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**OFFICE OF U.S. FOREIGN DISASTER ASSISTANCE**

**Prevention, Mitigation & Preparedness Division**

**INTERIM STRATEGIC EVALUATION**

**of**

World Environment Center

Local Accident Mitigation and Prevention Program:

India, Mexico, Thailand

August 9-September 3 and October 2-7, 1994

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## EXECUTIVE SUMMARY

This interim strategic evaluation of the World Environment Center (WEC) Local Accident Mitigation and Prevention Program (LAMP) was carried out in India, Mexico and Thailand from August to October, 1994. Indonesia, the fourth country in the program, was omitted from the evaluation because of a U.S. Embassy ban on official travel.

WEC-LAMP is designed to meet Office of U.S. Foreign Disaster Assistance (OFDA) objectives of reduced loss of lives, increased awareness of manmade accidents, and improved response to technological--namely chemical--emergencies. Begun in late 1992, LAMP is funded at \$3.5 million for 5 years.

### Findings

The most consistent feature of chemical emergency planning in India, Mexico and Thailand is that such planning is industry and government driven. Citizen groups, particularly those of a grass roots nature are generally on the outside looking in, despite the fact that WEC-supported courses and workshops have stressed the role of citizen awareness.

Beside the constraint of inadequate citizen participation lies the related problem of training for rank-and-file emergency first responders. Since much of the WEC-LAMP emergency training is directed to management and technical personnel, first responders such as police and fire personnel have until now been widely overlooked.

Important questions for this evaluation are (1) how useful has the LAMP program been in the three countries and (2) what are its chances of being sustained? For the first question, all three countries have benefitted from this program. As to the long range sustainability question, answers vary substantially. In India, management of the LAMP by the highly regarded National Safety Council along with the creation of a National Advisory Council should assure progress long after OFDA's funding has ceased. In Mexico, the execution of agreements with national and state governments and the presence of a culture of disaster awareness should contribute to its post-funding continuation. In Thailand, the program is almost entirely carried by the vigor and commitment of the project manager; however, because WEC has not fully engaged top national disaster managers, continuation of its results will mostly occur at the industrial estate level, which in itself is an acceptable outcome given the shorter remaining time-frame of WEC-Thailand.

## **General Conclusions**

It is expected that the LAMP program could have long-range impacts. As detailed in this report, all three country programs have made contributions of considerable value to chemical safety. No doubt some of these achievements will have a favorable impact in the years ahead.

The program has achieved significant progress in the technical and management domains of emergency preparedness. However, little progress has been made in the social and community development areas. Insufficient attention, for example, has been given to technical assistance in developing a corps of trained emergency responders either through a train-the-trainers approach or otherwise. This is due in part to a top-down orientation in the three countries, but also because of a lack of assistance from WEC-Washington to the three countries in addressing this constraint.

Secondly, the three country programs have not demonstrated significant advances in encouraging the enrollment of the community as an equal partner with the industrial and government sectors in the chemical emergency planning process. Furthermore, there is no evidence that WEC-Washington has in any significant manner encouraged the correction of this shortcoming through technical assistance of community development or social science experts, including members of active local emergency planning committees in the U.S.

## **Major Recommendations**

While progress in the technical and management areas of emergency preparedness needs to continue, if the program is to achieve its full impact, it now must shift its focus to the social and community development area. WEC-Washington must concentrate its efforts on training a corps of emergency responders. By using a train-the-trainers approach, it will allow the program to become more sustainable in the future. In addition, it will prepare the public to react more quickly and efficiently to future emergencies.

It is vital that WEC-Washington encourage the three country programs to enroll the community in the chemical emergency planning process. Each country should provide awareness and preparedness training programs for the community, which would allow the people to become both more involved in the planning and better prepared for actual emergencies. So by creating awareness and having people participate in emergency preparedness planning and response, those most at risk--the local community--will more directly benefit. At the same time, OFDA's objectives of saving lives, reducing suffering, and diminishing property loss will have a greater chance of being achieved.

## I. **INTRODUCTION**

### A. Purpose of the Evaluation

The purpose of this evaluation of the World Environment Center's Local Accident Mitigation and Prevention Program (LAMP) is to:

1. Provide an interim review of the present status of the LAMP program to determine whether there are constraints to fulfilling its intended purpose and to measuring progress towards its intended results;
2. Assist the implementing agency and industrial organizations, government, and community organizations by proposing solutions to the constraints of coordinating local accident mitigation and prevention;
3. Extract lessons learned that will assist the implementing agency to track program progress consistently over time; and
4. Build on existing indicators of program achievement through proposing appropriate new indicators; these indicators would include criteria for determining at which point in the assistance process the results will become sustainable.

### B. Intended Project Results

Implemented in India, Indonesia, Mexico and Thailand by the World Environment Center (WEC), the LAMP is designed to achieve several purposes. The most important of these are:

- **Reduced loss of lives**, human suffering, and property damage from technological hazards in target communities;
- **Increased knowledge**, awareness and sense of security by government, industry, and public officials and members of the community in targeted areas; and
- **Improved response** to technological emergencies and natural disasters.

Several outcomes are essential to achieving the above purposes. Outcomes necessary for reduced loss are (a) increased disaster awareness and preparedness in the community; (b) increased number of trained technological accident emergency responders; and (c) replication of successful technological accident prevention, mitigation and preparedness activities in other high-risk urban areas.

Outcomes required to achieve increased knowledge are (a) increased community involvement in technological accident prevention and emergency preparedness and response and (b) increased industry adoption of emergency preparedness and response plans for defined accident scenarios.

Finally, those outcomes essential for improved response are (a) periodic and regular testing of emergency plans by computer simulation, desk top exercise and live simulations and (b) strengthened national and regional technological disaster response networks.

This Program is supported by a U.S. Agency for International Development grant from the Office of U.S. Foreign Disaster Assistance, Prevention, Mitigation & Preparedness Division (OFDA/PMP). The grant is for \$3.5 million and runs from January 1, 1994 through September 30, 1997.

### C. How the Evaluation was Conducted

This evaluation is an assessment of the linkages in the industry-government-community "partnership triangle" on which the WEC-LAMP is built. The evaluators dissected this linkage into discrete parts so as to observe the results of activities of individuals and groups. They had to interpret from their observations how effectively these groupings have benefitted from WEC training, technical assistance, and networking. Furthermore, they had to determine how that knowledge has been applied in a practical manner to ever-challenging conditions posed by petrochemical production industries using technologies of varying degrees of sophistication. (Parts of India's petro-chemical sector use an admittedly 1960s technology, while Thailand and Mexico have more advanced technologies.) At the same time, the evaluators had to put into perspective the fact that these country LAMP programs have only been in place anywhere from nine months to two years, so there are varying degrees of progress, none of which is yet significant in terms of people-level impact.

Including travel time, India was visited by the evaluators on August 19-27 and Thailand, August 28-September 3, 1994. Mexico was visited on October 2-7, 1994. A pre-trip briefing was held in Washington with the World Environment Center in August. One of the evaluators had had considerable prior experience with WEC in providing technical assistance on behalf of OFDA/PMP on strategic planning and performance monitoring. This evaluation was thus intended to be a rough measure of how well and whether or not the concepts and techniques provided by the evaluation and monitoring assistance had been incorporated into the WEC country programs.

Interviews, observations, and documentation reviews comprised the major elements of the evaluation. Because the evaluators' itinerary was prepared by the WEC country program staff in advance, and due to the tightness of the schedule, little time for corroborating information was available. However, the nature of the relationships between industry, government, and non-governmental organizations in the countries visited was such that a certain tension among them was sometimes detectable. This tension occasionally uncovered important differences in orientations and perceptions of each other's accomplishments or shortcomings. Thus, a balanced picture has emerged that could be validated and corroborated were a repeat evaluation to be done. In attempting to ensure such a balance from the outset, the evaluation team membership was designed to represent two points of view. One is an applied social science, socioeconomic development, and disaster management orientation. The other is an applied, regulations- and compliance-based orientation to emergency preparedness.

One important purpose of this evaluation--in effect a strategic evaluation--was to help the country program staff think through their plans, current results, and future activities. The evaluators feel that this objective was partially met during the visit. It is hoped that with this report it will have been largely fulfilled.

## II. FINDINGS

### A. Constraints Addressed by the WEC Program

Nations such as India, Mexico and Thailand that have rapidly expanding petrochemical industries face hard choices in strengthening response to technological emergencies. Among the needs that must be met in such countries are:

- Development of written comprehensive on-site and off-site emergency plans that include: notification procedures, hazards analyses, vulnerability analyses, assessment of response resources in personnel and equipment, cross-agency emergency communications resources, qualified medical response personnel, mutual aid pacts, and scheduled tests for such plans
- Revisions and supplements to laws with enforcement commitment and provision of appropriate personnel
- Installation of the UN placards for hazardous materials vehicles, with training of first responders on material content and on initial treatment and handling of injured personnel
- A training program on information resources such as CAMEO
- A citizen education program in which citizen groups, the press and the public participate in the planning process
- An administrative and pre-planned command structure, such as the Incident Command System, to assure appropriate coordination during an incident and common nomenclature for equipment
- An understanding on the part of emergency planners of the appropriate uses of tabletop, functional, and full field exercises as methods for testing plans and training personnel, and the intention to undertake appropriate emergency simulations with follow-up critiques, and
- Creation of a data base of the hazardous chemicals being used, transported, stored and/or released into the air, water and ground.

A major effort involving government, industry, and the public is required to meet the above criteria. A procedure for the prompt and regular exchange of relevant information between industry, the community, and first responders is an essential requirement.

Specific constraints addressed by each WEC-LAMP program are laid out separately for each country.

## 1. India

Implemented by the National Safety Council (NSC) under a general Memorandum of Understanding (MOU) with the WEC, the LAMP is directed at overcoming the following constraints:

- (a) an insufficient number of professionals from the private and public sectors who are trained in technological accident prevention and mitigation,
- (b) an absence of local emergency planning committees in industrial areas,
- (c) lack of comprehensive written on-site emergency preparedness plans and accident scenarios for potential high-risk industrial sites,
- (d) inadequate off-site, community-based written emergency plans and accident scenarios for potential high-risk industrial sites,
- (e) relative absence of protocols for appropriate periodic testing and revamping of emergency response plans,
- (f) limited community awareness of chemical hazards, and
- (g) lack of full capability of NSC in off-site emergency preparedness.

The NSC program in emergency preparedness was a direct response to the absence of statutory authority to form local emergency preparedness committees (LEPC). A primary intention was to accommodate the right of citizens to know and to access freely information on potential industrial hazards. While formation of LEPCs is underway in two provinces not visited by the evaluators, NSC is committed to developing LEPC's in all six areas where it is assisting.

The NSC itself is a non-governmental organization (NGO) begun in 1966 at the initiative of government. NSC is in an appropriate position to foster the necessary trust and working relationships among industry, government, and the community in order to promote emergency preparedness and awareness of chemical hazards. Even more so, NSC was considered to have the capacity, not shared by government, to engender trust with industry officials for promoting both on-site and off-site preparedness.

In the charged climate of post-Bophal, the catastrophic 1984 Union Carbide plant accident which killed thousands of citizens, a hazardous chemicals act was passed in 1989. Formulation of the act came out of a major accident prevention program launched in India in 1988-89 by the International Labor Organization. But passage of the act also underscored the gap in public awareness of its vulnerability to chemical hazards.

## 2. Mexico

Constraints were identified during visits to the municipal offices of Coatzacoalcos, Veracruz State, home of considerable petrochemical activity, as well as to the state's Office of Civil Protection in the capital city of Xalapa. They were also identified during a meeting in Xalapa with public safety officers responsible for emergency response and during a meeting with Federal Civil Protection officers in Mexico City. These constraints are:

- (a) absence of community-based comprehensive emergency plans
- (b) absence of effective coordination between local government and industrial sector officials responsible for emergency preparedness and response,
- (c) in the main, failure to include the vulnerable community in emergency planning (an exception was WEC-initiated APELL training in Monterey),
- (d) a critical lack of resources for emergency response at the local level,
- (e) a certain indifference on the part of the state government agencies to realistic and practical operational problems in the industries and especially local governments,
- (f) absence of a Spanish edition of CAMEO,
- (g) absence of a national inventory of hazardous chemicals at fixed facilities or in transit,
- (h) existence of vast, sparsely populated areas that will make the replication of the Veracruz project difficult
- (i) staffing the local emergency response coordinator position on the basis of political patronage,
- (j) lack of authority to coordinate emergency response as contemplated in the Incident Command System,
- (k) inadequately equipped emergency command centers, and
- (l) evidence that vehicle placarding was neither complete nor always accurate.

## 3. Thailand

Constraints addressed by the LAMP Program, WEC-Thailand, adapted from a briefing document prepared by the LAMP Project Manager for the evaluators, are:

- (a) lack of precise understanding among official emergency planners of the consequences of chemical accidents,
- (b) absence of technical know-how in government agencies in emergency preparedness,
- (c) inadequate coordination of emergency planning and response between industries and provincial authorities,
- (d) inadequate integration of emergency planning and operations at local levels,
- (e) lack of communication, cooperation, and coordination of emergency response between industrial plants, and

(f) absence of commitment and effort to create public awareness of hazard vulnerability and preparedness.

Additional constraints identified during the evaluation itself are mainly elaborations of the above list, but nevertheless deserve brief mention. A top-down approach to emergency planning by government and industry alike is a generic problem confronted by the LAMP program. Rules and regulations for dealing with emergencies exist on paper, though as is so common, these are not well enforced. In addition, considerable secrecy on the part of government and industry pervades the topic of hazardous chemical manufacturing processes, so there is a reluctance to publicize information for fear, it is said, that the public will panic.

Related is the problem of "getting outside the gate," namely incorporating local emergency responders and potential affected communities in chemical emergency planning and testing of these plans. In the case of one industrial estate with which WEC is working--Bangpoo Industrial Estate--a large residential area is immediately surrounded by a high concentration of petrochemical activity. There is no plan which deals with either residents' awareness or their preparedness. In turn, a constraint cited from field observations during the evaluation was that many plants either do not have emergency procedures and safety equipment or if they do, these have not been tested. Many of the plants do not coordinate with one another on preparedness matters. And, finally, mock drills uncovered weaknesses in the speed and effectiveness of communications among frontline responders--the primary reason for drills.

## B. Emergency Planning Capacity

### 1. India

#### a. Legal Support for Hazard Prevention

As long ago as 1948, the country had enacted a Factories Act, subsequently amended in 1984. The 1984 amendments provided specific guidance for on-site emergency planning, such that

Every occupier shall, with the approval of the Chief Inspector, draw up an on-site emergency plan and detailed disaster control measures for his factory and make known to the workers employed therein and to the general public living in the vicinity of the factory the safety measures required to be taken in the event of an accident taking place.

