

A WHOLISTIC APPROACH TO DISASTER PREPAREDNESS AND MITIGATION
THE COSTA RICA EXPERIMENT

Costa Rica does not yet have a mitigation program, so I want to alert you that I am not here to present a case study of a successful mitigation program. My reason for being here is to describe the background and beginnings of a comprehensive preparedness and mitigation program which was initiated less than one year ago.

Although Costa Rica has a central planning unit, very little attention has been paid to land use. A number of professional engineers and academicians have had a genuine interest in mitigation for some time. However, those interested have usually not had the political muscle necessary to promote a program. Early efforts were primarily in the area of building codes and standards. The code which is currently in use was approved by the College of Engineers and Architects in 1974. The code was based on the assumption that the country was seismically uniform. The Costa Ricans now know that comprehensive study and research is necessary in order to develop seismic zonation.

Reforestation is the one area of mitigation which has been consistently applied in Costa Rica in recent years. Following the eruption of the Irazu volcano in 1963, and the subsequent mudslides, the Office of Civil Defense embarked on an intensive program of reforestation on the slopes of the volcano. That program has been continued for more than twelve years.

I. Introduction

1. General characteristics and history of hazards in Costa Rica.

Although Costa Rica is located in a zone of seismic faults and numerous volcanoes, there have been relatively few natural disasters of major consequences in the country. From 1900 to 1984, there have been only 2 serious earthquakes - Cartago in 1910 in which 1,750 people died, and again in 1952 in which 29 people died. In that same period, there have been 2 serious volcanic eruptions: Irazu in 1963, and Arenal in 1976. In recent years, there have been several minor earthquakes, but not in heavily populated areas.

Minor disasters, or emergencies, occur in Costa Rica with increasing frequency, and in many instances are either caused by human intervention, error, or carelessness. Flooding is a frequent problem and although occasionally beyond the control of man, loss of life and property could be reduced by proper planning or mitigation efforts.

Landslides are another frequent problem, and although they seldom result in loss of life, they represent a constant drain on the budget of the Ministry of Public Works. The combination of heavy rains and frequent minor tremors magnifies the problems created when roads are built in areas of precipitous topography susceptible to landslides.

Historically, disasters in Costa Rica have been the result of a combination of factors: the eruption of the Irazu volcano in 1963 created a series of ash dams in ravines on the slopes of the volcano. When heavy rains fell in 1964, great volumes of water were trapped in temporary lakes. After a time, the pressure became too great; the dams broke and triggered serious flooding below. This was followed by continuous mud flows for several days, causing enormous damage.

The earthquake of 1983, which struck the area of San Isidro del General, caused only limited direct damage to physical structures. No one was killed, and there were few serious injuries. The major regional hospital was damaged, as were some homes, churches and schools. However, of a more serious nature were the landslides which blocked the Pan American Highway and several feeder roads.

As one examines the history of disasters in Costa Rica, it is easy to see that although numerous potentially catastrophic events did occur in the past, they were not disasters because there was no population in the area. However, as new penetration roads are built, and as new areas are colonized and urbanized, those previously harmless events can now become potential disasters when there is a population to be affected.

Traditionally, Costa Rica's approach to disasters and to planning for emergencies has been no different from any other country in the third world. Recurring economic and social problems are an ever-present reality, and no one questions the need to respond to those perennial needs. Disasters, however, occur infrequently, and many of today's planners and decisionmakers have never actually experienced a significant disaster.

2. Background of hazards mitigation program in Costa Rica.

Like most countries of the world, Costa Rica has for a long time had an organization created to respond to emergencies. The Costa Rica Office of Civil Defense, which played a very significant role in responding to the Irazu volcanic eruption in 1963, was allowed to drift into oblivion. Its role was limited to the reforestation of the slopes of the Irazu volcano, as well as occasional response to minor flood victims.

Two events, however, mark the beginning of a significant change in the attitude of the government of Costa Rica towards disasters.

The first event was a relatively minor earthquake (6.5 Richter) which struck the Canton of Perez Zeledon, in the vicinity of San Isidro del General, in July, 1983. No one was killed in that earthquake.

