical Committee. In addition, he sits on several *ad hoc* industry committees that develop and present consensus positions to appropriate government agencies in response to proposed regulations that may affect the industry.

Prior to joining GATF, Jones was a criminalist for the Allegheny County Forensic Laboratory in Pittsburgh, Pa. He was also an analytical chemist for the Commonwealth of Virginia Bureau of Forensic Science.

He holds a B.S. in biology from La Roche College and an M.S. in chemistry from the University of Pittsburgh.

APPENDIX G

WORKSHOP OUTLINE

WORKSHOP OUTLINE

Note: The following is the outline that the participants hoped to introduce in the Workshop on Tuesday, January 10 and Wednesday, January 11, 1995.

I. Introduction:

- Personal introductions - who we are and something about our background and experience.
- About the workshop format, opportunities to ask questions throughout the workshop as well as at the end.

II. Overview:

- Comments about U.S. legislative and regulatory processes.
- Comments about mandatory pollution prevention.
- Comments about voluntary pollution prevention.
- Benefits of pollution prevention.

III. Pollution Prevention Opportunity Assessment: The Mechanics of Pollution Prevention Assessments

- Pre-assessment conference.
- Facility site assessment.
- Post-assessment conference.

IV. Pollution Prevention in the Lithographic Industry:

- Understanding your operations - flow charting.
- Pollution prevention opportunities specific to the lithographic industry by media:
    - Air emissions concerns:
        - Issues: VOCs, NOx, particulates, odor, noise
        - Sources: cleaning solvents, fountain solutions, inks, developers and fixers, glues, paper, machinery
        - Locations: prepress, pressroom, bindery, maintenance
        - Technology
        - Case Study
    - Water emissions concerns:
        - Issues: BOD, COD, pH, TSS
        - Sources: cleaning solvents, fountain solutions, system cleaners, silver, chemistry, glues, coatings
        - Locations: prepress, pressroom, bindery maintenance
        - Technology
        - Case Study
    - Solid waste concerns:
        - Issues: landfill or incineration of bulk wastes (solid and liquid), hazardous wastes, special wastes

    - Sources: cleaning solvents and wipers, inks, scrap film and plates, packaging (cartons, skids, pallets, chemical containers), trim waste
    - Locations: prepress, pressroom, bindery, maintenance
    - Technology
    - Case Study
- Stormwater runoff:
    - Issues: BOD, COD, TSS
    - Sources: activities exposed to rainfall

V. Energy Conservation:

- Fuels: natural gas, propane, oil
- Electricity
- Green Lights Program
- Energy Star Program
- Case Study

VI. Managing Environmental Issues:

- Developing industry awareness - PIA self-study course
- Continuation of economic and environmental growth
- Advantages of a pro-active approach
- Organizing for efficiency - function-based approach
- Getting assistance

VII. Conclusion:

- Brief review of workshop topics
- Opportunity for questions and interchange