Section 41-B of the 1984 Amendment provides for the disclosure of information "regarding danger, including health hazards and the measures to overcome...hazards arising from the exposure to or

handling of the materials or substances in the manufacture, transportation, storage and other processes to...the general public in the vicinity." Unfortunately, there tends to be resistance by both government and industry officials to such disclosure. Because this is an important issue that must be faced by the NSC/WEC-LAMP program, it will be raised again later in the report.

In 1986 an Environmental Protection Act was approved and a Notification (Regulation), "Manufacture, Storage, & Importation of Hazardous Chemical Rules" was adopted in 1989. These rules specified the duties of nine designated officials, listing 434 hazardous chemicals which must be reported to the authorities, and requiring that the District Collector ("Manager") or District Emergency Authority designated by the State Government be responsible for the preparation of off-site emergency plans. In this last activity the authority and the occupier (i.e., manufacturer) must exchange information on planning for an off-site emergency.

#### b. Organization of Hazard Planning

The organization of India's emergency planning for technological accidents is based on the definition of 945 "major accident hazard" (MAH) units, encompassed in the 1989 hazardous chemicals act. MAHs are based on the concentration of certain levels and types of hazard-prone chemicals. NSC has initially targeted two of the country's largest industrial zones, Thane-Belapur in Maharashtra and Manali-Ennore in Tamil-Nadu. Together these comprise only 45/945 MAHs, a seemingly small proportion. However, these particular MAHs cover some of the larger concentrations of chemical industrial activities in the country. Prospective additional targets under the LAMP include 43 MAHs in Kanpur state in UP, 18 in Cochin state, and several in Baroda and Haldia.

The large industrial complexes are not the only targets of NSC's chemical safety program, since that agency feels it is essential to bring small and medium sized chemical processing firms and relevant local officials and communities into the program.

Important progress in the evolution of NSC's strategy to influence a broad spectrum of industry, government and the community, has been made through the formation of the National Advisory Committee (NAC). Envisioned under the WEC-NSC agreement, the NAC includes representatives of national and state governments and industry, whose role it is to review and to deliberate issues, then to recommend adoption of national safety standards. National government is represented by ministries of Environment and Forests, Chemicals and Fertilizers, state government (Maharashtra) by the Labor ministry, through its Industrial Safety and Health office, and municipal authorities by

Bombay Fire Brigades. National ministry commitment to the hazard prevention program was signaled by inauguration of the APELL seminars in Delhi and Bombay by the Ministers of Labor and Environment.

c. Present Status of On-Site Planning

The following figures illustrate that Indian national law on hazards prevention is not yet fully enforced: nation-wide, out of 928 factories, 263 did not have plans almost ten years after the enactment of the Factories Act Amendment; in India's 20 states where plants handle hazardous materials, out of a total 928 plants, 665 have on-site emergency plans.

On the estates where NSC has a facilitating role the picture is considerably better, however. By the end of last year in Thane-Belaour, among 215 factories with hazardous materials, 191 had on-site emergency plans, while in Manali-Ennore, 41 out of 48 plants reportedly have on-site plans.

Given the high standards stipulated under Indian law, it is not surprising that the Director General of the National Safety Council reported to the evaluators that though progress has been made, "...the country still has a long way to go to achieve the desired level of chemical disaster management."

2. Mexico

a. Legal Support for Hazard Prevention

The Civil Defense National System was formed in response to the Mexico City disaster caused by the earthquakes in September 1985. The government realized the need for reform and improved strategies, including development of a more actively organized volunteer sector that could facilitate emergency response. Though time was not sufficient for the evaluators to examine Mexico's statutes on emergency management, few complaints were heard from the private sector on their adequacy.

There were complaints, however, about the lack of resources to assure compliance with these statutes. What is more, one fire official interviewed contended that industries transporting hazardous materials or waste do not always bother to have the correct placard on the vehicle. This was subsequently confirmed by statements at an international conference on hazardous spills. The Secretariat of Communications and Transport deals with the transportation of hazardous materials via a regulation entitled "Reglamento Para el Transporte Terrestre de Materiales y Residuos Peligrosos." Improved enforcement is an urgent need.

No statute exists requiring a national toxic release inventory, such as the U.S. annual inventory. A 1994 publication, Atlas Nacional de Riesgos, is an overview of natural and man-made disasters and emergencies, including chemical emergencies that have occurred in Mexico. This atlas could be used as a training and hazardous planning tool.

b. Organization of Hazard Planning

In Mexico there is an explicit organization for hazard response, though the evaluators saw no documents on comprehensive hazard planning. The "National System of Civil Defense" provides for a national, state and municipal system of emergency preparedness. The stated purpose is to protect "people and society from man-made and natural disasters through actions which can reduce or eliminate losses of human beings, destruction of material goods and damage to nature." The chairman of each civil defense unit is the chief elected official at his/her level.

At the national level, the executive secretary for civil protection is the Secretary of the Interior Department, at the state level the government secretary, and at the local level the municipal council secretary. There is also a "technical secretary" at each of the three levels and a board composed of, the evaluators were advised, "holders and representatives from departments and agencies with activities related to civil defense, public and private sector representatives and educational institutions and/or experts on civil defense." At least at the municipal level lack of resources impedes effective operation of the local office.

Each of the three levels of government ideally has the following coordinating roles: damage assessment, safety, search and rescue, provision of equipment and goods, health, supplies, emergency communications, and rebuilding. Interviews with local officials and industrial safety personnel disclosed that this structure at the operational level exists more in theory than fact.

In the industrial area visited by the evaluators in Coatzacoalcos, participating firms have formed a safety and mutual aid group to deal with the possibility of chemical emissions in the area. This group, made up of safety management representatives from a dozen or so firms, calls itself CLAM (Comite Local de Ayuda Mutua) or Local Mutual Aid Society.

c. Present Status of On-Site Planning

On-site planning is carried out in the Coatzacoalcos industrial zone by CLAM, as well as by other industrial sector offices. The chairman of CLAM, who is elected annually, allocates resources in an emergency but has no authority to compel support. An

extensive emergency plan was prepared in 1991-1992 by CLAM for on-site emergencies.

## Thailand

### a. Legal Support for Hazard Prevention

No fewer than 34 laws underpin the disaster management bureaucracy in Thailand. Furthermore, at least nine ministries, 20 departments, and ten committees deal with disaster in one way or another. A recent study titled "Strengthening Disaster Management Strategies in Thailand" (UNDP:1994), from which the above figures were derived, characterizes the legal basis and organizational structure for disaster management as "immensely complex." One of the most obvious reasons for this complexity is that the country's exceedingly rapid economic and technological growth has outstripped public responsibility for the safety of the nation's citizenry. This situation is compounded by the fact that an urban population explosion is occurring in areas where there are concentrations of major petrochemical and other hazardous industries. Hazardous waste production alone is being generated at such a high rate that its treatment or storage is unsafe.

The 1979 Civil Defense Act is the major legal impetus for the country's management of disaster. In 1992, several laws were enacted bearing on emergency preparedness for chemical accidents, including acts on the environment, hazardous substance, factories, and public health. While laws are in place, as indicated earlier, there is purportedly both a reluctance to obey regulations and a lack of enforcement, both of which constrain emergency preparedness in the country. Another factor in the political/legal nexus of emergency preparedness is said to be the historical preoccupation of national political leadership with the national security of borders dating to the Vietnam War era. This has tended to preempt concerns with the growing risk of technological accidents resulting from the fast growth of the chemical manufacturing industry.

### b. Organization of Hazard Planning

The three major players in Thailand's disaster management are the National Economic and Social Development Board (NESDB), the National Accident Prevention Committee (NAPC, formerly the National Safety Council), and the Environmental Policy Planning Division, Ministry of Science, Technology, and Environment (EPP). The powerful NESDB is concerned with overall economic preparedness, including measures to strengthen and improve disaster management so as to ensure sustainable development. It took the initiative in adopting the APELL approach and delivering the first presentation of the APELL workshop. The NAPC, since it

is chaired by the Prime Minister, is clearly an important body. The EPP is directly charged with controls of hazardous substance.

Other related ministries are Industry, with divisions of Hazardous Substance and Chemical Control, Industrial Safety, Factory Inspection, and Public Health, which focuses on the health aspects of prevention and preparedness. While the evaluators did interview Industrial Safety personnel in the Ministry of Industry, representatives of the other bodies were not included in their itinerary. When asked if they should not meet with some of them, it was indicated that the WEC country office did not have access to such high-level bodies as NESDB, NAPC and EPP.

The principal channel for on-site hazard planning is the Industrial Estate Authority of Thailand (IEAT), a semi-public government agency under the Ministry of Industry. It is through IEAT that the WEC-LAMP Program provides assistance in emergency preparedness. IEAT was formed in 1972 in response to rapid industrial growth and its undesirable consequences. IEAT is chartered "to support a systematic and orderly development of industries."

Despite the presence of a clear level of awareness, meetings with IEAT senior management left the impression that a total commitment to full scale emergency planning and management is lacking from the Estates Authority.

The evaluators visited two estates under IEAT management that are being assisted through WEC-LAMP. The first, Map Ta Phut Industrial Estate, located in Rayong Province about 200 km. south of Bangkok, is the most advanced petrochemical complex in the country. Situated on a deep-sea port, Map Ta Phut includes facilities for natural gas separation, olefin plants, and many downstream petrochemical-based industries. To give an idea of the scale of this estate, total investment by 40 industries is over US \$20 billion, including two new refineries under construction.

Bangpoo Industrial Estate, was the second industrial site visited by the evaluators. It was the first industrial estate under IEAT, formed in 1977. Located in Samutprakarn Province on the east coast adjacent to Bangkok, Bangpoo contains over 200 leading international and domestic companies, including many chemical processing facilities--many smaller ones--and employs about 55,000 workers. Its total investment is about US \$10 billion.

### c. Present Status of On-Site Planning

A clear statistical picture of on-site planning did not emerge during the limited time of the evaluators' visit. Even where on-site emergency planning at the firm level was present, there was

no coordination of those plans from one firm to the next and between these firms and local emergency services. One answer to the on-site coordination problem has been the formation of at least some industrial states of Chemical Clubs (equal to safety groups or emergency preparedness committees), but these lack citizen participation.

There is presently in Thailand no national policy to unify rules and regulations for emergency preparedness. Nor is there coordination of emergency preparedness actions among industrial manufacturers. Furthermore, there is little coordination between firms and local emergency authorities. And finally, there is almost no link between firms, local emergency authorities and vulnerable residential communities. In this context the APELL concept intends to serve as both a policy tool and a practical blueprint for linking industry, official first response agencies, and local communities in the partnership it envisions.

### C. Education, Training and Information Dissemination

#### 1. India

In the climate of post-Bophal, a hazardous chemicals act was passed in 1989, an outcome partially attributable to the 1988-89 International Labor Organization program in major accident prevention. This act stimulated a concomitant need to increase public awareness of its vulnerability to such hazards. That need, recognized by the United Nations Environment Program, prompted the introduction by UNEP of the Awareness and Preparedness for Emergencies at Local Level (APELL) training workshop. APELL is directed at developing a partnership between industry, government, and community in preparedness planning and response. NSC sponsored the first courses in APELL in Madras and Bombay in 1992 and thus began India's effort to bring together the three partners to launch its nationwide initiative in emergency preparedness and awareness.

The three APELL workshops held in 1992 had a total attendance of 181 persons. In 1993 two courses were conducted on medical response to chemical disasters along with a course on "Management of Technological and Natural Disasters" and two courses on Chemical Emergency Preparedness. In 1994 two APELL/Chemical Emergency Preparedness workshops and a training course on "Chemical Emergency Preparedness and Response: An Approach That Works" (CEP) were conducted in Bombay. Attenders were predominantly new and mid-level professionals from the chemical industries. The three day course covered 15 different items including on-site emergency preparedness and response plans, the planning process and forming a planning group, and Computer Aided Management of Emergency Operations (CAMEO). The evaluators attended the opening session of the August CEP course and, upon

review of the course outline, felt there was a relative absence of involvement on the part of the attenders, who obviously had much experience and knowledge to contribute to the larger group. There also appeared to be an absence of small-group, breakout sessions or exercises to give participants the opportunity to apply knowledge presented in the lecture portion.

The CAMEO program, is now being used by emergency management officials, government and industry alike. CAMEO provides response information for over 3,000 chemicals and contains other valuable data on emergency management of toxic substances. NSC, as sponsor of CAMEO training, conducts its courses in English, as it is a more universal language on the sub-continent.

Training visits by NSC and other officials sponsored by WEC to the U.S. have sparked an interest in tailoring some training courses for use by a variety of first responders. Courses on medical emergency response, role of the incident coordinator, chemical spill control, and crowd control, for example, were mentioned as strong possibilities for different kinds of first responders. The MOU does not spell out course demand in any detail, including first responder training. It is assumed that the 1995 work plan has addressed this need.

Whether directly attributable to the NSC LAMP program or not, one example of private sector training initiative is illustrative, although unrepresentative: Herdillia Chemicals Ltd., located in the Thane-Belapur industrial estate with which NSC is directly working, is probably unique in the comprehensiveness of its training program. First, for on-site preparedness, Herdillia has a bi-monthly table-top review and annual update of its plan; all of its workers are trained for on-site response; there are six response teams, one chief controller and one incident controller; and accidents are reported immediately to the Collector's office. Second, as part of its community outreach program Herdillia's emergency preparedness staff works with local physicians and school teachers and principals in promoting preparedness and awareness. Third, this firm has a training program for first responders, mainly for highway transport chemical accidents. To date Herdillia has trained as many as 1800 police constables/ first responders in basic response to chemical hazards control. Finally, all transport vehicle drivers who come on-site are given emergency information and shown a video in their local language on driver safety and first response.

As a sign of its commitment to developing an emergency planning capacity, the NSC in 1993, just prior to the signing of the WEC agreement, issued an Indian Edition of a report titled "Hazard and Operability Studies." This report is described as "an accepted technique to identify hazards in the process industry. Identification of hazards constitutes the first step in the task of Hazard Analysis which in turn provides a basis for risk

assessment." In addition, the NSC has issued advisory cards with such subjects as electrical safety, safety in welding and gas cutting operations, and packaging and labelling of hazardous chemicals. Finally, NSC has launched a national campaign to promote public awareness of industrial hazards through posters and pamphlets.