The second event occurred in August, 1983. Dr. Karen McNally, a Seismologist from the University of California, Santa Cruz, had initiated a project to install a seismic monitoring network in Costa Rica. During her visit to Costa Rica in August 1983, she advised the USAID Mission of a possibility that a major earthquake could strike the meseta central of Costa Rica within the next two years. This report was also made to the Government of Costa Rica.

As a result of the alarming report, the Government of Costa Rica requested that USAID provide some radio communications equipment in order to provide better communications in emergencies. After consultation with OFDA, it was determined that before committing funds for radio equipment, it would be wise to have an analysis of the overall preparedness level of the Government of Costa Rica.

Four advisors were recruited by OFDA, and the assessment was made in late September 1983. The Team consisted of one specialist in communications, one in government organization, one in emergency management training, and one in emergency preparedness. The Team recommended a series of measures which were subsequently accepted by the Government of Costa Rica. The Team recommended a reorganization and re-vitalization of the Office of Civil Defense, and a comprehensive program for the years 1984-1985. The Program is summarized in Annex A.

The members of the Team of advisors felt that the situation provided a unique opportunity to initiate a comprehensive approach to emergency preparedness and disaster mitigation. There were a number of significant factors which were deemed to be unusual in the Costa Rica case: First of all, there was very strong support from the Executive. The President himself was very concerned and anxious to take whatever measures necessary to avoid a catastrophe. Second, the Vice-President was personally committed and consistently demonstrated that commitment by chairing meetings, securing funds, and personally reviewing the emergency legislation. Third, the Director of Civil Defense was retiring, and his departure would make transition easier. (It should be pointed out that the Director of Civil Defense was not incompetent, but that he had lacked the political influence necessary to gain Executive support for his program.) A fourth factor was the widespread public awareness which had been created by the alarming prediction of an impending earthquake.

Another fortunate factor was the willingness of the Office of Foreign Disaster Assistance to make a commitment to the Government of Costa Rica to provide assistance in developing a comprehensive program. By making available the services of a technical advisor, OFDA was able to insure that emphasis would be placed on the application of lessons learned from many examples in various parts of the world.

II. The Perez Zeledon earthquake - a frame of reference for mitigation efforts in Costa Rica.

When the earthquake struck Perez Zeledon in July, 1983, the Office of Civil Defense was not immediately brought into the picture. A government official attached to the Office of the President happened to be in the area. He was immediately designated as the coordinator of the government response, and the Office of Civil Defense was virtually ignored. Two persons who had formerly worked with Civil Defense after the Irazu eruption were asked to assist in setting up an emergency communications system, and a committee of local officials and citizens in San Isidro was named by the government.

In the course of responding to the emergency, a series of costly errors were committed. The assessment of damage was unrealistic, and a number of false assumptions added to the problem.

The health survey reveals a lack of perspective. While it is true that there were some injuries, none were sufficiently serious to tax the local capabilities for treatment. The regional hospital suffered damage, but the damage was later seen to be more cosmetic and discomforting than life-threatening. There were no deaths. Nevertheless, helicopters were requested for evacuation of the injured.

The housing and infrastructure assessments were misleading. The actual damage to housing probably appeared to the uninitiated to be significant, but in fact was relatively quite minor.

Over-cautious and uninitiated engineers and geologists feared that if the tremors continued (which they did), the landslides would multiply (which they did).

Based on partial knowledge about the landslides in northern Peru in 1970 which killed 66,000 people, they assumed that the residents in the affected area were all in danger. Therefore, it was decided that more than 5,000 people would be evacuated - many by helicopter. There were, of course, a number of major differences from the Peru case: (1) The population in the area affected around San Isidro was scattered rather than concentrated (no towns or cities); (2) the affected area was on relatively low hillsides with gradual slopes, and no high mountains above them; and (3) the slides only occurred on the two roads which led into the two affected valleys, and no houses were within 300 meters of the slides which occurred.

The following list of inputs and costs gives an idea of the response which the government initiated and coordinated:

(1) 2 Helicopters from Panama to evacuate families - cost \$25,000. U.S. Gov't.

(2) 14 tents 20'x40', for shelter for 126 patients for 5 days - cost \$36,500. U.S. Gov't

(3) Temporary shelter and food, etc. for 5,600 persons for 30 days - \$504,000. Gov't of Costa Rica.

