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I. Background

Information systems to be of any value at all, have to be utilized and to be utilized they have to be simple. Management is primarily an excercise of taking information and making appropriate decisions for action based upon same. To the extent that we can improve the quality of information and the speed in which it is presented to the manager we will theoretically improve his ability to take action. The entire thrust of this proposal is to develop and test a system which:

1. Improves the quality of data available to the manager of a disaster situation.
2. Decreases the time needed to present this information in an interpretable form.
3. Does all of the above using technology which will be highly reliable under harsh circumstances with lower power requirements and a high degree of portability.

In a recent conference sponsored by the Disaster Surveillance Division of the Pan American Health Organization (PAHO) and the United Nations Office of Disaster Relief (UNDRO) combining international organization functionaires with political and administrative personnel who had actual experience with managing disasters, it became evident that no consensus had been reached regarding a precise set of indicators which could be applied to a given disaster situation (sudden impact disaster only). Furthermore, the high number of possible combinations of events means that the normal standardization and observation needed for epidemiological studies is almost impossible using

traditional methods. Based upon the recognized need for the improved levels of information and the availability of increasingly high performance and portable micro-computing devices we propose a pilot study that would address some of these problems as a first step toward a full fledged disaster information system for use in sudden impact disasters.

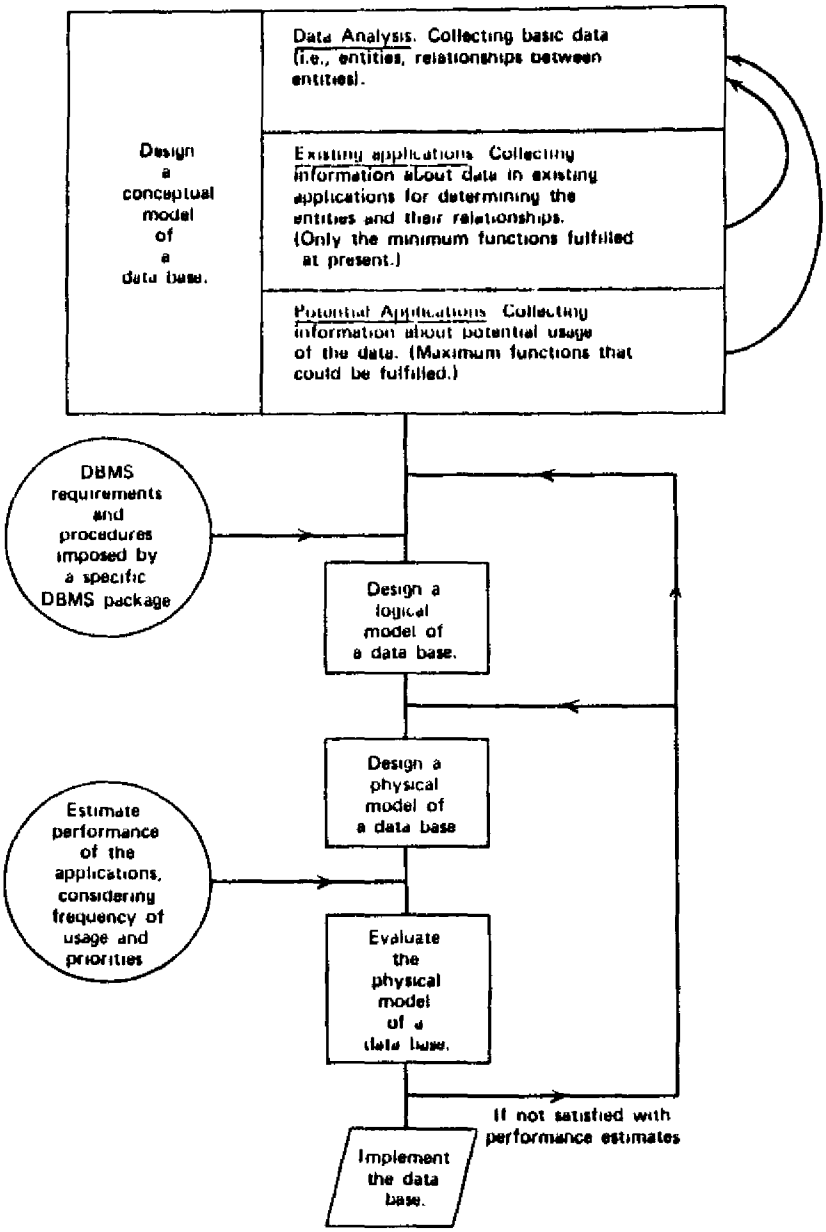
Figure 1 represents the major steps in the development of an information system of any kind and provides an ordering device for what we plan to do as part of this proposal.