## 2. Mexico

The LAMP program in Mexico has held a series of workshops to disseminate emergency management information, as follows:

- Awareness and Preparedness for Emergencies at Local Level (Seminar) March 29-April 1, 1993 (Monterey)
- Coordination Strategies and Emergency Response with Hazardous Materials (Seminar) Nov. 30-Dec 3, 1993 (Mexico City and Coatzacoalcos)
- Risk Analysis Seminar, March 24-25, 1994 (Mexico City)
- Seminar on Emergency Medical Response to Chemical Accidents, June 16-17, 1994 (Xalapa, Veracruz State)
- Safety Transport of Hazardous Materials Seminar, June 23-24 (Mexico City) and Sept. 22-23, 1994 (Xalapa, State of Veracruz).

The seminar "Coordination Strategies and Emergency Response" was the first time that a tabletop exercise and mock drill were used. Altogether 345 persons attended these training sessions. There were 47 speakers with a total of 249 hours of instruction. The evaluators reviewed the agendas for these training sessions and they appear to, in each case, cover the subject adequately. While most attenders were government officials, the industrial sector was also represented. There were relatively few attenders from the ranks of fire fighters or other response personnel. It should be noted that there appears to be only a limited concept of "train the trainers" in Mexico. Thus, for example, it is not clear how much of the training received by the 345 participants trained under the LAMP program has benefitted other emergency professionals.

In addition to the courses mentioned in the above paragraph, training has also been sponsored by WEC in more specialized areas, such as Soils Remediation, Community Risk Minimization, Waste Incineration Systems, Medical Wastes Disposal, Toxic Wastes Disposal. WEC has also been active in publishing numerous technical manuals and leaflets.

When a Spanish version of CAMEO is available it is anticipated that training in this computer program will become a top priority for WEC-Mexico.

Two impressive videos produced by WEC-Mexico were reviewed by the evaluators, one on a field exercise and the other a comprehensive

review of factors causing a wide range of natural and manmade disasters. The latter, in Spanish, appeared to be of particularly high quality. These videos are being widely used for training.

A manual, titled "Manual De Capacitacion Sobre Coordinacion De Estrategias y Respuesta A Emergencias con Materiales Peligrosos," has been published by WEC-Mexico. It is intended to be used with the field exercise video. The manual covers a wide range of chemical emergency management subjects including, for example, the uses of protective equipment, the incident command system, and processes and techniques for decontamination.

There was little evidence from the material provided or from the briefing that the LAMP program plays a major role in public education for chemical emergencies. However, given the presence in Mexico of a fairly strong culture of emergency awareness, it is likely that the public education system is already promoting a significant level of civic education in emergency preparedness. For example, the WEC-Mexico country director, as part of his professional activities, regularly presents lectures at the University of Mexico and to community groups on emergency preparedness.

Based on the number of media messages and preparedness campaigns, it appears that the public is adequately informed about the potential hazards through radio, television and poster public service messages. Public and private buildings seemed well marked with emergency instructions.

### 3. Thailand

Starting in the third quarter of 1992 WEC-LAMP launched its program to train specialists and disseminate information in order to increase awareness and knowledge of technological accident preparedness and prevention. This program has provided training to a variety of recipients in APELL, CAMEO, Community Awareness and Emergency Response (CAER), medical readiness for mass treatment, first aid, on-site preparedness standards, and fire inspection and safety standards. Support has also been lent for such specialized courses as Safe Loading and Transport of Agrochemicals and health disaster preparedness. Technical assistance for many of these courses derives from institutions, external and domestic, such as CDC, EPA, UNDP, and Asian Institute of Technology. Venues for the training include public health offices, local government offices, local hospitals, factories, among others.

Included under dissemination is the institutionalization of the CAMEO data base in many Thai organizations. The complete CAMEO package has been adopted by many Royal Thai Government agencies,

including IEAT, NESDB, the Pollution Control Division, Ministry of Labor, and Ministry of Public Health. Translation of CAMEO from English to Thai has been supported by the program. WEC-LAMP and IBM-Thailand co-sponsored a distribution of computerized chemical Hazards Information System for use by, among others, local emergency authorities including hospitals, police and fire officials. They led a day-long, two session training workshop in CAMEO for disaster management planners and industrial safety experts, offering hands-on computer training. The workshop focused on use of the software for accessing hazardous chemicals information in an emergency situation.

Courses designed to address specific areas of need with respect to the two industrial sites and local communities assisted by WEC-LAMP are the Emergency Preparedness and Accident Prevention Workshop, the Fire Prevention and Fire Protection Workshop, and Readiness to Cope with Industrial Disaster in Public Health and Medical Areas.

The last course (Public Health Readiness), a seminar, is directed at creating both greater awareness and preparedness for emergency medical officers, as well as those with whom they work in responding to accidents. It covers public health consequences of industrial accidents, health risks from specific accident types, based on knowledge and use of hazardous materials information systems, and procedures for emergency medical response management. Assisted by two U.S. Public Health Service experts, this seminar took place alongside another exercise, a three day assessment, titled "Disaster Assessment and Epidemiology for Hospitals in Map Ta Phut and Bangpoo Areas." The assessment was aimed at determining capacity of hospitals in industrial areas to manage medically casualties, to be well-prepared, and to assess medical and health implications of disaster.

D. Industry/Public Sector/Community Response to Technological Disaster

1. India

a. Industrial Estate Preparedness

Site visits to two industrial estates were made by the evaluators, first Thane-Belapur Industrial Association (TBIA) in Greater Bombay, second Manali-Ennore Industries Area (MEIA) in Madras. NSC has formal relationships with these associations in facilitating emergency preparedness programs based on the three-part relationship among industry, government, and community. These visits uncovered different rates of progress in emergency preparedness in the above three sectors.

Thane-Belapur TBIA is one of the largest industrial sites in India, with 1,400-1,500 industrial firms occupying more than 2,500 square hectares. Here, many of the larger chemical processing firms have undertaken risk management studies and have on-site emergency plans. Visits to several plants by the evaluators indicated a high degree of readiness by individual firms to respond to on-site emergencies. Written off-site plans are far more rare and considerably less well-developed.

The threat of chemical hazards in the Thane-Belapur area is magnified by population pressures, which has forced communities to locate near this estate. In part to counter this trend, a meteorological station has been established on the estate to monitor wind conditions and provide early warning signals. And an emergency response station is in preparation which will hopefully have a fully-equipped, 50-person response capacity. Capital development funds for the station have been provided by the Maharashtra (state) Industrial Development Corporation. TBIA is also in possession of CAMEO software which it will use to inventory all chemicals and potential hazards on the estate.

Manali-Ennore Manali-Ennore Industrial Area, lying on the outskirts of Madras, consists of about 20 large and medium-size chemical and petrochemical plants. Included on the estate are one refinery, two fertilizer plants, a chloralkali and LAB plant, among others. Chemicals that are processed include ammonia, chlorine, HF, LPG, and other toxics and flammables. Efforts to limit settlements near the plants have had some favorable effect in reducing the size of vulnerable populations. The first off-site plan was commenced in 1988, a time in which the concept of off-site planning was relatively new. It was completed by mid-1989. Three off-site mock drills have been carried out, first in 1989, second in 1992, and most recently in April, 1994. The last was observed by UNEP and U.S. Environmental Protection Agency training officers.

#### b. Public Sector Participation

Thane-Belapur Off-site planning preparations in the Thane-Belapur area have included training of physicians for medical emergency treatment, preparation of a handbook for medical management of hazards, establishment of mutual aid and response groups (based on existing mutual aid and fire fighting model), and development of a disaster management plan for each major accident hazard (MAH) unit. Police have also received some training in basic knowledge of toxicity, flammability, crowd and traffic control. Community awareness development is being promoted by TBIA in cooperation with the Bombay Chamber of Commerce, the Tata Institute of Social Sciences, the local Rotary Club, and through school-based training programs.

Incident command in TBIA as well as the rest of the country is mandated by National Government to the District Collector, who is the officially appointed manager responsible for the off-site emergency plan in his/her district. Emergency management is only one of the Collector's innumerable management responsibilities, so it is not usually a priority. A recent change in district emergency preparedness in Thane District was noted in a visit by the evaluators to the Collector's office. In that district the Municipal Commissioner, who is appointed by elected officials, shares the emergency preparedness role with the Collector, perhaps confusing the division of labor. Furthermore, the Collector himself reported that inadequate communications and infrastructure networks, such as poor, congested roadways, as well as insufficient fire service equipment, greatly impede emergency response capabilities.

Another public sector player in emergency planning is the Maharashtra State Office of Industrial Safety and Health. It is mainly concerned with inspection and enforcement, though it also cooperates with on-site industrial firms, the District Collector's office, and local police, fire, and medical authorities in promoting shared use of human resources and equipment. While the importance of the role of the community in emergency preparedness is well recognized by government officials, traditionally the community is not represented in this grouping of participants.

Most of the accidents to date in the Thane-Belapur area have been hazardous material highway transport accidents, many of which did not even occur in the major accident hazard units (MAHs) encompassing the TBIA estate. Thus, local authorities often become first responders, rendering their role critical. Such local officials, namely police and fire, followed by medical personnel are also the least trained at this point, although as we have seen earlier, that situation is gradually improving.

Manali-Ennore An important part of public sector involvement in off-site emergency preparedness in this industrial area is played by the Manali-Ennore Industries Emergency Preparedness Committee (MEIEPC). Formed in 1990, MEIEPC coordinates industrial participation in off-site planning, facilitates participation of government authorities and agencies in enacting the plans, and contributes to public education and awareness activities. MEIEPC consists of safety managers from most large and medium-size firms in the industrial area.

This committee has played a greater role in promoting public awareness than its counterpart in Greater Bombay, TBIA. Examples of MEIEPC's efforts include:

- production of a public education video in the local language to educate the community on off-site emergency

actions,

- publication and distribution through government agencies of posters, illustrated booklets,
- training of local authorities such as police, fire brigades, medical and para-medical personnel, and transport officials in off-site actions, and
- initiating and, with government authorities, developing action plans for mock drills.

The MEIEPC, in cooperation with local government officials, is presently preparing detailed maps of all local areas for off-site emergency planning purposes. It is also preparing prioritized off-site actions in a Ready Reckoner calendar format, to be made available on a continual basis to government emergency offices.

### c. Community Participation

NSC, industrial estate, and public officials alike freely admit that citizen participation in emergency preparedness is the least developed part of the triangle representing industry, government and community cooperation in promoting chemical safety. This situation has several causes, though too many and too detailed to devote space to here. Historically, the combined parts played by the traditional Indian feudal system and the British empire did not foster reliance by governments on public participation in decision making. Also, the government appears wary that information on potential hazards will only engender public fear--born out, in fact, by situations in which there was unfortunately incomplete knowledge available to citizens thereby only causing them to panic.

Thane-Belapur The most difficult element of the TBIA outreach program so far has been recruiting potential first responders who reside in communities most vulnerable to chemical hazards. Among community members, the youth are especially hard to reach. While the *talathi* or "lowest revenue officer" is the first formal governmental contact point at the community level in the case of chemical accidents, this person has no emergency training. Other possibilities for a community liaison are teachers, social workers, and members of various youth groups, women's groups or local cultural organizations known as *Saunskar Varg*. None of these is presently the target of first responder training or is even significantly involved in emergency planning.

Manali-Ennore Local emergency personnel and three "community leaders" were interviewed by the evaluators in a group setting following a larger meeting with the MEIEPC. Fire, police, and medical emergency representatives were present, along with three leaders of the community, who were appointed by the local government. They were chosen, it was said, on the basis of their employment in nearby chemical plants and their role as community spokesmen. Local government has provided them an office in a

community building, where they can address various needs of the community and keep in contact with fellow residents. Leaders and emergency personnel were fully cognizant of the vulnerability of residential areas to potential chemical hazards from nearby plants and of the need for public awareness and preparedness training. They suggested working with health, fire, and police officials, as well as with the Collector's (District Chief Officer) office in promoting community awareness.

Towards the end of a meeting with the Emergency Preparedness Committee, participants and evaluators reviewed a map of the industrial area including adjacent communities and locations of fire, health and police service facilities. The evaluators suggested that one way to engage community members in preparedness would be to address their interest in the possibility of having a round-the-clock paramedic available in the community clinic. Community representatives could use their position in the community, alongside the already cooperating district medical chief to petition the authorities for support of a paramedic specialized in treating toxic maladies. Associated training in chemical accidents could then be provided to community members. This might result in a greater sense of security among residents, in addition to a greater degree of actual preparedness on their part.

#### d. Response Capability

Thane-Belapur Several written emergency plans exist for this area, including a "Green Book" produced by the Directorate of Industrial Safety and Health (Maharashtra state), which includes information on inventories of hazardous chemicals and their threats, emergency procedures, first aid requirements, personnel resources, and emergency telephone numbers and hospitals. Another recent plan is the "District Management Plan for Hazardous Factories in Thane District," which is a formal plan including specific information to police and transportation emergency personnel, fire stations and brigades, emergency medical personnel. It contains a chemical fact sheet by firm, location, activity, hazardous chemical inventory (amount stored and consequences of storage and processing), physical range of consequences, emergency actions given a 15-minute notice period. This plan also contains a large amount of medical emergency information, including antidotes and treatment for exposure to hazardous chemicals, and a list of requisite equipment and medicines.

A "truncated" mock exercise was held on the TBIA at the NOCIL plant in December, 1989. The simulation, requested by a government official (the Collector), was a simulated chlorine gas release, plotted for a population concentration in three- and five-mile radii. Elements of the response included the use of the Material Safety Data Sheets (MSDS) for chlorine, a vehicles

map, emergency control center, field operations, and off-site control operations. While time:task ratios were efficient, weaknesses were cited as telecommunications problems, fire and rescue vehicle logistics (poor roads and traffic plans), and lack of protective clothing for police and other officials.

Manali-Ennore As indicated earlier, three off-site mock exercises have been carried out to date. The second exercise, for which there is detailed information, is perhaps more important for the recommendations that derived from it than for its measured efficiency. Recommendations include: community participation, improved rallying post communications, better communications between industrial firm and police during emergency, earlier reporting by government, improved public awareness, and better pollution monitoring. These areas were all improved upon in the third drill in April, 1994. Importantly, the local residents were actively involved in this drill, as their evacuation from an area near the hazard site had gone smoothly and safely without apparent confusion.

Many of the recommendations offered after the second drill were direct outcomes of the APELL workshop given in 1992 for Manali-Ennore area participants. The third drill was even more instructive, resulting in several changes in preparedness conditions of the industrial zone. One of these was the permanent elimination of a serious traffic bottleneck so as to open up vital emergency routes. This was achieved by MEIEPC through a large new parking area for hundreds of transport vehicles attached to a very large plant. All in all, improved communications between the community and the emergency planning and response personnel have resulted from both improved table top and mock drills.