(4) Shelter, food, clothing, medical care for approximately 1,000 persons for 6 months - \$546,000. Gov't of Costa Rica.

(5) Related administrative costs for items 3 and 4 above - cost \$196,000. Gov't of Costa Rica.

The map on the following page illustrates the topography of the area affected by the earthquake, and will demonstrate the reasons for questioning the response which followed the event.

III. The Costa Rica Comprehensive Preparedness and Mitigation Program.

The Costa Rica Program represents an attempt to have a wholistic or comprehensive approach to preparedness and prevention. This is based on the belief that all of the elements are crucial. For example, one can have a great plan and a modern well-equipped Emergency Operations Center, but if there is not a trained cadre of response personnel, little benefit can come from the equipment and plans. Likewise, a mitigation program can only be effective if there is a public awareness of the vulnerability and the needs for codes, zoning, or other imposed limitations, supported by a commitment to enforcement, and the means for enforcement or implementation.

The Costa Rica program is based on several axioms which have been gleaned from the experience of a number of people involved in emergency response and management. Some of these are:

- In Emergency Preparedness, self-reliance must be the basis on which all response plans are built.
- Decision-making and response actions must be kept as close to the local or affected area as possible.
- Local resources are more easily and quickly available, more culturally and situationally appropriate, and are most often those with the best usage record.
- Without consistent support by the Executive of a nation, there cannot be an effective preparedness and mitigation program.
- No preparedness program can be effective without intensive training and periodic testing and simulations.
- Training is more effective, relevant, and cost effective if it is done locally.

At the risk of boring you, I will give a detailed description of each of the components of the program. (A copy of the complete program of activities is included in Annex A).

1. POLICIES AND LEGAL BASE

1.1 Review of the Law - Ley de Emergencia No. 4374

The law which covers national emergencies in Costa Rica has been in effect since 1969, and replaced an earlier law enacted in 1964.

A thorough review of the law revealed the following weaknesses:

- ← Directed toward disaster relief and response, with only limited reference to Planning, Preparedness, and Mitigation.
- ← Assigned responsibility to a National Emergency Commission with broad powers. However, the Office of Emergency Services was appended to an obscure Department within the Ministry of Public Works.
- ← Membership on the National Emergency Commission was large and unwieldy.
- ← The law limited the "period of emergency" to 30 days, after which time the Executive would have to seek approval from the Legislative for extension of the emergency.
- ← The Law made no provision for financing response or preparedness.

1.2 Draft new Law, and Decrees (Decretos)

The Vice-President, who is a lawyer and former member of the Congress, was sufficiently interested in the new law that he personally chaired the meetings in which the new bill was drafted.

The new bill includes a number of significant changes:

- ◀ The Vice President is designated as Chairman of the National Emergency Commission, and the Office of Emergency Services placed under the Office of the Vice-President.
- ◀ The Membership on the National Emergency Commission reduced to seven members, including the Vice-President.
- ◀ The National Emergency Commission given responsibility for naming regional Emergency Committees.
- ◀ Authority given to the President to extend "state of emergency" by decreto or Executive Order.
- ◀ Provides for naming of a Comite Tecnico Asesor (Technical Advisory Committee - the functions of this committee are described in 2.4).
- ◀ Gives rank of Vice-Minister to Director of Office of Emergency Services.
- ◀ Provides for a National Emergency Trust Fund, with interest proceeds to finance small emergencies, and ongoing expenses. Principal could be used for major disasters.

In any democracy, and Costa Rica is fanatically democratic, the legislative process can be slow. Sometimes several months can pass between the time a bill is presented, debated, and finally voted into law. Therefore, the Vice-President considered that it would be wise to enact some changes immediately. Thus, several of the new provisions were enacted on a temporary basis through Decreto, or Executive Order.

2. ADMINISTRATION

2.1 Naming of a new Director of the Office of Emergency Services with the rank of vice=Minister. Although the choice for this position was made in February, and the Decree giving him the rank of vice=Minister was signed in early March, the action did not take effect until mid=May (under Costa Rican law, no decree can take effect until it is published in the Official Gazette).