II. Development of a Conceptual Framework and/or Indicator Model

Here our procedure has been to first review the literature with specific reference to indicators which might be utilized as part of the action model. Unfortunately, the literature is very sparse with no work which precisely addresses the issue raised. When no consensus has been reached among the experts, a strong argument can be made that only people who have had direct experience with disaster situations can contribute to the specification of a coherent and functional conceptual model for developing an effective management information system. The following proposal and list of indicators (Appendix A) is a direct continuation of the results from the "Delphi" approach utilized at the PAHO/UNDRO disaster conference.

Figure 1

Steps in the development of a data base to be used in a management information system



Adapted from Atre (1980).

III. General Principals in the Design and Implementation of a Management Information System (MIS)

A. Operational Definitions

MIS A management information system permits the integration of data across the operational boundaries of an organization. A MIS includes programs (software), equipment (hardware), personnel and procedures which integrate a data base into a form in which it can supply the different points of view of the diverse users and personnel who manage and direct the system.

Data base A collection of related data with different uses, applications and points of view. These different points of view only come into being after the data has been rearranged and sorted.

Information Data which has been arranged for decision-making purposes. The utility of the products of a MIS depend on the quality of thought and planning which go into the system before its implementation.

Principal causes of failure in the implementation of an MIS*

1. It addresses a wrong or irrelevant problem.

2. Behavioral factors have been overlooked.

3. Management support or involvement in the design stage has

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* Adapted from McCosh et al (1981)

been lacking.

These problems are always more severe when the design of the system is left to technical specialists instead of including the personnel, who will be involved in the use and operation of the system, in the design stage and creation of the conceptual model (Figure 1).

IV. The Needs Assessment Stage in the Development of an MIS

This crucial stage is most often overlooked in the development of a management information system. Ultimate failures or shortcomings are often due to lack of sufficient preparation at this stage. Too many directors of programs leave this stage to the technical specialists only to be disappointed with the lack of relevance and applicability of the results to the problem at hand.

A. Development of a conceptual model of the enterprise

This includes a listing of all of the departments, programs, individuals, and their relationships. This is the time for updating organigrams, flow charts, job descriptions and most important of all clear operational definitions of the elements and activities of the enterprise. Without this last part, it would be impossible to systematize a coherent data base to order the information necessary for making decisions.

B. Identification of users of the system

A thorough effort should be made to identify every current and potential user of the system both inside and outside of the organization. Different users of a system always have different points of view of its structure and purpose and this is the stage to begin reconciling them.

C. Specification of the uses or products of the system

Probably the key step in the whole process, this must be done by the users identified in the previous step and is often a laborious and drawn-out process. The users must specify what information they need with what periodicity. Dummy reports, graphs, tables and charts should be prepared. Getting busy program managers to specify what they need can be a tedious affair because many of them, especially in the health and medical fields, are not accustomed to addressing this type of conceptual problem and probably hope that a technician can deliver a ready made system for their use. Unfortunately, the technician usually possesses limited knowledge of the managers' needs and is not capable of providing the necessary output by himself.

V. The Proposal

The current proposal envisions three phases in the creation of a microcomputer based information system for disaster control and management using hurricanes as the target disaster.