## 2. Mexico

### a. Industrial Estate Preparedness

The level of industrial preparedness appeared high. It was not clear that such preparedness was formal. Guidelines for on-site cooperation among firms in Coatzacoalcos had been prepared; however, there was no effective relationship with local authorities in the event of an off-site accident. Industry officials have no actual authority to order responders or to design and coordinate an operations plan, should an off-site response be required. These conditions may lead to conflicting decisions and misdirected resources during a serious emergency. Regarding this constraint, the WEC-Mexico project director identified two specific needs at the municipal level: (1) support in risk and hazards identification and (2) support in training medical assistance teams to respond to hazardous materials accidents. The evaluators concur with this assessment.

## b. Public Sector Preparedness

Mexico exists in what civil protection authorities call a "culture of disaster preparedness." Posters advising citizens on how to respond in an emergency appear in many public places. Some office buildings even have encapsulated suits readily available for emergencies, openly visible behind breakable glass. In some buildings private guards are trained and given regular refresher courses in first responder responsibilities, including use of the encapsulated suit.

Further evidence for public preparedness is a letter of May 2, 1994 from the Veracruz Department of Health to the Project Director of WEC-Mexico. This letter noted that lessons learned from a seminar sponsored by WEC in December, 1993, made possible a successful response to a serious chemical spill the following January. This was also recounted in some detail in a briefing provided to the evaluators by state health officials.

In contrast, many police and fire officers have not been trained as first responders even to an awareness level. Industrial sector personnel expressed concern about the incapability of public emergency personnel to respond to such accidents as transportation spills, especially in the more remote areas of Northern and Western Mexico. The project director for WEC-Mexico conceded that police and fire personnel are not very well trained.

In addition to the above constraints, some concern was expressed about the lack of decontamination rooms at hospitals and about the danger of admitting contaminated personnel into emergency rooms.

### Agreements between WEC and National and State Governments

One important facet of the relationship between the private and public sectors in emergency preparedness is the two agreements WEC has signed with different levels of government on emergency preparedness. One agreement is with the Interior Department of the National Government, which grew out of an APELL training. The other is with Veracruz State, home of the largest chemical and petrochemical zone in Mexico, handling about 70% of the Mexican production. As a sign of the importance of the agreement, the WEC director is a member of the Veracruz State Council of Civil Defense. Seeing the relationship between WEC and Veracruz, officials from several other states (Guadalajara, Salina Cruz and Morelos) have approached WEC-Mexico about executing similar agreements.

Signed in May 1994, the WEC agreement with national government is intended to:

(a) increase and promote cooperation between the secretariat of the Secretary of Interior and WEC-Mexico in civil defense issues, as well as in prevention and mitigation of disasters, particularly those caused by chemicals or manmade accidents. The cooperation is to consist of:

- exchange of technical personnel (Mexican and foreign) who can collaborate in training, project development and advice,
- coordination of seminars, workshops and courses, and
- exchange of technical information.

(b) increase cooperation in the following:

- design of prevention and assistance strategies, and
- design communications strategies for emergency awareness and preparedness.

A similar agreement was executed, also in May, with the Veracruz State Government. Its general purpose is to establish cooperation "between the State and the World Environmental Center in Civil Defense issues, prevention and mitigation of disasters, particularly those caused by chemicals and man-made accidents."

Cooperation between WEC and the State will include exchange of technical experts for training, project development and advice on specific problems. It also covers coordination of workshops, courses and seminars, and the exchange of technical information. It was intended to increase cooperation in the design of prevention and assistance strategies and of communications for awareness and prevention.

An important element in the management of emergencies in Mexico is the National Center for Disaster Prevention (CENEPRED). It is located in Mexico City in an impressively-designed, earthquake-proof structure. Construction was funded by the Japanese Government. The Center's role is to assist civil defense agencies through research and training. One of its recent studies dealt with the environmental problems of the 'maquiladora' industries along the northern border of Mexico. In their discussion with the evaluators, the CENEPRED staff demonstrated their knowledge and concern for the need of such important tools as commodity flow studies, national inventories, and remediation.

The only type of data base on hazardous chemicals is the one maintained privately by Mexico's chemical manufacturers' association, ANIQ or Asociacion Nacional de la Industria Quimica. ANIQ has a membership of 325 firms, which are responsible for producing 80-85% of Mexico's petro-chemicals.

### c. Community Participation

Some Red Cross personnel attended a number of the workshops but, by and large, the training by WEC-Mexico has been geared toward public officials at the professional and managerial levels. However, there is a good deal of public education on emergency preparedness in Mexico in the schools, through posters and other media.

The State Council of Civil Defense includes personnel from industry, local teams of mutual aid, Red Cross, army, navy, state legislators, and others. Nevertheless, the WEC-Mexico project director lists other needs at the regional level such as interaction among states, government agencies, and non-government organizations (NGO's), as well as (at the local level) community awareness and training. He also identified the need for mock drills involving community participants. The evaluators concur and urge that mock drills be used not only for training but also to test comprehensive written emergency plans.

### d. Response Capability

The on-site response capability is well organized in the Veracruz industrial sector. This is not the case for the municipal level, in Coatzacoalcos, whose offices the evaluators visited not far from the industrial zone. Under federal policy, the municipality is the first responder. Local emergency management personnel seem dispirited, lack resources and wish for a better working relationship with the industrial sector. Staff turnover, some of which is due to political patronage, is a problem. An out-dated radio communications system depends in part on the telephone system for some linkages, an often unreliable resource when emergency conditions prevail.

The municipal emergency communications system is located atop the main municipal building that can only be accessed by an outdoor flight of stairs--an impossible feat in a hurricane wind. If there were a major airborne release, the site could easily fall within the reach of a toxic plume. The municipal director of civil defense readily conceded that the present breakdown in coordination between the municipality and the nearby industrial estate will have the practical effect of reducing the effectiveness of any response should an emergency occur.

During the evaluators' five day visit in Mexico, no emergency operations centers were visited. The WEC project director fully recognized the absence of such centers as a serious shortcoming and ranked this as one of Mexico's strongest needs. He envisioned the day when major emergency centers will exist, one in each of the four quadrants of Mexico and a fifth in the Federal District of Mexico City. A first step could be to establish a national response center supervised by the Under

Secretary of Civil Defense in the Interior Department, which would require that all accidents involving amounts over allowable quantities be reported to the center. Especially under its existing agreement with the federal Civil Protection Office, WEC-Mexico is a highly appropriate facilitator of discussions on this important matter.

Industrial personnel were highly critical of the role of local government in disaster response. Their argument (as reflected in notes taken during a meeting with the industrial safety managers who make up the CLAM in the Coatzacoalcos industrial area) is paraphrased as follows:

Local government resources for civil protection are limited; the staff doesn't have emergency equipment; they have titles on an organization chart. Because they have few resources, they try to get those belonging to us, the private companies. Civil protection needs money so they can have their own resources.

We need a local or regional authority to interact with (mention was then made by one of the safety engineers present of the "worst case scenario" exercise held at Charleston, West Virginia in July 1994 as an eventual model for an exercise in Mexico).

WEC should coordinate with the Mexican chemical manufacturers' association so that the latter can provide courses to local emergency authorities in chemical emergency response. WEC should concentrate on first responders and local government officials.

WEC should help bring us (private sector and local government) together. All the help WEC can give us would be very, very welcome.

Local officials in Coatzacoalcos stated that although government disaster management authorities had conducted simulations for fires and earthquakes, they had not yet run an off-site simulation of a chemical disaster. These officials recommended that plant safety officials do school briefings for students, since the local government said it did not have the staff. The local head of civil protection expressed an intense interest in working with the private sector. However, his term expires in three months.

### 3. Thailand

#### a. Industrial Estate Preparedness

The Map Ta Phut estate is considerably ahead in its preparedness planning and testing of its emergency plan on the ground than

Bangpoo estate. WEC-LAMP is just now beginning its assistance to the Bangpoo estate, having expended most of its energy with Map Ta Phut over the last two years.

Map Ta Phut Several site visits were made by the evaluators within this very modern industrial estate. Some of the larger, more established firms have safety departments, which include functions in plant safety, occupational health and environment, and fire fighting and security. These departments have been instrumental in presenting courses in emergency response and planning. Their representatives also make up an important constituency of the estate's 'Chemical Club,' the group that deals with emergency preparedness across firms, through a mutual assistance plan, and which plays an integral role in the development and testing of off-site plans. The Club will shortly be formalized as an association, to be headed by senior industry officials. Its present chairman, the safety director of the National Petroleum Chemical Corporation, is a highly active, dynamic individual who plays a very significant role in mobilizing participation from within and without the estate in off-site emergency preparedness.

The larger firms on Map Ta Phut estate have impressive fire fighting and medical emergency operations. Others are not well-equipped nor organized to deal even with on-site emergencies. This is attributable, the evaluators were told, to a "certain management mentality." Evaluators were told that ten firms out of 46 have fire fighting facilities, the rest having hydrant systems. Five firms have good, tested on-site emergency plans, about 15 have procedures, but have not conducted exercises, and 20 or so have no plans at all. Furthermore, an earlier evaluation by U.S. EPA disclosed numerous shortcomings in factory safety.

Bangpoo Industrial Estate This estate has over 300 firms (of which about one-third are petro-chemical) and almost 60,000 employees on site. It also has a residential community at its periphery. The estate's first priority, its management told the evaluators, is the safety of its on-site employees, since if a chemical gas plume were to blow in any particular direction, employees would have difficulty escaping through the single exit gate. Next in priority are the estate's residential neighbors. The community has apparently already launched a protest to the estate concerning their risk of chemical accidents. The need for stricter preparedness at Bangpoo is underscored by accidents occurring on the estate. Recently a gas and oxygen accident sent 50 employees to the local hospital.

Recognizing the importance of having an emergency preparedness plan for the estate and surrounding area, its director has asked for authority from IEAT to establish a center for emergency response on the estate. Already, space for an operations and

training center has been set aside in the estate headquarters building. IEAT's budget has supported a purchase of radios and phones, as well as a fire truck. A local emergency preparedness group--along the lines of the Map Ta Phut Chemical Club--has been started. A sign of its importance is that 150 out of 300 companies purportedly have joined the Bangpoo Chemical Club.

WEC, through the LAMP program has provided training to plant personnel in Bangpoo in developing their emergency preparedness plans. Through WEC, in January 1993, the U.S. EPA conducted a one-day workshop for safety personnel from several of the large petrochemical firms in Bangpoo on Community Awareness and Emergency Response (CAER). At the end of October 1993 Bangpoo Industrial Club co-sponsored along with IEAT and WEC a week-long EPA-implemented workshop on Emergency Preparedness and Accident Prevention. Held at Map Ta Phut estate, the training was attended by Bangpoo Emergency Response Team members, including representatives from the Bangpoo Industrial Club, fire brigade, public and private hospitals, the local community, Ministry of Transport and Ministry of Labor, Civil Defense, and IEAT. The estate also has an outreach program to bring its emergency preparedness personnel into closer contact with the medical community, fire and police personnel. An example of the outreach is training in first aid for chemical accident victims and in medical readiness for mass treatment aimed at emergency medical personnel, sponsored by one of the more safety conscious firms on Bangpoo estate.

#### b. Public Sector Participation

The Government is in charge of all emergency preparedness planning and response. National Government has mandated that all 76 provinces write their own emergency plan. However, the 13 provinces which have the highest concentration of chemical industries are supposed to develop and exercise an emergency plan similar to the one demonstrated at Map Ta Phut. At the District level, the fire and police are under the authority of the Ministry of Interior and the provincial Governor is in charge of evacuating residents from communities. At the local level, the fire fighting unit is under the authority of the Municipality managed by elected officials but still under the provincial Governor's control.

During any emergency incident command communication procedures are very important, a fact that arose in the Map Ta Phut simulation. During that simulation the provincial hospital response to the emergency should have been more rapid but was held because of confusion over communications. In that particular case, the "unified command system" broke down.

WEC has provided support for the training of local responders, including police and medical emergency personnel. In the Map Ta

Phut area, 100 traffic policemen have been given brief introductory training in responding to highway hazardous chemical accidents. Of particular interest is WEC supported medical preparedness at Rayong Provincial Hospital which serves the area of Map Ta Phut and its vicinity. This hospital has provided medical response emergency training for its own emergency personnel, as well as training for factory workers in resuscitation, CPR and other first aid procedures. It has also tested its plans, including its Emergency Plan--Level 2, which deals with 20 accident victims or more. A triage approach is applied using a color-coded scheme which coordinates patients and hospital treatment areas. Triage-ing is done in a screening area within the hospital, which pre-assigns patients into treatment categories. This approach appears to be effective.

Opportunity exists for public sector participation in the City of Samut Prakarn, which borders on the Bangpoo Estate. A visit there with appointed and elected officials suggested an impressive vigor and commitment to emergency preparedness. The City Manager, appointed by the Ministry of Interior, and two elected Deputy Mayors (one of whom is in charge of the city's emergency preparedness center), were all fully aware of the potential risk of chemical accidents from nearby industry and were willing to experiment a bit with public participation in future preparedness planning. Each had participated in a WEC-supported training visit to the U.S. For their own city they reported inadequate safety controls on transportation and a commensurate lack of equipment to deal with transport spills and resulting fires. These problems fall out, they suggested, from larger constraints of limited budget expenditures on emergency equipment and training of provincial fire fighters

It was the Samut Prakarn mayor's fire fighting unit, in fact, in contrast to provincial resources, that was very well-equipped and accompanied by a trained group of first responders. The city's emergency plan includes a warning to the local population in case of a chemical cloud moving in from Bangpoo. But there is no awareness promotion available to the local population. Municipal leaders indicated a need for officials and such public figures as school teachers to be trained in awareness and general preparedness. Generally, these urban officials admitted an absence in their city of a readiness to respond to a chemical accident, in terms of either equipment or training.

An idea mentioned by the Samut Prakarn officials as a possibility for promoting preparedness was the neighborhood associations. While somewhat dependent for their power on the will of the municipality, these elected, representative groups, along with local physicians and school teachers, could play a part in bringing about awareness of chemical threats to their constituents. Particularly since an estimated 60% of Bangpoo's work force is from this city, they could be brought into

preparedness training as knowledgeable players. Much needs to be done, however, given these motivated officials' opinion that the residents at this time "don't know what a chemical is...except that it is something that has a foul smell."