2.2 Naming of the new National Emergency Commission. Although the membership in this Commission was decided in February, no action has yet been taken. (Delay in actions which are actually quite simple, are a fact of life in any bureaucracy. I cite this matter to underscore the kinds of frustrations one endures when serving as an "advisor"!)

2.3 Establishment of Emergency Operations Center and installation of communications equipment. Although this action has been completed, we cannot say that Costa Rica has a functioning EOC. Whilst radio operators are on duty 24 hours per day, and whilst the means to communicate with all of the essential agencies and officials does exist, nevertheless, until personnel are trained and prepared to function in an emergency, there can be no functioning EOC.

2.4 Naming of the Technical Advisory Committee. This is another area of frustration. All but one member of the Committee has been identified since March, but the Decree which makes their nomination official has not yet been sent to the President for signature. This matter illustrates one of the negative aspects of having the Vice=President as the key official in Emergency Preparedness. (When he first became active in Emergency Preparedness, there were two Vice=Presidents, and no serious crises in the country. Now there is only one Vice President, a number of crises, and the Vice=President frequently cannot give attention to less pressing matters.)

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The role of the Technical Advisory Committee is significant in the Costa Rica Program. Each of these nine committee members is a specialist and chairs a sub-committee with specific areas of responsibility: e.g., health, transportation, communications, public utilities, etc. In normal times, the Technical Advisory Committee serves as advisor to the Director of the Office of Emergency Services. These Committee members, with their respective sub-committees, are responsible for preparedness activities in their area of specialization.

In an emergency, they are responsible for damage assessment, coordination of activities within their area of responsibility, and providing liaison between the respective government agencies and the Director of Emergency Services.

3. PLANNING

3.1 Draft Summary Plan for Immediate Response = (Plan Sumario de Accion Inmediato)

Initially, it had been thought that priority attention should be given to drafting a complete Basic National Plan, with annexes for each major sector. However, it was decided that some plan was needed for immediate use. As a result, the decision was made to develop a summary plan which could serve until there was time to develop a complete Basic Plan. The summary plan was completed in March. 1984?

3.2 Draft National Basic Plan. As explained above, the decision was made to leave this for later. Once the Emergency Services Office has been functioning for a while, the staff should be able to develop a more appropriate and practical Basic Plan. Meanwhile, the Summary Plan will be sufficient.

Saeny Books

3.3 Draft Sector Annexes. The Health Sector Plan, which is to serve as the prototype for the other sectors, has been completed. [The Sector Plan for Public Works will be initiated in early December with technical assistance by Arq. Milagros Nanita.] *never done*

3.4 Design Data Bank System. This action has not yet been initiated. A small personal computer has been acquired and the OFDA advisor will begin to develop the program in 1985. The plan is to have all lists, inventories, and resources in the computer, with cross reference access.

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3.5 Reforestation Plan for the San Isidro. The plan for reforestation of the areas affected by the 1983 earthquake. The Plan has been completed, and is awaiting financing.

4. PROCEDURES

The following procedural manuals are designed to provide standard operating procedures which clearly define the roles and actions of each person involved in the emergency event. All have been completed, and copies are available to the conference participants who can read Spanish.

You will note the reference to Radio Amateurs. From the beginning, we have involved the Costa Rica Radio Amateur Club in all aspects of emergency communication planning. In the event of an emergency, the Club will assign two operators to each shift in the Emergency Communications center to handle written international traffic.

- 4.1 Operations Manual - Emergency Operations Center.
- 4.2 Administrative Manual - Emergency Operations Center.
- 4.3 Communications Manual - Emergency Operations Center.
- 4.4 Operators Manual - Radio Amateurs
- 4.5 Alert and alarm systems for earthquakes and volcanoes.

When this item was included in the original plan, it was thought that an alert/alarm system would be necessary. However, it has now been determined that it is not necessary. In the event of need, the seismic monitoring center can communicate directly with the EOC via telephone or VHF radio.

5. TRAINING

In developing the Costa Rica program, it was felt from the very beginning that training would be the most significant component in the program of activities. It was also felt that, insofar as possible, training should take place in the country.