A. Phase I.. The Needs Assessment Phase (26 weeks)

This phase will include:

1. Development of initial conceptual model of the problem.
2. Identification of the users, uses and products desired from the system.
3. Completion of the conceptual model including final identification of the indicators to be included and complete specification of the data files, records and elements and their relations into a network conceptual model of the data base.

B. Phase II. The Testing/Simulation Phase (34 weeks)

This phase will include

1. Translation of the conceptual model to a logical model and then into a physical data base (Figure 1).
2. Testing of the model by running computer simulations at selected sites. One of the main advantages of computer technology in managing disasters is that one need not wait for a hurricane to determine if the system works.

3. Revision of the system and preparation of all documentation necessary for its implementation.

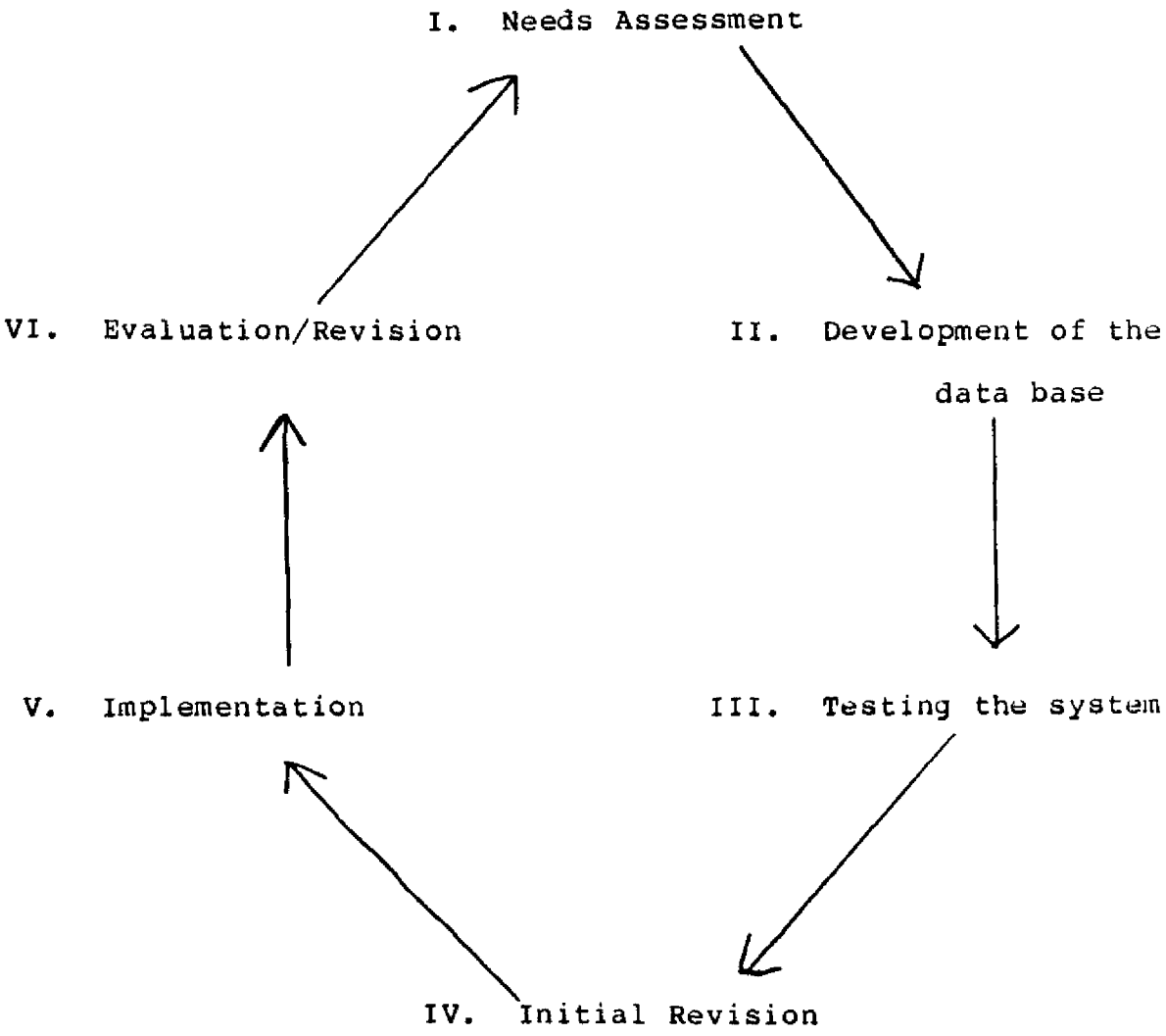
The final MIS developed by Tulane will feature ease of use operation so that it can be managed by people with little or no training or computer expertise. The documentation will include all instructions necessary for the operation of the system, routine maintenance and protection of the integrity of the data in disaster situations.