#### c. Community Participation

This is the least well-developed aspect of the WEC-Thailand LAMP Program. Given that WEC is not a major player in the Thai disaster management arena, it is not surprising that the Program has not been able to nudge along the participation of communities surrounding Map Ta Phut and Bangpoo estates in emergency planning or response. Such participation is not promoted in earnest even by the IEAT, whose senior managers, during an interview with the evaluators, indicated that citizen participation is the responsibility of the provincial government. More to the point, they suggested that it is the Governor's domain, since he is the commander for emergencies. One exception to this stance occurred when one community demanded from IEAT compensation for alleged lead poisoning, which residents subsequently though incorrectly linked to incidences of AIDS. Where necessity prevailed, IEAT supported the training of community leaders.

#### d. Response Capability

An emergency response drill to test the Map Ta Phut Industrial Estate off-site emergency preparedness plan took place on July 15, 1994. Held on the estate, the drill was broad-based and on a scale never before experienced in Thailand. Emergency services of estate firms, local police, fire and hospital were provided. Provincial and district authorities participated, under the direction of the office of the Governor of Rayong Province. Approximately 1,000 people purportedly participated in the drill. The drill was observed by many and was filmed by a crew and shown on monitors from many sites of the emergency. Prestige was added to the event by attendance of the Governor of Map Ta Phut Industrial Estate, Governor of Rayong Province, and the Deputy Prime Minister.

The drill focused on a fire that erupted from a gas leak at the base of a spherical tank on the estate. The extent of the response is perhaps best illustrated by the use of helicopters to evacuate the most seriously wounded to Rayong Hospital. Importantly, a portion of neighboring Map Ta Phut village was evacuated in army personnel vehicles. In a post-mortem, most plan elements were given high marks, with the sole exception of -- not surprisingly -- "public information and education." As noted earlier, communications also were not fully effective--the command system having broken down at certain, critical points. This is partly a matter of their not understanding the Incident

Command System and the Unified Command System between provincial and district levels.

E. Management

1. India

The NSC is responsible for much more than simply mitigating chemical hazards and supporting the emergency preparedness program. It is responsible for bringing to bear the latest concepts, principles, and practices of hazard awareness and emergency preparedness on its clients, the industries it serves. This is done through an active training program, which includes workshops in APELL, CAMEO, Chemical Emergency Preparedness (CEP) and Risk Assessment.

Another avenue for bringing new ideas and practices into the arena is through NSC's formal and informal contacts with industry, local government, and state government officials. Incorporation of surrounding communities has proven more difficult. One likely reason for this situation is that the industries which contribute to the NSC through membership fees are given higher priority by the NSC. Such a situation is, however, not purported to be based on a conscious decision by NSC. Ultimately it is by the productivity of NSC's links in the partnership of industry, government and community that the success of its program will be judged.

Internal management of the NSC-WEC' agreement is somewhat diffuse. One full time position and a small fraction of the Director General position are funded under the agreement. It was often difficult to trace the management strands of this agreement out to the people, programs, and activities comprising the LAMP. Why? Much of the program uses training for impact, and this is best assessed in behavioral terms such as preparedness and response effectiveness. Also, it was sometimes difficult to determine how well the relationships with NSC's clients were being managed, since these could not always be determined from the intended results. Nevertheless, the management of the agreement overall seems to work well. Training courses appear to be well promoted and delivered on time. Arrangements for the evaluation visit were thorough and efficient and a reasonable balance was kept between the professional and interpersonal.

The Manali-Ennore program, coordinated primarily by the safety engineer of ICI, is facilitated in a dynamic, committed and empowering manner. Of the two components, this is the one further along in incorporating community members into the awareness part of the program and into actual participation in the exercises and the coordination of preparedness activities.

To the extent that NSC has played a role in supporting this individual, it deserves credit for good management.

One aspect of overall management that was not self-evident was the capability of NSC to plan systematically the mid-to long-term intended results of the LAMP. A plan per se was not readily available and when something was produced it consisted of only a list or series of activities through 1994. It did not state purposes, intended results, and some idea of how activities linked to purposes. Nor did this list suggest if and how monitoring of the activities would be achieved.

It was not clear how much detailed support WEC-Washington has provided NSC in planning its program so as to ensure that intended results are achievable. WEC has been given considerable support by OFDA in developing a performance monitoring plan; however, that any of this planning process was shared with the NSC was not evident.

Another area where WEC support of NSC was unclear was in helping NSC to deal with such important constraints to program success as the difficulty in incorporating potentially vulnerable community members or residents into the industrial estate preparedness programs. Several relevant approaches to community participation in socio-politically developing country settings exist and could be shared with NSC. However, some social science orientation to such approaches and their application is preferable.

## 2. Mexico

One can only be impressed with the excellent relations between WEC-Mexico and the governmental sector at the national, state and municipal levels. The agreements with national and state governments discussed earlier are a testimony to these highly positive relations. One element of WEC's effectiveness in dealing on a collegial basis with government and the private sector is due to WEC's non-political and non-profit status, which allows it to play a mediating/facilitating role without having its motives be "suspected" by either.

WEC-Mexico is staffed by the country director (who doubles as the LAMP program coordinator), a program assistant assigned to LAMP, a full time secretary, and a part-time intern from the university who assists the LAMP and who is presently carrying out a risk analysis study for WEC. This small group is dedicated, highly motivated, and very productive. An example of their attention to detail is the very thorough briefing book prepared for this evaluation, including a clear statement of where they see the need for WEC to strengthen its support. In addition, there was a refreshing openness by the WEC team to the evaluators' suggestions made during the exit briefing.

WEC's relationships with international bodies have been effective in developing a network of technically trained specialists nationwide. Links with, for example, UNEP, U.S. agencies including DOT, EPA, CDC, NOAA, as well as Transport Canada, and Texas A & M University are illustrative of its efforts to build such a network.

The WEC-Mexico staff was receptive to the thinking that a "technical fix" should not necessarily be the predominant approach to achieving the aims of LAMP. Citizen awareness and preparedness are essential elements in effective emergency planning.

### 3. Thailand

Thailand-WEC management of the LAMP is energetically and efficiently carried out by the LAMP project manager. While the legal and institutional profile for disaster management in Thailand would appear adequate, the actual situation is one of many constraints to achieving comprehensive emergency preparedness. It is against a tide of complex political-bureaucratic constraints that WEC, as an admittedly minor catalyst, must struggle. For reasons not fully understood by the evaluators, WEC does not appear to have much interaction with the major players in national disaster management, namely NESDB, NAPC, and EPP. Furthermore, it does not seem to have access to these players. Thus on the policy front WEC does not play an influential role in the dialogue about emergency preparedness. Neither does it appear to be a player at the national level in comprehensive emergency preparedness planning and response. For these reasons WEC-LAMP does not seem to have an impact higher than at the provincial or industrial estate level.

On the other hand, WEC-LAMP is playing a catalytic role in facilitating the emergency planning and response efforts on selected industrial estates, noted in detail in earlier sections. For that effort the project manager is to be highly commended.

In the absence of a performance monitoring approach, in which expected results are projected on at least an annual basis and monitored accordingly, the WEC-Thailand program employs the same technique as WEC-India--that of developing a list of activities. How these activities are intended to achieve presumed results is not apparent from anything the evaluators heard or saw. It is not suggested that results were not achieved; it is simply unclear how the activities are expected to add up to a regional impact on comprehensive emergency preparedness.

### III. PROGRESS TOWARDS PEOPLE-LEVEL IMPACT, INSTITUTIONAL EFFECTIVENESS, AND TECHNICAL FEASIBILITY

#### A. India

The present evaluation of the National Safety Council's implementation of the WEC-LAMP occurred only eight months following the effective date of signing the Memorandum of Understanding between the World Environment Center and the NSC. Therefore the Program is in the initial stages. For this reason the results of the evaluation of the India program are directed at supporting NSC and WEC in recognizing constraints and making appropriate adaptations based on an assessment of what is feasible, as well as building on activities and principles already deemed successful.

The findings presented in Chapter II should be viewed in the context of the important strides made in India during the last decade in emergency management for chemical events. The NSC has had a commitment to developing an emergency planning capacity prior to the WEC-LAMP grant. Centered in the NSC, with continued assistance from a variety of international sources, is a capacity to encourage individual corporations and the industrial areas at Thane-Belapur, Manali-Encore, and Kanpur and Cochin to prepare emergency plans. Implementation will require a number of far-reaching elements presently beyond the management capability of NSC, including: enforcement of several existing national laws on emergency management, land use controls around industrial areas, and critical road improvements. These external factors, while outside the scope of this evaluation, clearly affect materially the capacity to implement emergency plans and to respond effectively when emergencies occur.

#### 1. Emergency Planning Capacity

Building on the existing base of emergency preparedness, the NSC, through WEC-LAMP, has introduced a new emphasis on training and facilitating the relationship among industry, government, and to some extent non-governmental organizations in promoting emergency preparedness. In addition to an increase in on-site, company-level emergency plans, there have been some noteworthy achievements in off-site planning. Examples used earlier include awareness-level first responder training provided by one manufacturer in the Thane-Belapur area to 1,800 constables in an adjacent local jurisdiction and the publication of an off-site emergency plan sensitive to community participation by the Manali-Ennore emergency preparedness committee. While the first responder training example is not directly attributable to WEC-LAMP, it can clearly be tied to the APELL training of which the NSC is one of the major proponents. The off-site plan in Manali-Ennore benefitted directly from NSC's facilitating role.

The creation of a National Advisory Committee (NAC) under the Memorandum of Understanding represents, so long as the Committee remains actively involved in directing high level attention to critical emergency planning issues, a monumental step forward in the coordination of emergency management in India. This body has considerable potential to influence national policy and regulatory law pertaining to chemical hazard preparedness. While membership on the NAC includes top government officials and private sector representatives, as well as some officials responsible for first responder coordination, once again it is short on civic or citizen representatives.

## 2. Education, Training, and Information Dissemination

Probably the greatest progress by NSC is in the education and training part of the WEC-LAMP. Training has been provided for central, state and local government officials, professional groups, industry and trade unions, and to a lesser extent community members.

An area of training stressed by the recently constituted National Advisory Committee (NAC) and frequently raised in interviews but largely overlooked in education and training is the transportation of hazardous materials, often viewed as an element of off-site emergency planning. Considering the high volume of hazardous chemicals being transported over long distances throughout the country and the heavy loss of life that has occurred in highway accidents, the NAC feels that attention should be given to developing systems and capabilities to prevent and respond to emergencies occurring during transportation of hazardous materials.

It is too early in this program to assess in any definitive way the capacity to disseminate systematically the material developed by the NSC to date. However, the NSC and the NAC both have the capacity to circulate material widely. Considerations external to this review present daunting challenges, like the number of official languages and dialects, the high level of illiteracy, and population pressures. Nevertheless, the NSC has gone a long way in raising the consciousness of a growing number of influential public and private officials through its sponsorship of a series of workshops for both public officials and technical level personnel. It has also provided, in recent years, educational material for the general public in the form of public service promotion. The Director General of NSC also carries the message of emergency preparedness to international assemblies in India and abroad.

### 3. Industry/Public Sector/Community Response to Technological Disaster

At less than a year into the program, the capability to respond to chemical emergencies according to guidelines spelled out in such training programs as APELL and CEP, quite naturally, limited. Thane-Belapur Industries Association officials openly admit that they are only at the initial stage of building capacity to respond effectively to hazards. In response to the question "how effective are the educational programs in raising government, individual and community awareness in the essentials of technological accident prevention and mitigation?" the response was "poor." In Maharashtra State, where the Thane Belapur industries are located, 50 of the 215 factories with hazardous materials do not have on-site emergency plans. In Tamil Nadu, where the Manali-Ennore industrial area is located the record is somewhat better, of 48 factories 41 have on-site plans.

Off-site emergency planning is more advanced in the Manali-Ennore Industries area, it addresses some attention to the need of surrounding communities to be able to respond should an emergency arise. The three mock drills carried out there by the Emergency Preparedness Committee (EPC) over the past several years have been effectively executed and furthermore, used as learning experiences for updating off-site plans and improving subsequent drills. Representation on the EPC by local community leaders and officials, including the chairman of the local, voluntary Environmental Protection Association, is heartening.

### 4. Management

The effort of WEC and NSC to institutionalize awareness and response capability is only in its initial stages. The general structure of the program, namely the partnership approach, is the appropriate one, with the caveat that the community angle of the triangle needs more proactive attention from the NSC and more active and innovative technical support from WEC-Washington on approaches to community development (ones adapted to socio-politically sensitive conditions). Even within the industrial estate association committees themselves, the evaluators met individuals with creative ideas about how to incorporate residential communities into off-site planning and response (e.g., Dr. S.L. Patil, TBIA and Mr. R. R. Umakanthan, Co-ordinator, Manali-Ennore Industries Emergency Preparedness Committee and Manager, Safety, ICI India Ltd., Ennore Works).

The existence of the National Advisory Committee offers the possibility for NSC and its supporters to become a major player in the national emergency preparedness movement. Opportunities to promote first responder training of fire and police and medical and other local community officials are present, as are

those to promote citizen participation in off-site response planning and implementation. There are also possibilities of raising to national policy levels the institutionalization of off-site response guidelines, based on the growing experience from Manali-Ennore and, less so, from Thane-Belapur, as well as on standard practice in other countries. And, though it is somewhat outside the scope of the WEC-LAMP, the opportunity is available to influence a policy dialogue on such important matters as:

- legislation for hazardous waste disposal,
- enforcement of emergency preparedness regulations,
- use of the UN hazmats placarding system with training for operators of hazmats vehicles, and
- land use practices to control the settling on hazard vulnerable areas by (usually) socio-economically disadvantaged people.

## B. Mexico

Emergency preparedness for technological disaster in Mexico is well along the path to development. The appropriate legislation is in place, rules and regulations are present, and a culture of disaster awareness is present. The government has all the best intentions and the right mind set; however, in the cases observed by the evaluators, it had not made available the resources--especially material resources--to implement its program. Industry also shares a "culture of awareness" and a well-trained emergency personnel. In contrast to government, industry does have emergency preparedness plans and most of the necessary material resources to deal at least with on-site technological accidents. It is within this context, as a facilitator, that WEC works.

In promoting the implementation of agreements with national and state government, WEC has helped to advance the action of preparedness. The agreements, on one level, give WEC the leverage to request that government live up to fulfilling its commitment. On another level, and perhaps more importantly, they give WEC the vantage point from which to work openly and (it fully appeared) cordially with government emergency officials. These agreements put this WEC-LAMP Program in a particularly good position to achieve long-term impact.