You will see in the Program of Activities, (Annex A,) that we have included a training workshop for the Cabinet (both Ministers and vice-Ministers). The objective is to provide a basic introduction to emergency response and to deal with some of the myths which many government officials tend to have about disasters. We will also attempt to introduce them to the mitigation program. This brief workshop is designed to raise their level of awareness as well as commitment.

The training of community leaders represents the most significant component in the training program. A training unit of six persons will be established. In addition to the training coordinator, there will be a specialist in graphic arts and two teams of two trainers each. The intention is to develop materials focused specifically on the community. Although some materials from the outside can be utilized, the plan is to design materials which are easily identified with the context in which the community leader works. Approximately 80 communities have been identified for training. Each team of two persons would be scheduled to train 40 groups per year.

This training will concentrate on how to mobilize local resources, damage assessment, how to coordinate outside resources, reliance upon and use of local resources, etc.

I will make a few comments about each of the other items in the training program: Under the category of specialized training, we have included training in damage assessment for the Technical Advisory Committee. In the event of a disaster, this committee serves as specialized staff in the EOC.

In early January, we have planned a workshop for the Amateur Radio Club. This training, in addition to a general introduction to emergencies, will focus on the handling of written traffic via the International Assistance Network.

6. HEALTH

Under Health, we have listed seven areas. In all likelihood, we will add to that list now that PAHO is locating a full-time Emergency Preparedness specialist in San Jose.

6.1 Management of mass casualties has already been completed. See report in Annex B. As indicated in the report, there will be a follow-up to the workshop. A team of four will visit each hospital in the country to review emergency plan.

7. MITIGATION

7.1 Vulnerability Studies

7.2 Development of risk maps.

When this two-year program was designed, there was no one around with actual experience in planning a mitigation program. Nevertheless, there was a strong commitment to prevention, and a belief that it should be an integral part of

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the program. Guidance was sought in attempting to develop a workplan. The member of the Technical Advisory Committee responsible for Seismology/vulcanology, Engineer Jose Sandoval, is also the Director of the School of Engineering of the University of Costa Rica. In July 1984, Engineer Sandoval spent two days with INTERTECT in Dallas to discuss Costa Rica's interest in developing a Mitigation Program. Sandoval presented the following guidelines which were felt to be essential in developing the Costa Rica program:

- ^^ The actual work should be done by Costa Ricans
- ^^ Insofar as possible, University students should be incorporated into the work in order to benefit from the learning experience.
- ^^ Emphasis should be on practical applicability.
- ^^ In planning the mitigation program, every action should be set in the context of the overall social and economic development context of the country.
- ^^ Although the Office of Emergency Services is responsible for introducing the Mitigation Program, the Universities, as well as the Ministry of Planning and other key Ministries, should have key roles in developing the workplan and in its implementation.

As a result of the Sandoval meeting, INTERTECT agreed to provide guidance for the Mitigation Program. Specifically, INTERTECT agreed to assist the Office of Emergency Services in defining the scope of work for a comprehensive hazard management program and designing the four major subcomponents of the program. They are:

- ^^ the housing and urban settlements vulnerability analysis
- ^^ the economic vulnerability analysis (including industry)
- ^^ the agricultural vulnerability analysis
- ^^ the lifelines vulnerability analysis

Each of these subplans will be designed in such a way that they will lead to recommendations for vulnerability reduction efforts in each of the four sectors.

WORK PLAN

Methodology

- ^^ Review of prior work and existing data.
- ^^ Interviews with key personnel.
- ^^ A four-day workshop to define the scope of work and prepare a detailed work plan.

Scope of the Hazard Management Plan

The workshop will develop a comprehensive plan for carrying out the hazard management program. This plan will include:

- ^^ A detailed outline with a complete program, including outlines for each of the four vulnerability analyses to be carried out during the project.
- ^^ A definition of the approach to be used during the study (whether it will be a technical approach, or an economic modeling approach).
- ^^ A deliniation of the limits of the project area.
- ^^ The objectives of the plan and a description of how each of the objectives will be met.

- ^^ An outline of the scope of work, including detailed descriptions of how each of the project activities is to be carried out.
- ^^ A Workplan. The workplan will define the methodology to be used for each of the subactivities, identify the staff requirements and prepare preliminary job specifications, describe work sequence, prepare an organization chart and determine resource requirements for implementing the workplan.
- ^^ A proposed schedule for the project.
- ^^ A detailed preliminary budget.