C. Phase III. Implementation of the System and Ongoing Evaluation/Revision (Figure 2)

This proposal includes Tulane participation only through the first and second phases.

Figure 2

Stages in the development of a management information system



VI. Chronogram for Phase I

#	Activity	Weeks
1.	Confirm agreement between Tulane and PAHO	0
2.	Development of initial conceptual model at Tulane including: A. Data to be inventoried 1. Resources 2. Population-based statistics B. Data to be collected for damage assessment 1. Resources 2. Population-based statistics C. Methodology for comparing usable resources left after damages with needs of population to ascertain rapidly the amount and type of emergency aid necessary Included in the model will be flow charts of the activities involved in the decision making process.	1-6
3.	Identification by PAHO of 2 Caribbean counterparts for development and testing of the models. The 2 sites should be as different as possible to help ensure the generalizability of the final product to a variety of field situations.	1-4
4.	Delivery of written draft of model by Tulane to PAHO and Caribbean counterparts for their review.	7-8
5.	Meeting with PAHO in Washington to review and revise the model.	9
6.	Further revision at Tulane in preparation for first Caribbean site visit.	10-11
7.	First visit to Caribbean counterparts to confront the conceptual model with the local reality of what is necessary, available and possible. One week will be spent at each site.	12-13
8.	Further revision at Tulane to incorporate suggestions from the field and to make the model adaptable to both the two different test sites and more generalized situations.	14-16

VII. Chronogram for Phase II

#	Activity	Weeks
1.	Completion of report from Phase I.	0
2.	Development and testing of logical and physical model of MIS at Tulane by the Programmer in conjunction with the Research Associate.	1-12
3.	Visit to PAHO in Washington by the Research Associate and the Programmer to present the first version of the MIS.	13
4.	Revision of the MIS at Tulane in preparation for Caribbean site visit.	14-16
5.	Visit to Caribbean sites by the Research Associate and Programmer to test the MIS and run first simulations.	17-18
6.	Revision of MIS at Tulane to incorporate experience from the field.	19-21
7.	Second visit to PAHO in Washington by Research Associate and Programmer to present and evaluate revised model.	22
8.	Revision of MIS at Tulane in preparation for second Caribbean site visit.	23-25
9.	Second visit to Caribbean counterparts by Research Associate and the Programmer to field-test the MIS and run final simulations.	26-27
10.	Completion of MIS and complete documentation necessary for its implementation (Phase III).	28-34

VIII. Bibliography

ATRE, S. Data Base: Structured Techniques for Design, Performance and Management. John Wiley and Sons, New York, 1980.

McCOSH, AM, RAHMAN, M and EARL, MJ. Developing Managerial Information Systems. Halstead Press, New York, 1981.