### 1. Emergency Planning Capacity

Mexico possesses many of the elements of emergency preparedness which, if built upon effectively by WEC-Mexico in the next several years, could assure a sustained impact of the LAMP program. Among the favorable factors are:

- the presence of a culture of disaster awareness in the Nation
- skilled and committed officials at both the national and state levels
- competent and dedicated personnel in the plant safety field
- a rational civil protection plan imbedded in law and policy
- an environment that is opening to unification of and more serious application of regulations pertinent to hazardous materials transport, in part as a result of the North American Free Trade Agreement
- an impressive fact finding source and concern for preparedness in the National Center for Disaster Prevention
- significant agreements between WEC and the national government and one critical state government
- a WEC-Mexico staff which in every respect appears competent and which has excellent relations with relevant government agencies and industrial officials

Lacking however is any mechanism to ensure the continuation of these efforts once the WEC funding has expired.

## 2. Education, Training, and Information Dissemination

WEC-Mexico's contribution to the training of government and industry officials has been a true stimulus to the growth of a professional body of emergency preparedness experts. Some of this training WEC has implemented in its top flight seminar room in its office in Mexico City. WEC has also produced some excellent video training tapes for use in disaster management planning and emergency response.

As a sign of WEC's growing expertise in providing assistance in emergency preparedness (a significant part of which derives from its workshop and seminar training program) there has been considerable demand for it from five or six states. Based on these states' knowledge of WEC's work in Veracruz state and on their knowledge of the risk of heavy petro-chemical industry concentrations in their own states, they have requested WEC to plan assistance.

WEC as well as others is fully cognizant of the absence of training at the awareness and the operational levels for first responders. This is a shortcoming that needs attention. The Center for National Disaster Prevention (CENEPRED) is also acutely aware of this shortcoming and has suggested that there exists an excellent basis for cooperation between itself and WEC to train first responders. The evaluators agree with this suggestion.

One issue arose from industry officials, who complained openly about that they feel they are placed in the position of having to

pay for the cost of government officials' attendance at WEC-sponsored courses.

National government and Veracruz State Government both have programs for periodic, systematic dissemination of public safety information. The Center for National Prevention of Disasters also plays an important role in raising awareness of the public to its role in evacuations. The agreements between national and state government and WEC to provide emergency planning and response support represent an excellent possibility to promote public participation. Clearly at the local or municipal level, based on what the evaluators saw, there is a need to promote a much higher level of public awareness than that which currently exists.

Considering the close proximity of Coatzacoalcos to a major petro-chemicals production site, there is a striking absence of awareness of--much less preparedness for--an eventual chemical emission. That situation represents a clear opportunity for the unity of local and state government, the industrial safety sector, and WEC-Mexico in addressing public vulnerability.

To show its commitment to the need for more and better information on technology-related accidents, WEC is developing a clearing house for such information.

### 3. Industry/Public Sector/Community Response to Technological Disaster

WEC-Mexico has made headway in promoting the linkage between industry, public sector and the community. Its formal agreements with national and state governments speak well of its relationships, as does its work with the CLAM and CRIS groups. WEC also has developed an effective link to Mexico's chemical manufacturers' association or ANIQ. WEC also has excellent ties with university chemical engineering professionals and with the prestigious CENEPRED.

On the operational level, WEC has supported the completion of three on-site and one off-site mock drills. While on-site drills incorporated industry safety personnel, the off-site drill included local and state emergency responders and encompassed an area of significant population concentration. WEC recognizes that local governments are not well prepared in emergency preparedness, especially in matters of evacuating the community from affected areas. One example raised by several officials was Guadalajara, where a chemical fire and explosion in underground pipes resulted in many deaths. Evacuation procedures were not employed in that most unfortunate accident.

Another constraint is that a large number of companies in Veracruz state are still at risk to fire and contamination. WEC

is aware of this situation and has already shifted its focus from large national and multinational firms to mid- and small- sized firms.

A very important issue which WEC has indicated its intention to address is the absence of an effective working relationship at the local level with the industrial sector on the one hand, and citizen and governmental sectors, on the other. Companies often serve as a substitute for local emergency authorities, including provision of fire fighters and paramedics, especially in hazardous materials accidents. This problem is compounded by the fact that changes in political leadership result in rapid turnover of civil protection authorities, at all levels. The lack of continuity in emergency authority sometimes contributes to a diluted commitment to emergency preparedness and an absence of professionalism among emergency management officials. In the case of Coatzacoalcos, the result was a lack of trust between the municipal authorities and industry-based CRIS and CLAM response groups. Another manifestation of the politicization of emergency management positions is that while there are professional, technical and financial resources at the state level, such do not exist at the local level where the first response occurs.

#### 4. Management

WEC-Mexico is a well organized and managed office and is highly committed to its purpose. Similarly for the other WEC country offices, it also needs to engage in more strategic planning, defining its intended results, developing measures so it knows when it has achieved its purposes, and generally be able to focus its resources so that it knows how the different pieces of its program add up to a sustainable emergency planning and response capability. Such planning would allow WEC-Mexico to improve its problem solving capability, pick out areas in need of greater or lesser support, and more effectively concentrate its efforts.

#### C. Thailand

Since the WEC-Thailand LAMP Program has only a year remaining, this section is adapted to helping locate WEC's competitive edge in creating impact in the time that it has left. A critical constraint for this program, as stated previously, is its limited access to national players in the disaster management arena. The evaluators were unable, due in part to certain sensitivities, to explore with any consistency why that is the case.

##### 1. Emergency Planning Capacity

The impact of WEC-LAMP on emergency planning capacity has been that of a catalyst at the estate and, less so, the provincial and

local levels. One of two major estates that WEC is assisting, Map Ta Phut, has organized sufficiently well to have carried out a well-publicized mock drill with national recognition. NESDB was attributed with the success of that drill, but WEC played a facilitating, though admittedly modest role.

WEC has begun an organized effort in emergency preparedness with the Bangpoo estate authorities. There are several constraints at the national level to preparedness. Until those national agencies whose responsibility it is to manage disaster planning and response have unified their forces, the emergency planning capacity of the chemical industry will most probably occur on a piecemeal basis. However in the evaluators' view, had the WEC-LAMP Program had access to the critical national disaster management agencies, thus allowing it to play its professed non-politicized facilitating role, it could be demonstrating greater impact than it appears to have had.

## 2. Education, Training, and Information Dissemination

WEC-LAMP has implemented a number of training workshops and courses that have been instrumental in promoting capacity building among plant safety specialists, some local authorities, and first responders. For selected Map Ta Phut estate company safety personnel, some local emergency responders, and local government officials, the WEC-supported training has been one of the instrumental sources for preparing that estate to carry out the important simulation of July, 1994. To the extent that it can continue that impetus in Bangpoo, it could produce a similar result there. The remaining time for the program (September 1995), however, may not allow it to complete that effort. There is some possibility for a regional approach to training first responders in CAMEO, which may represent an effective strategy in the remaining time.

Within the confines of its provincial-industrial estate influence, WEC has provided a useful role in stimulating increased knowledge of emergency planning and response. Even within that sphere of influence, it is not clear what portion or degree of preparedness and awareness is a function of WEC's catalytic role or to other actors and forces. In the area of public awareness WEC has not been successful in bringing the citizenry in general or vulnerable communities in particular into the triangle of trust mandated by APELL. Awareness of the public and, more specifically, of vulnerable populations has not benefitted from participation in training and, therefore, on the whole are unprepared to respond to chemical accidents. This is an area that no one organization or group in Thailand for that matter has been successful in penetrating. Nevertheless, WEC-LAMP has in a limited fashion spread the message of preparedness to certain arenas, such as the industrial estate and among local authorities. Under the circumstances, it can probably only be

expected that WEC will have its remaining impact in disseminating preparedness information in a limited sphere of influence.

3. Industry/Public Sector/Community Response to Technological Disaster

The beginnings of a response capability to chemical emergencies in Thailand exist. The strongest aspect of this capability is the industrial, which will probably allow for adequate on-site responses. For off-site response, given the experience with local authorities and in the absence of significant community participation, that capability needs considerable strengthening. While the Map Ta Phut off-site mock drill appeared to be successful, it also drew attention to some weaknesses. For one, there were gaps in the early communications between provincial and district authorities; for another, community participation in the drill appeared to be a one-time event, with few if any plans to provide further promotion of awareness. However, it is noted that the role of such drills is to uncover just these kinds of problems.

4. Management

Management of WEC-LAMP has sensibly focused its energies on activities at the industrial estate and provincial and district levels. Given this orientation, the functioning of management is productive, though the single-handed role of the project manager results in his being overworked. It seems that his burden would be significantly lightened were he able to draw upon the major, national disaster management players. Since the project manager does not appear to have the necessary access, it is unclear whether or not he can obtain it, and therefore, for the instant, WEC's impact will probably only occur at sub-national levels.

#### **IV. LESSONS LEARNED**

Lessons learned are generalized for all three countries, as well as abbreviated. Many have been alluded to earlier. Some are probably self-evident.

##### **All Things Are Not Equal Between the Countries**

Different levels of socioeconomic and technological development characterize India, Mexico and Thailand. Thus the LAMP interventions have to deal with very different conditions of technology, political organization and culture, language, and sociopolitical sensitivity to the public's right to know, among others. A meaningful comparison of the three country programs is therefore not warranted.

##### **The Technical Fix Versus Social Developmental Inputs**

However, it can be said, regardless of different levels of development, that none of the three countries warrants a predominantly "technical fix" to its need for emergency preparedness. Granted, the stature of a chemical engineer, the technical background shared by almost all WEC country program staff, is probably necessary in these societies to gain access to officials dealing with chemical accidents. As shown earlier, though, for these programs to have impact on higher purposes, they require more than a technical solution. Thus the recommendations of the next chapter are often oriented to the sociopolitical understandings and interventions necessary to bring these programs to their intended ends.

##### **Where the Rubber Hits the Road**

The technical fix sometimes overlooks people in the process, especially the at-risk populations, indeed, those who most "need to know." In the three countries, the people who need to know are the affected population and the first emergency responders, who have often been found not knowing what to do in the case of a chemical accident. The recommendations that follow focus on training and awareness for those who are most likely to arrive at or live near where the emergency occurs.

##### **Results Do Count**

USAID's approach to strategic planning and performance monitoring does help in achieving results. This approach has been very useful in this evaluation of the WEC-LAMP Program and would be equally valuable to the management of WEC activities both in Washington and in the host country.

## V. CONCLUSIONS AND RECOMMENDATIONS

Conclusions and recommendations are presented for each country program separately. They are abbreviated, since most of their origins and implications have been discussed above. Before presenting these, however, two major conclusions applicable to the overall WEC-LAMP Program are highlighted below.

**Conclusion 1:** Most of the training provided has been appropriately directed to the management and technical domains, an important focus. Insufficient attention, however, has been given to training or technical assistance in developing a corps of trained emergency responders either through a train-the-trainers approach or otherwise. This is due in part to a top-down orientation in the three countries, but also because of a lack of assistance from WEC-Washington to the three countries in coming up with practical ways of addressing this important constraint.

**Conclusion 2:** In all three country programs there is no significant encouragement to enroll the community-at-risk as an equal partner with industry and government in the chemical emergency planning process. Furthermore, there is no evidence that WEC-Washington has in any significant manner encouraged the correction of this shortcoming through technical assistance of community development or social science experts, including members of active local emergency planning committees in the U.S.

**Recommendation:** WEC-Washington needs to develop an action plan to confront these two issues head-on and promptly. A training of trainers program for first response is most probably within the management capability of WEC. A citizen awareness program which calls on local community development expertise is also actionable in the immediate short term and within WEC's capacity.

### How To Interpret the Recommendations

The following recommendations are prioritized in numerical order. Some are actionable immediately; others in the mid-to-long term. Furthermore, while many of the recommendations are actionable by WEC-Washington or WEC country offices alone, others will require leveraging from additional players in the "partnership."

#### A. India

##### 1. Emergency Planning Capacity

**Conclusion 1:** There is a significant number of factories on industrial estates processing hazardous materials, but not yet having on-site emergency plans. There is also a growing

recognition that the completion and testing of such plans should be a high priority.

**Recommendation 1:** The National Safety Council should advise industrial estate associations on the need for their members to develop scheduled reviews and test the written on-site plans with table-top and full-scale field exercises.

**Conclusion 2:** There were frequent and consistent complaints that the state and national governments fail to enforce laws which are already on the books to protect the public from hazardous materials accidents.

**Recommendation 2:** Technical assistance should be provided by WEC to enhance the efforts already initiated by NSC to improve enforcement of these laws.

**Conclusion 3:** There is no national or state record of the hazardous substances stored, used or discharged into the land, water or air of India.

**Recommendation 3:** As a long range objective and therefore perhaps beyond the manageable interest of NSC, that organization, through the National Advisory Committee, should foster enactment of legislation for a national inventory of toxics processed, stored, and transported. (Among other benefits of reporting emissions is that it might encourage manufacturers to find recycling uses for chemicals now regarded as waste.)

## 2. Education, Training, and Information Dissemination

**Conclusion 1:** There are widespread concerns that publicized hazard information could cause panic among residents near hazardous manufacturing. In fact, several incidents are sighted where rumors actually caused panic evacuations. This is an area which requires attention, though one that clearly needs to be approached with sensitivity.

**Recommendation 1:** With assistance from WEC-Washington, NSC should accelerate its program to give citizens an awareness of the risks of chemical hazards. Included in this program would be information for citizens on the rational steps that they would need to take to protect themselves from such hazards.

**Conclusion 2:** One of the greatest concerns of industry, government, and NSC officials is the large and increasing number of highway hazardous materials accidents.

**Recommendation 2:** NSC and the WEC-LAMP program should facilitate the provision of assistance, from an agency such as the U.S. Department of Transportation-Federal Highway Administration, in designing a training program for drivers of

hazardous materials transport vehicles. This should include as a major component first responder for hazmats highway accidents.

**Conclusion 3:** Awareness level training of first responders such as Herdillio Corporation provided to police constables was well organized and appropriate as a beginning step in training for first responders.

**Recommendation 3:** Comprehensive training of first responders should be designed and implemented, using a community-based, train-the-trainers orientation. Such training should first be made available to the operations level.

**Conclusion 4:** At the present time there is seldom placarding of vehicles carrying hazardous chemicals.

**Recommendation 4:** The National Safety Council, through its role on the National Advisory Committee, should facilitate discussion at the national level leading to the full adoption and eventual enforcement of the United Nations system of placarding hazardous materials transport vehicles. Drivers and first responders should, at the same time, be trained to respond effectively when chemical accidents occur.