Workshop Participants

Participants for the workshop will be selected by the Office of Emergency Services. A balanced group will be selected representing the major institutions and groups concerned with natural hazards and their effect on the country.

Additional Activities

- ^^ The consultants will furnish the Office of Emergency Services a mini-library of key reference materials on hazard management and vulnerability analysis. The consultants will also help establish a library catalogue system using the Disaster Information Sharing System.

Participating Organizations

This project will be carried out under the direction of The Office of Emergency Services. The Costa Rican coordinator will be Engineer Jose Sandoval. Technical support will be provided by INTERTECT, with Fred Cuny as Team Leader.

7.3 National Seismograph Network, Strong Ground Motion Network, and Geodetic Volcano Monitoring System

In 1982, OFDA provided a grant to the University of California, Santa Cruz, to initiate a comprehensive scientific project. The beginning of that project preceded the 2-year comprehensive program which I have been describing, but has been incorporated into it, and will undergo some modifications before the 5 year life of the project is completed.

As you will see by the Objective and the Scope of Work, the project is ambitious and costly.

I will describe the project briefly:

OBJECTIVE:

To establish in Costa Rica a National Seismograph Network and train local personnel in the operation and maintenance procedures. Begin the development of scientific expertise and the establishment of cooperative projects to process and analyze the incoming seismic data for earthquake and volcano hazards reduction and risk mapping.

SCOPE OF WORK

- Expand and upgrade the existing seismograph network in Costa Rica to a standardized group of 20 instruments.
- Procure and install strong ground motion accelerographs to expand and upgrade the existing Costa Rican network to twenty sites.
- Provide technical training of Costa Rican seismologists and technicians in the operation and maintenance of the network's seismographic instrumentation and electronics.
- Install a DEC 350 computer with appropriate software for earthquake location analysis, data reduction, and archival preservation.
- Analyze earthquake data from the National Network to determine the locations and faulting mechanisms of seismically active faults in order to locate and map regions of potential hazards.
- Complete the analysis of the seismic history of Costa Rica in order to identify sources of earthquakes with present hazards to the country's infrastructure.
- Analyze accelerograph records for strong earthquakes to determine local building response characteristics as records become available from moderate earthquakes.
- Provide technical assistance to appropriate Costa Rican Government agencies in seismic and volcanic risk analysis and mapping for hazards mitigation related to energy and mineral exploration and the insurance industry.
- Provide short-term traineeships and research assistant-ships for advanced technical training in earth science and engineering for select Costa Rican scientists.
- Initiate a geodetic volcano monitoring system and augment laboratory capabilities for volcano analysis in Costa Rica and for volcanic hazards studies.

COMMENT

The attached memorandum (see Annex C) summarizes the concerns which I have for this project. There is no question that the project can be of enormous benefit to mitigation efforts in the country. Nevertheless, we believe that it is essential that the project become an integral part of the overall preparedness and mitigation program. I am happy to report that steps have now been taken to insure that the project activities are under the responsibility of Costa Ricans, and that plans are modified to insure that it is within the ability of the Government of Costa Rica to support and continue.

IV. Conclusion

As I stated in the beginning, I came here to describe plans and hopes, rather than accomplishments. I have attempted to present a detailed and honest description of the initiation of a process. I am a bit uneasy about describing plans and activities in which I have a personal stake, but I trust that your indulgence will not limit your willingness to criticize our approach, and to recognize that any help you can give us now from the benefit of your experience will help us avoid needless mistakes.

Ideally, this paper would have been written and presented by a Costa Rican, rather than an outside Advisor. Certainly one of the weaknesses of the Costa Rica program is that the burden of initiative still rests with an outsider. It is my belief that only as these kinds of programs have become completely "national," will they be appropriate and fruitful.

In Spanish we have a term which is very appropriate for what I am trying to say. We say that a person has to have mistica if they are to be successful in some endeavors. In Preparedness and Mitigation, mistica, or COMMITMENT, is essential if we are to succeed. Yes, indeed, theories, plans, studies, people, equipment, systems, and training are necessary. However, without COMMITMENT we will fail.