IX. Budget

A. Phase I (6 months/26 weeks)

Personnel

Item		Ann. Salary	%	Amount
1	Research Associate (MPH + Doctoral training)	15,000	35	2625
2	Secretary	13,000	20	1300
3	Fringe (est. 17%) for sec'y	--	--	668

		Cost per month	Total
Supplies			
1	Stationary, stamps, xerox etc.	100	600
2	Phone + Telex 50/mo	50	300
3	Preparation of reports	50	300

Travel

		Quantity	Price	Total
1	Trips N.O.-DC-N.O.			
	a) Ticket	2	400	800
	b) Per diem (5 days per trip)	10	75	750
2	Trips to Caribbean			
	a) Ticket[1]	2	800	1600
	b) Per diem (12 days per trip)[2]	24	158	3792
			Subtotal Phase I	12735
	20%		Institutional Overhead	2547
			Total Phase I	15282

B. Phase II (8 months/34 weeks)

Personnel

Item		Ann. Salary	%	Contribution
1	Research Associate	15,000	20	2000
2	Programmer	20,000	50	6667
3	Secretary	13,000	20	1734
Fringe for sec'y and programmer (17% est.)				1769

		Quantity	Price	Total
Supplies				
1	IBM PC compatable portable[3] computer, graphics capability, 256K RAM, 2 disk drives and a printer[3]	1	6000	6000
2	Software for above including[3] a data base and an integrated word processor-spreadsheet[3]		1000	1200
3	Misc. stationary, paper, stamps, xerox, etc.	100/mo		800
4	Phone/Telex	50/mo		400
5	Preparation of reports and manuals	125/mo		1000
Travel				
1	Trips N.O.-D.C.-N.O.			
	a. Ticket	4 trips x 400		1600
	b. Per diem	20 days x 75		1500
2	Trips to Caribbean			
	a. Ticket[1]	4 trips x 800		3200
	b. Per diem (12 days per trip)[2]	48 days x 158		7584
			Subtotal Phase II	35454
			20% Institutional Overhead	7091
			Total Phase II	42545
			GRAND TOTAL PHASES I + II	57827

C. Notes to the Budget

1. The cost of the plane ticket based on the price of a New Orleans-Jamaica-Barbados-New Orleans round trip. The actual cost will depend upon the sites selected by PAHO.

2. Based on peak season rates in Jamaica and Barbados, U.S. Department of State, Standard Regulations (Government Civilians, Foreign Areas) Maximum Travel Per Diem Allowances for Foreign Areas.

3. Developments in micro-computer technology and software are progressing so rapidly that it would be best to wait until the beginning of Phase II for the purchase of the equipment. Meanwhile, the prices are holding constant or even decreasing.

SOURCE: Development of Indicators for Monitoring Progress Towards Health for All by the Year 2000, WHO, 1981.

INDICATORS

Definition: variables which help to measure changes and which are used as markers toward reaching objectives and targets; reflections of a given situation.

Characteristics:

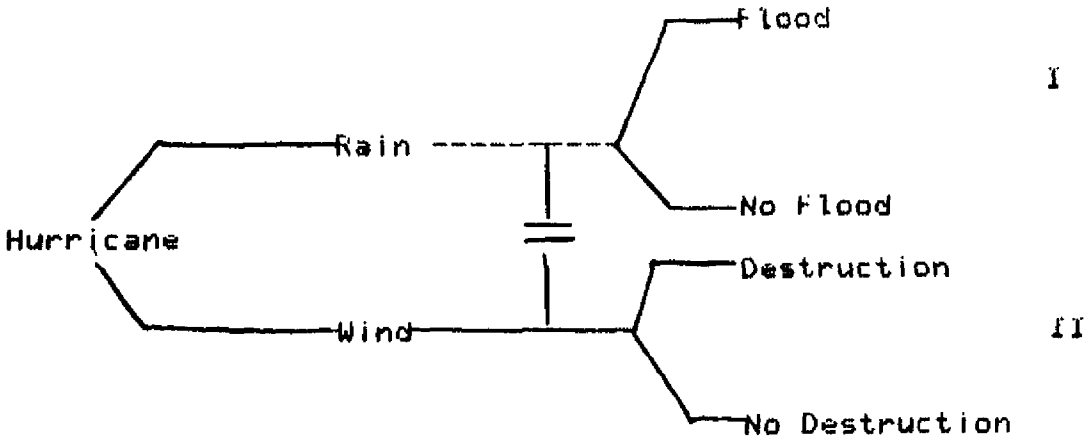
1. Valid - accurate; measure what is supposed to be measured
2. Objective - precise; results are similar if measured by different people under similar circumstances
3. Sensitive - sensitive to changes in the situation
4. Specific - should reflect changes only in the situation concerned