**Conclusion 5:** As individual fire brigades are supposed to receive the material safety data sheets (MSDS) from their authorities, to ensure this is happening NSC has requested that the industrial sites distribute these to local fire brigades.

**Recommendation 5:** An MSDS distribution procedure should be routinized at least for the estates NSC is working with, and through the NAC this procedure should be established nationwide.

### 3. Industry/Public Sector/Community Response to Technological Disaster

**Conclusion 1:** Although there is considerable resistance to community participation in emergency preparedness and response, personnel working on technological emergency management are grappling with the issue of citizen involvement in the planning process.

**Recommendation 1:** The LAMP Program should pursue the objective of direct citizen involvement in the planning process and support communities near industrial areas in developing written community response plans, including hazardous transportation spills. Teams of teachers, social workers, health workers and community leaders should be enrolled in a train-the-trainers program aimed at citizen education and participation. Initiative for this component for each of TBIA and MEIA has already been taken by the physician who is Secretary of TBIA and the Director of Safety for ICI and head of TBIA's emergency committee.

**Conclusion 2** The Collector or District Commissioner presently has executive management responsibility for off-site emergency planning. Since the Collector is usually occupied with other matters, such emergency planning for off-site chemical disasters often suffers. Given this gap the NAC had already proposed that a Deputy Collector be assigned for off-site emergency planning and response.

**Recommendation 2** Such a deputy should be charged with responsibility for off-site planning and testing of written plans. He or she should be required to have up-front intensive training in emergency planning and preparedness. District offices should have written emergency plans, which should be drafted, revised, and tested with table top and full field exercises and with full participation of the deputy as the incident commander.

**Conclusion 3:** The Director General of NSC expressed concern over the adequacy of the medical system to respond effectively to chemical related accidents.

**Recommendation 3:** WEC-Washington should organize a U.S. emergency medical support review by physicians, who are experts in industrial/emergency medicine, to work with a team of physicians serving the industrial estates of India.

#### Management

**Conclusion 1:** Managers of the LAMP program for both industrial estates are anxious for and open to advice and assistance in incorporating public participation into their activities.

**Recommendation 1:** WEC-Washington should immediately provide to both LAMP programs expertise and knowledge of approaches to participation or community development. Such approaches should reflect the perspective of both developing and developed countries. WEC should actively promote participation, in association with training of trainers in emergency awareness and preparedness, using appropriately sensitive social input. Furthermore, WEC-Washington should systematically provide social science input to its country program, since the technological core of the program is inadequate to deal fully with critical human dimensions of the program.

**Conclusion 2:** While technical assistance to WEC-Washington in performance monitoring/managing for results has been rendered, this approach seems not to have been absorbed by field teams (though more of a sense was present in Manali-Ennore than Thane-Belapour). What was observed was a form of program planning based more or less on a list of activities completed or to be completed. But what was absent was a sense of how these add up to program level impact.

**Recommendation 2:** WEC-Washington should encourage an approach to chemical emergency planning and response that targets specific achievements for specific times.

**Conclusion 3:** Field staff are often aware that state-of-the-art written materials on various aspects of emergency management exist, but, during the course of their work, they do not have ready access to them nor do they have immediate access to new materials.

**Recommendation 3:** WEC should periodically alert implementers of the LAMP program of the availability of new materials including computer programs.

## B. Mexico

### 1. Emergency Planning Capacity

**Conclusion 1:** There is an absence in Coatzacoalcos municipality (where a large proportion of Mexico's petrochemical production lies) of either a comprehensive written emergency plan or cooperation between municipal and industrial emergency response authorities. In fact there was clear evidence of a strong tension between these parties.

**Recommendation 1:** Using the immediate necessity for a written, community-based emergency plan for Coatzacoalcos community, WEC should become the stimulus and facilitator of a rapprochement between municipal and industrial authorities. It should do this through facilitating the cooperative development of a written emergency plan by municipal officials, state civil protection authorities, and industry safety personnel, including members of CRIS and CLAM.

### 2. Education, Training, and Information Dissemination

**Conclusion 1:** First responder capabilities are a constraint to effective emergency preparedness and response, in part due to the lack of adequate material resources and training.

**Recommendation 1:** WEC should facilitate strengthening of a first responder capability by targeting the train the trainers method to emergency authorities at municipal (starting with Coatzacoalcos) and state levels (Xalapa, Veracruz), and where necessary to industry. Initial training should devote 4-8 hours to awareness, followed by more extensive training in on-site operations. The cost of training should be co-shared by government and industry. A prestigious national level institution such as CENEPRED should be invited as a cooperator.

**Conclusion 2:** There is a relative lack of skills in hazard analysis, vulnerability analysis, and inventorying of response resources in the country at large.

**Recommendation 2:** WEC should promote and, where possible, facilitate ongoing training in these areas.

**Conclusion 3:** CAMEO and ALOHA, both important operational and training computer tools in emergency preparedness, are as yet not available in Spanish.

**Recommendation 3:** WEC promptly should avail itself of the Spanish language edition of CAMEO when the translation is completed by the Information Management and Program Support staff of the U.S. EPA .

**Conclusion 4:** No inventory of hazardous materials is readily available to public authorities.

**Recommendation 4:** WEC should promote the development of an improved inventory of hazardous materials for increasingly encompassing areas of the country, including a toxic release inventory, a better statistical base, and improved commodity flow data. Its relationship with ANIQ and national government officials should facilitate this effort. Government should not expect the private sector to assume the full cost.

#### Industry/Public Sector/Community Response to Technological Disaster

**Conclusion 1:** There is an absence of regional operations centers capable of responding to emergencies.

**Recommendation 1:** WEC should promote the development of regional operations centers, each with a strong emergency medical capacity, in areas of high petrochemical production. It should start with a center to be located in the southern zone of Veracruz (including Coatzacoalcos), for which to implement a comprehensive written emergency plan.

**Conclusion 2:** Social science inputs are missing from the WEC-Mexico LAMP Program. This diminishes the achievement of one of the important purposes this program: to prevent and to mitigate accidents and, ultimately, to save lives.

**Recommendation 2:** WEC should seek a social scientist or other professional, who is sensitive to the critical importance of citizen awareness and participation in emergency preparedness and response, to advise the LAMP Program. This person should have hands-on experience in community development and be able to deal with public and industrial officials on the sensitive issues of comprehensive emergency management.

**Conclusion 3:** Simulation exercises need to be carried out more often so as to update and maintain comprehensive, written emergency plans in a state of preparedness.

**Recommendation 3:** WEC should promote simulated emergencies, using the Coatzacoalcos emergency plan, once it is drafted. After the written plan has been tested by simulations, it should be updated and revised as necessary.

**Conclusion 4:** On April 7, 1993, Mexico enacted its first comprehensive hazardous materials transportation law entitled, "Regulation for Surface Transportation of Hazardous Materials and Wastes." This regulation is now being augmented with Official Mexican Standards (NOMS).

**Recommendation 4:** This law now needs to be implemented and reinforced through increased first responder applications.

#### 4. Management

**Conclusion 1:** The continued absence of a strategic planning and performance monitoring approach to management will diminish WEC-Mexico's already significant successes and its overall capability to achieve its intended long range improvements of emergency management.

**Recommendation 2:** WEC-Washington needs to support its Mexico country office in learning how to plan strategically, develop meaningful indicators, and systematically monitor performance.

**Conclusion 2:** One operational problem discerned was the lack of a permanent WEC office, which could adversely affect the project's efficiency.

**Recommendation 2:** To the extent feasible, some arrangement for a vehicle should be considered.

**Conclusion 3:** WEC-Mexico has no mechanism for sustaining the project after WEC funding has expired.

**Recommendation 3:** WEC-Mexico should review options to assure continuation of the program, including the possibility of convening a group of civic leaders to help sustain the program.

#### C. Thailand

##### 1. Emergency Planning Capacity

**Conclusion 1:** Not all firms on the estates visited had prepared on-site emergency preparedness plans.

**Recommendation 1:** WEC-Thailand, through its association with the industrial estate chemical clubs should encourage greater on-site chemical emergency planning.

**Conclusion 2:** Managers of the industrial estates visited expressed their desire to involve the community in emergency preparedness planning but are uncertain how to proceed.

**Recommendation 2:** WEC-Washington should facilitate provision of a safety/community development specialist with experience in international development who has effectively addressed community participation in emergency planning and response in a developing country, to work with the IEAT and the Chemical Clubs to foster hands-on public participation in emergency planning and response.

**Conclusion 3:** There is no national or state inventory of the hazardous substances discharged annually into the land, water or air.

**Recommendation 3:** As a project objective WEC should take up the challenge to make inroads at the national level by fostering a national dialogue on the enactment of legislation for a national inventory.

## 2. Education, Training, and Information Dissemination

**Conclusion 1:** Petrochemicals processed on IEAT estates generate a significant proportion of the hazardous materials transported on Thailand's highways; for most of these materials there is insufficient information on managing hazmat accidents.

**Recommendation 1:** WEC-LAMP should facilitate for at least the two estates with which it deals directly (and perhaps for the others) and for highway police charged with vehicle safety enforcement, an accelerated program of first responder awareness training. WEC should also work with the estates and related hazmat carriers to provide driver awareness training and support for placarding vehicles. Once a better data base has been created, WEC should promote implementation of commodity flow studies for all the estates.

**Conclusion 2:** Evaluators found a strong expression among plant safety personnel and government officials of the need to train medical emergency response personnel.

**Recommendation 2:** WEC-LAMP should consider the feasibility of promoting a training program for medical emergency response personnel, such that hospitals can improve their readiness and preparedness in treating industrial accident victims. Training should take place initially in the immediate areas of the two estates and subsequently on a regional basis, perhaps in concert with the other relevant IEAT estates.

**Conclusion 3:** Because the application of CAMEO in various emergency preparedness settings has been successful, the WEC-LAMP program manager determined that further dissemination of CAMEO will be one of the main thrusts of the final year of the program.

**Recommendation 3:** WEC-Washington should take steps to assure the early availability of the modified CAMEO package to the WEC-LAMP manager. Once available and translated to Thai, CAMEO should be targeted regionally to all relevant industrial estates and hospital emergency rooms.

3. Industry/Public Sector/Community Response to Technological Disaster

**Conclusion 1:** While an effective, broad-scale off-site mock drill was conducted for Map Ta Phut estate, a self-critique noted that the Instant Command System had broken down during the drill, the result of an organizational gap between the provincial and local (hospital and fire) authorities, as well as a technical gap due to the absence of a single radio channel having been made available for emergencies.

**Recommendation 1:** WEC-LAMP should take the lead (in cooperation with IEAT and Chemical Club member firms) in clearly communicating to the authorities the critical requirement for provincial and local authorities to coordinate emergency response communications, including dedication of a single emergency radio band. These authorities should be given explicit technical assistance in how to streamline the emergency communications process.

**Conclusion 2:** While IEAT management at both headquarters and individual estates expressed a commitment to public participation in emergency preparedness, the evaluators found little evidence for an estate-wide plan to include vulnerable communities in its preparedness planning (with the exception of the Map Ta Phut mock drill). Such a plan could contribute significantly to removing the Thai veil of secrecy about chemicals which minimizes public awareness of what it must do in the face of a chemical threat.

**Recommendation 2:** WEC-LAMP should provide technical support to Bangpoo Estate in developing a written emergency plan that includes full partnership of the surrounding community. The nearby Samat Prakarn municipality is an excellent place to start, given its sympathetic leadership and the presence of neighborhood groups which could serve as a pilot for increasing awareness; this is especially the case since about 60% of the Bangpoo work force lives in Samat Prakarn. Given the high local employment rate on the estate, on-site and off-site planning alike could proceed simultaneously.

#### 4. Management

**Conclusion 1:** It was observed that the WEC Thailand country office has little access to the top national players in disaster management.

**Recommendation 1:** WEC should try to make some input to, or even get membership on, the Committee for National Emergency Response, a national working group of 30 members whose charge is to support a national policy for APELL and, related, to unify rules and regulations for emergency preparedness.

**Conclusion 2:** While WEC-Washington was given substantial technical assistance by OFDA/PMP in the "managing for results" approach and in performance monitoring and reporting, it was not clear that WEC-Thailand had benefitted from this assistance.

**Recommendation 2:** WEC-Washington should make the commitment to imparting to the WEC-LAMP project manager the approach and its purpose; such assistance, while it may not seem as critical given the projected closure of the LAMP program by September 30, 1995, is important in terms of final assessment and reporting on end of project results.

**Conclusion 3:** It seemed to the evaluators that that there was insufficient interaction between WEC-LAMP and significant, national-level disaster management players. It was not possible, however, to ascertain that the development of the WEC-LAMP program by the WEC country office had in fact been encouraging, much less given approval by the national government.

**Recommendation 3:** For future projects such as LAMP, WEC-Washington needs to ascertain, and inform OFDA, that host country national government officials are supportive of the project concept and open to cooperation.

#### General Conclusion

As detailed in this report all three country programs have made contributions of considerable value to chemical safety. No doubt some of these achievements will have a favorable impact in the years ahead. A few fundamental questions remain, however, to be answered. How much momentum will be generated so that once the funding is concluded, continued progress in chemical emergency planning and response can be sustained? Furthermore, what is the appropriate structure to perpetuate the program's results? And, to what extent is the power structure, both political and industrial, committed to improving the planning and response? Experience with these issues could well have impact on OFDA's approach to future program proposals.

The evaluators found India's LAMP program the most likely to continue to have impact in the future. Prior to LAMP the National Safety Council (NSC) had an independent corporate existence and considerable experience with industrial safety programs. Although the assistance from WEC-Washington has been valuable, NSC is not dependent on WEC for its existence. Additionally, the NSC has played a major role in the creation of a National Advisory Council, of which highly ranked members of business and government are members. It is reasonable to expect that this Council will encourage a sustained commitment to comprehensive emergency management.

In Mexico, the two agreements WEC has signed with government in addition to the presence of a culture of disaster awareness hold promise of a long range impact of LAMP. The vigor and commitment of the WEC-Mexico staff is another favorable element.

Notwithstanding the energetic commitment of the WEC project manager, WEC-Thailand does not appear to have either the inroad to high level national officials who make disaster management policy nor does it have a strong corporate structure. Its chance of having a long-term impact on national chemical safety is therefore limited. Clearly, its effects will be felt by the industrial estates and selected municipal and provincial government agencies with which it works directly.

Finally, given OFDA/PMP's commitment to performance monitoring and reporting, it should request that WEC develop an action plan to address the priority issues raised in this evaluation. Secondly, it should request that WEC, through its periodic reporting, demonstrate progress toward responding to the priority recommendations.