Levels of Application to the Monitoring of Implementation and Evaluation of Impact:

1. Policy
   a) national
   b) subnational
   c) local/community
2. Managerial/Technical
   a) national
   b) subnational
   c) local/community

1ST DRAFT

HURRICANE MODEL



1. Assume that rain and wind are primary climatic elements of hurricanes.

2. Definitions of I and II:

   I. Identified areas for consideration:

      -health
      -environmental sanitation
      -infrastructure
      -food

      Reference: Disaster Needs Assessment Conference May, 1984

   II. Direct destruction to infrastructures

      -hazard analysis
      -vulnerability analysis

      These are primarily architectural/engineering concerns.

3. Four possible combinations of resulting conditions (i.e., after the hurricane) are seen:

1) $F\bar{D}$

2) $\bar{F}D$

3) $\bar{F}\bar{D}$

KEY:

F - Flood
D - Destruction

These point to the intensity of the disaster and are the equivalent of the dose-response phenomenon in the classic epidemiology sense.

4. Each of the above conditions dictates the particular area(s) for consideration.

1) $F\bar{D}$ ===> I + II

2) $\bar{F}D$ ===> I

3) $\bar{F}\bar{D}$ ===> II

4) $\bar{F}\bar{D}$ ===> do nothing

BASELINE INFORMATION

TOPIC	INDICATOR	SOURCE	JUSTIFICATION
Hurricane	Strength: rain, inches per ? gusts, knots per ?	meteorologic station records	indication of intensity of storm
	Duration of eye (epicenter) over island, hours	meteorologic station records	indication of intensity of storm
	Time of storm, day or night	meteorologic station records	indication of possible severity of damage/injury
	Area affected, km^2 + delineations from eye	Civil Defense records	estimation of extent of severity of damage/injury
Population	Estimation of population by age, sex, urban/rural area	census	provision of denominator for calculation of rates identification of high risk groups
	Annual increase, %	census	estimation of population should data be outdated

Health	Crude mortality rate (overall)	Ministry of Health records	indication of quality of life (i.e., what to expect)
	Infant mortality rate	Ministry of Health records	indication of quality of life
	Incidence of infectious disease by type and geographic distribution	Ministry of Health records	provision of endemic disease profile of island
	Number of health posts/ hospitals by area	Ministry of Health records	location of health services
	Staffing of health posts/hospitals by area	Ministry of Health records	inventory of personnel for possible mobilization
	Number of beds per health post/hospital by area	Ministry of Health records	inventory of capacity of existing resources
Water Supply	Capacity of production component, liters per second	water treatment plant records	indication of condition of production of potable water
	Number of tanks for catchment	water treatment plant records	indication of condition of production of potable water
	Volume of water stored, cubic meters	water treatment plant records	indication of condition of supply component

HEALTH	ENVIRONMENTAL	FOOD	INFRASTRUCTURE
morbidity surveillance -respiratory conditions	administration + operation of temporary housing (urban and rural)	necessity for food -availability of existing food reserves -provision of food aid	establishment of water and electrical services to essential facilities (e.g., hospitals)
-gastro-intestinal conditions	water supply/ wastewater-sewage-garbage disposal (urban)	-distribution of food	
			establishment of communications/transportation systems
-snake bites -malaria	vector control and elimination of possible breeding sites (rural)		

Water Supply	Number of operating pumps	water treatment plant records	indication of condition of supply component
	Capacity of supply component, liters per second	water treatment plant records	indication of condition of supply component
	Number of supply points	water treatment plant records	indication of condition of distribution cpnt.
	Number of operating pumps	water treatment plant records	indication of condition of distribution cpnt.
	Capacity of distribution component, liters per second	water treatment plant records	indication of condition of distribution cpnt.
	Calculation of residual chlorine or other disinfecting agent	water treatment plant records	indication of condition of distribution cpnt.
Wastewater Treatment/ Disposal	Number of connections by drainage zone	sewage plant records	extent of service coverage
	Number of pumping stations	sewage plant records	indication of capacity of system
Vector Control	Number of mosquitoes per trap--weekly, monthly, season by species	MOH - Mosquito Control Program records	indication of "normal" levels of specific mosquito populations
	Number of rodents per trap--weekly, monthly, season by species	MOH - Rodent Control Program records	indication of "normal" levels of specific rodent populations

	Incidence of reported rodent or dog bites in previous years	MOH epidemiologic records	indication of expected rates of rodent or dog bites in population prior to hurricane
	Incidence of vector-transmitted diseases	MOH epidemiologic records	indication of expected rates of vector-transmitted diseases prior to hurricane
Emergency Food	List of recommended acceptable foods on island	area nutritionists community members	indication of types of provisions to obtain & distribute
	Inventory of government/non-government/ international organizations with food aid activities by type of of food aid rendered	survey	availability of internal resources for supply and distribution
	Number of transport vehicles on hand by type	military Ministry of Transportation records Civil Defense	availability of resources for transport of food
Infrastructure	Source of energy	plant records Ministry of Interior records	indication of system generation
	Capacity of electricity generation component, MW	plant records Ministry of Interior records	indication of plant capacity for production of electricity

Infrastructure	Annual production of electricity, Gw	plant records Ministry of Interior records	indication of expected electricity output
	Capacity of backup system for electricity, Mw	plant records Ministry of Interior records	indication of capacity for emergency services
	Line capacity for electricity, Kv	plant records Ministry of Interior records	indication of transmission capability of electrical system
	Kilometers of lines, primary and secondary	plant records Ministry of Interior records	indication of distribution capacity of electrical system
	Personnel for energy sector, man-hours	Ministry of Interior	indication of manpower capacity of electrical system
	Area served by radio, km2	Ministry of Communications survey of stations	indication of capacity of radio communications
	Number of telephone hookups	Ministry of Communications	indication of capacity of telephone system
	Number of telegraph/telex systems	Ministry of Communications	indication of capacity of telegraph/telex systems

Infrastructure	Personnel for communications sector, man-hours	Ministry of Communications	indication of manpower capacity of sector
	Types of building codes	Ministry of Interior	guidelines for reconstruction with possible alterations in code for hurricane-proof measures
	Volume of traffic/ major route, road or railway	Ministry of Transportation	indication of normal traffic conditions
	Type of traffic/ major route, road or railway	Ministry of Transportation	indication of transport types per route
	Personnel for transportation sector, man-hours	Ministry of Transportation	indication of manpower capacity of sector
	Number of airport runways	Ministry of Transportation airport records	indication of operating capacity of airports
	Number of arrivals and departures by aircraft type, daily and weekly	Ministry of Transportation airport records	indication of volume of airport traffic
	Airport personnel, man-hours	Ministry of Transportation airport records	indication of manpower capacity of air system

INDICATOR INFORMATION FILE

Indicator: Number of individuals without adequate food by age

Program Area: Emergency Food

Data Source(s): reports from heads of communities and institutions
individuals of affected communities

Method(s) of Collection: interview
survey

Level(s) of Aggregation: community

Information Required for Policy Decision:
Estimation of population without adequate food supply

Time (periodicity): 0-7 days, daily

Policy Decision(s):
Dispatch (or not) of food to affected community
Allocation of resources

Reference(s): Disaster Needs Assessment Conference, May 1984

Observation(s):

INDICATOR INFORMATION FILE

Indicator: Requirements for food distribution

Program Area: Emergency Food

Data Source(s): distribution point records

Method(s) of Collection: survey

Level(s) of Aggregation: community/national

Information Required for Policy Decision:
Final review of food needed

Time (periodicity): 31-365 days

Policy Decision(s):
Assignment of resources: equipment, materials, personnel, money