All in all, it is certain that all three country programs have made significant progress in the technical area of emergency preparedness. While technical progress should continue, if the program is to achieve its full impact, it now must shift its focus to the social and community development area. By encouraging public participation in the planning, the program will not only be more likely sustainable, but also, OFDA's strategic objectives of saving lives, reducing suffering, and diminishing property loss will have a greater chance of being fulfilled.

## Annex 1

### Indicators of Chemical Emergency Preparedness

The following indicators are offered to LAMP program managers and industry or government emergency preparedness officials as an example of the kinds of measures used to determine if targets are being met. Stated in the form of questions, the indicators are listed under achievement levels defined as goal, program objective and outcome. Goal is usually achievable in a 10-year or more time span, objective in 4-7 years, and outcome, 2-3 years.

#### LAMP Goal Level Indicators (10 yrs+)

- To what extent has the project reduced loss of life, injuries and damage to property

#### LAMP Objective (Program) Level Indicators (4-7 yrs)

- Have all personnel who are likely to be first responders been adequately trained
- Have individual on-site plans been subjected, at least on a sampling basis, to performance audits, and has the number of factories without on-site plans been reduced
- Has a local written comprehensive plan been drafted in which government, industry and the affected community actively participated
- Have unusual hazards such as hazardous roads, absence of alternate escape routes and lack of appropriate exit gates been identified and remedial steps taken
- Has the UN placarding system been implemented for all vehicles carrying hazardous materials

#### LAMP Outcome Level Indicators (2-3 yrs)

- Has a first responder "train the trainer" program been instituted for health, police and fire personnel
- Have first responders been trained in CAMEO, to the extent that computer software is available, and has the local site information been input to CAMEO to secure maximum benefit from this program
- Have chemical emergency committees been organized for individual estates and/or communities that include a cross-section of first responder personnel, community representatives and health experts
- Have such committees, with full participation of members, developed and maintained an up-to-date chemical emergency plan that defines hazards, vulnerabilities, response and medical resources, plans of action and up-to-date notification procedures
- Have such committees held tabletop, functional and full

field exercises with appropriate debriefings or written evaluations

●Have on-site emergency plans been tested

●Are up-to-date inventories of hazardous chemicals kept in a central location

●Following field exercises, have written evaluations been prepared and steps for improvement been scheduled

●Has a commodities flow study been undertaken to determine the type and volume of hazardous materials being transported on highways

●Are mutual aid pacts adequate for worse-case scenarios

●Is there a formal channel, such as a quarterly newsletter, to disseminate information to the major industrial sites in the nation

●Has the possibility of flooding been considered in locating industries that use hazardous chemicals

●How many truck operators are trained in how to handle an accident involving hazardous materials

●Has a routine procedure been instituted to assure that police, fire and medical personnel have timely access to MSDS's

## Annex 2

### Persons Contacted

(Uncorrected)

#### INDIA

Arunachalam, D.	General Manager (Works) Tamilnadu Petroproducts Limited Madras
Bhanushali, Ramesh P.	Deputy Director (Safety) National Safety Council, Bombay
Bir, T. K.	Administrative Services Manager Herdillia Chemicals Limited, Bombay
Gupta, K. C.	Director General National Safety Council, Bombay
Kolhatkar, M. D.	Fire & Security Officer Herdillia Chemicals Limited, Bombay
Mandke, A. P.	Thane Fire Brigade, Mumbra
Jayadevan, K.	Assistant Secretary Thane Belapur Industries Association New Bombay
Jeevanandam, G.	Senior Officer SRF Limited, Madras
Kannan, R.	Senior Manager - Technology CETEX Petrochemicals, Madras
Krishnan, L.	Deputy Manager (Safety) Tamilnadu Petroproducts Limited, Madras
Kumar, R. Ashok	Safety Consultant Essential Engineering Company, Bombay
Mande, P. R.	Manager - Safety, health & Environment Services Herdillia Chemicals Limited, New Bombay
Manvatkar, Nutankumar V.	Manager (Fire Services) Reliance Industries Limited, Surat District

Mirashi, H. N.	Director, Industrial Safety & Health Maharashtra State
Narayanan, N. R.	Vice President CETEX Petrochemicals, Madras
Parekh, Dinesh	Vice President Industrial Assoc., Thane - Belapur
Patil, Dr. S. L.	Physician, Sec'y TBIA
Patil, Visay B.	Assistant Technical Officer National Safety Council, Bombay
Philip, Pothan	Deputy General Manager - Engineering CETEX Petrochemicals, Madras
Pillai, M. Pazhaniandy	Chief Manager (Production) Tamilnadu Petroproducts Limited Madras
Dr. Rabatmathan	Medical Chief Manali - Ennore area
Rahgavan, P. K.	Purchase Officer Ashok Leyland Limited, Madras
Rego, A. J.	Joint Director National Safety Council, Bombay
Rohatgi, A. K.	Manager (Env. Control      Safety Training) Standard Alkali, Thane
Sadasivan, N.	Works Executive Bharat Pulverising Mills Ltd., Bombay
Sethuraman, S.	Assistant Executive (Safety) CETEX Petrochemicals, Madras
Sinha, V.	Advisor, Administration & Personnel Regional Labour Commissioner Central Bombay
Srinivasan, B. R.	Assistant Executive CETEX Petrochemicals, Madras
Srinivasan, V.	Deputy Project Manager World Environment Center
Sullivan, Paul T.	Latin America Program World Environment Center

Ulaganathan S. Deputy Manager (Safety)  
Madras Refineries Limited, Madras

Umakanthan, R. R. Coordinator  
Manali - Ennore Industries,  
Emergency preparedness Committee  
Manali-Ennore area

## **MEXICO**

Alonso, Sr. Jose Coordinator  
Troy Industries

Balcazar, Arturo Cortazar Ingeniero  
Ref Lazarocardenas

Bostelmann, Jan M. Pholenz Ingeniero  
I.C.B.

Carabias, Vicente Perez Director General  
Centro Nacional de Prevencion de  
Desastres  
Coyoacan

Catillo, Sr. Del Rosaro Llado Prevencion de Accidentes

Corona, Reynaldo Guerrero DIF Estatal

Fernandez, Georgina V. Jefa del Area de Riesgos Quimicos  
Coordinacion de Investigacion  
Centro Nacional de Prevencion de  
Desastres

Galmiche, Fdo. Mahana Ingeniero  
Fertimina S.A.

Gomez, Dr. Ines Socorro Jurisdiccion Sanitaria Xalada

Gonzalez, Moisas Capotillo Ingeniero  
Jefe de Oficina de Salud Ambiental y  
Ocupacional SSA

Hernandez, Jonathan Perez Second Inspector  
Asociacion de Jefes de Bomberos  
Profesionales de la Republica  
Mexicana A.C.  
Relaciones Publicas  
Xalapa, Ver.

Herrera, Hariberto Ingeniero  
Troy Industries

Herrera, Joaquim Reyes	CRIS, A.C.
Hdez, Jonathan Perez	IMSS (Bomberos)
Inigo, Bertha O. Rebonedo	Doctora ISSSTE
Kuri, Juan Gerardo Neme	Doctor CEMEU
Leal, Raul Garcia	Director General de Proteccion Civil Secretaria de Gobernacion Juarez, C.P.
Lopez, Fernando J. Vidal	Suptte. De Seguridad Control Ambiental y Capacitacion Cloro de Tehuantepec, S.A. de C.V. Coatzacoalcos
Lopes del Angel, Joel E.	Penex Petroquimica
Medina, Enrique Bravo	Director en Mexico WEC
Meriche, Miguel A.	Sales Nales?
Mendoza, Droceli Fernandez	Centro Sct. "Veracruz"
Mora, Dr. Eucario Lopez	Director del Hospital, Dr. Luis F. Nachin
Olvers, Gustsus Montero	Subdirector Medico ISSSTE
Perez, Eduardo Inacias	Jefe del Servicio Medico
Perez, Lydia Hdez	Doctora CRUZ ROSD
Pohlenz, Jan Michael	Suptte. Seguridad Industrial Control de Calidad
Portilla, Francisco Spinoso	IMSS
Puente, Luis Soria	Ingeniero Quimico National Center
Ruiz, Ruth Galvan	Jefa de Departamento de Salud Ambiental SSA
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**THAILAND**

Achasai, Payont                                      Section Head, Fire Fighting Section  
National Petrochemical Public Co Ltd,  
Rayong

Arromdee, Helen                                      Scientist  
Industrial Safety Division  
Ministry of Industry, Bangkok

Boonyanugraha, Paichit                              Director, Industrial Sarety Division  
Ministry of Industry, Bangkok

Carter, Frank    Managing Director  
Chemtrans, Samutprakarn

Chaikittiporn, Chalermchai                              Chairman  
Dept. of Occupations Health  
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Chayovan, Sarawoot, PhD.                              Deputy Governor (Administration)  
Industrial Estate Authority of  
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Hanpol, Tanya    Deputy Governor (Operation)  
Industrial Estate Authority of  
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Hollister, David    Program Coordinator  
Asian Disaster Preparedness Center  
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Jeggle, Terry    Director  
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Kitporca, Chaiamnuay                                      S Q & E Manager  
Siam Occidental Electrochemical Co.,  
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Petcharuttana, Prakob	Director National Petrochemical Public Co Ltd. Rayong
Preuttikul, Charas	Factory Manager W.R. Grace (Thailand) Ltd Samutprakarn
Senivongs, Chakthep	Project Manager World Environment Center, Bangkok
Shook, Gary	Program Coordinator Asian Disaster Preparedness Center Bangkok
Sripicharn, Chalot	Country Director - Thailand World Environment Center, Bangkok
Thewtanom, Narapote	Manager Office of the Bang-Poo Industrial Estate, Samutprakarn
Wongklahan, Wisot	Board of General Surgery Rayong Hospital, Rayong
Yadav, S. S.	Executive Director Controllers & Consulting Engineers Bombay

**Annex 3**  
**Itinerary**

**INDIA**

22 August 1994 - Monday

11H00 Meeting in the Council's Office

23 August 1994 - Tuesday

10H30 Meeting with the key officials of TBIA and representatives of MARG in the office of the TBIA

13H30 Lunch at TBIA

14H30 Visit to the Emergency Response Centre of TBIA and discussion

24 August 1994 - Wednesday

11H00 Meeting with the Thane District Collector (yet to be confirmed by the Collector)

13H30 Lunch at Herdilia Chemicals

14H30 Visit to Herdilia Chemicals to see and discuss the Emergency Preparedness activities of the Unit

25 August 1994 - Thursday

09H45 Attend inaugural function of the training course on "Chemical Emergency Preparedness and Response-- An Approach that Works" at West End Hotel, Bombay, and meet the participants.

17H40 Departure from Madras by Indian Airlines flight No. 173

19H30 Arrival at Madras

26 August 1994 - Friday

10H30 Meeting with Manali-Ennore Industries Association at MRL, Madras

14H30 Meeting with Emergency Preparedness Committee with executives of the industry in the Manali-Ennore

Industrial Area.

27 August 1994 - Saturday

10H00 Visit to ICI Otd. and discuss about te emergency  
preparedness activities of the Unit

20H15 Departure from Madras

**MEXICO**

03 October 1994 - Monday

Activities Presentation for the Period 1993-1994

Scope of the Agreements between WEC Mexico and  
Government Ministry and WEC Mexico and Veracruz  
State Government

Lamp Program Impact on Industry, Government and  
Community

Review of WEC Mexico's training material  
(handbooks and videotapes)

Future of LAMP Program (period 1995-1996)

04 October 1994 - Tuesday

Visit to Government Ministry building

Meeting in Federal Civil Defense Main Office

Meeting in National Center for Disaster Prevention  
(CENAPRED)

05 October 1994 - Wednesday

11H00 Meeting in Xalapa's Government Office

01H30 Meeting in Veracruz Ministry of Health

Presentation of Veracruz State Programs for Risks'  
Prevention and Mitigation at Local Level

06 October 1994 - Thursday

11H30 Meeting with Coatzacoalcos Emergency Response  
Teams (CRIS and CLAM)

01H30 Meeting in Coatzacoalcos Municipal Office with the State Civil Defense Representative

07 October 1994 - Friday

LAMP Program Final Review and Evaluation at WEC-Mexico Office

Comments and Recommendations from OFDA Staff

**THAILAND**

29 August 1994 - Monday

08H00 WEC-Thailand Office  
Meeting with Country Director: background introduction; summary of achievements/impacts

09H30 Leave for Ministry of Industry

10H30 Meeting with Director of Industrial Safety Division

12H00 Lunch with Mahidol University Professor (Industrial Safety Advisor for Map Ta Phut & Bangpoo Industrial Estate)

14H00 Leave for Rayong (220 Kms from Bangkok)

17H00 Check-in at Star Hotel, Rayong

30 August 1994 - Tuesday

09H00 Visit Thai Plastic and Chemical Company: discussion with Safety Manager/Assistant

10H30 Meeting with the Director of Map Ta Phut Industrial Estate

10H00 Meeting with the Director of Map Ta Phut Port

12H00 Lunch with Chairman of Map Ta Phut Safety Club

13H30 Visit Fire Training Center/National Petrochemical Company

15H00 Meeting with the Director of Rayong Hospital

16H00 Leave for Bangkok

18H30 Arrive at hotel

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31 August 1994 - Wednesday

08H00 Leave for Bangpoo Industrial Estate (40 Kms from Bangkok)

09H15 Meeting with City Manager of Samut Prakarn Province and Deputy Mayor

10H00 Visit Municipality Fire Brigade

10H45 Visit IEAT Bangpoo Office  
Meeting with Director of Bangpoo Industrial Estate

12H00 Lunch with key members of Bangpoo Safety Club

13H30 Visit ICI Asiatic (Agriculture) Plant  
Discussion with Chairman of Bangpoo Safety Club

14H30 Visit Chemtrans & Siam Occidental Electrochemical Company

16H00 Visit Samrong Hospital - Bangpoo Branch

16H30 Leave for Bangkok

01 September 1994 - Thursday

08H00 Leave for Industrial Estate Authority of Thailand (IEAT)

09H00 Meet with Deputy Director of IEAT & Director of Information Technology & Computer Application Center

10H00 Leave for Asian Institute of Technology (AIT)

11H00 Meeting with ADPC Coordinator (Asian Disaster Preparedness Center)

12H00 Lunch at AIT

14H30 Back at WEC Office

02 September 1994 - Friday

Leave for U.S.A

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## Annex 4

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#### INDIA

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