Reference(s): Disaster Needs Assessment Conference, May 1984

Observation(s):

INDICATOR INFORMATION FILE

Indicator: Quantity of food distributed by type

Program Area: Emergency Food

Data Source(s): distribution point records

Method(s) of Collection: survey

Level(s) of Aggregation: community/national

Information Required for Policy Decision:
Review of food needed

Time (periodicity): 31-365 days

Policy Decision(s):
Solicitation of additional quantities by type

Reference(s): Disaster Needs Assessment Conference, May 1984

Observation(s):

INDICATOR INFORMATION FILE

Indicator: Number of persons who require food in affected areas

Program Area: Emergency Food

Data Source(s): individuals of affected community
community heads
institution heads

Method(s) of Collection: interview
survey

Level(s) of Aggregation: community/national

Information Required for Policy Decision:
Estimate of population requiring food

Time (periodicity): 31-365 days

Policy Decision(s):
Continuation (or not) of food aid

Reference(s): Disaster Needs Assessment Conference, May 1984

Observation(s):

INDICATOR INFORMATION FILE

Indicator: Requirements for food distribution

Program Area: Emergency Food

Data Source(s): distribution point records

Method(s) of Collection: survey

Level(s) of Aggregation: community/national

Information Required for Policy Decision:
Review of food needed

Time (periodicity): 8-30 days

Policy Decision(s):
Assignment of resources: equipment, materials, personnel, money

Reference(s): Disaster Needs Assessment Conference, May 1984

Observation(s):

INDICATOR INFORMATION FILE

Indicator: Quantity of food distributed by type

Program Area: Emergency Food

Data Source(s): distribution point records

Method(s) of Collection: survey

Level(s) of Aggregation: community/national

Information Required for Policy Decision:
Review of food needed

Time (periodicity): 8-30 days

Policy Decision(s):
Solicitation of additional quantities by type

Reference(s): Disaster Needs Assessment Conference, May 1984

Observation(s):

INDICATOR INFORMATION FILE

Indicator: Number of persons who require food in affected area

Program Area: Emergency Food

Data Source(s): individuals of affected community
community heads
institution heads

Method(s) of Collection: interview
survey

Level(s) of Aggregation: community

Information Required for Policy Decision:
Estimate of population requiring food

Time (periodicity): 8-30 days

Policy Decision(s):
Continuation (or not) of food aid

Reference(s): Disaster Needs Assessment Conference, May 1984

Observation(s):

INDICATOR INFORMATION FILE

Indicator: Inventory of institutions that can provide food

Program Area: Emergency Food

Data Source(s): community heads
institution heads

Method(s) of Collection: interview
survey

Level(s) of Aggregation: community

Information Required for Policy Decision:
List of institutions for possible distribution mechanisms

Time (periodicity): 0-7 days

Policy Decision(s):
Review of distribution mechanisms

Reference(s): Disaster Needs Assessment Conference, May 1984

Observation(s):

INDICATOR INFORMATION FILE

Indicator: Number of vehicles and types required to transport food

Program Area: Emergency Food

Data Source(s): local/national transportation department
military

Method(s) of Collection: interview
survey

Level(s) of Aggregation: community/national

Information Required for Policy Decision:
Immediate requirements for transport

Time (periodicity): 0-7 days

Policy Decision(s):
Requisition of vehicles and special supplies

Reference(s): Disaster Needs Assessment Conference, May 1984

Observation(s):

INDICATOR INFORMATION FILE

Indicator: Quantity of food necessary

Program Area: Emergency Food

Data Source(s): nutritionists
PAHO/WHO publications on nutritional emerge

Method(s) of Collection: consultation/interview
library research

Level(s) of Aggregation: community

Information Required for Policy Decision:
Amount of food to assure adequate supply

Time (periodicity): 0-7 days

Policy Decision(s):
Solicitation of appropriate quantities

Reference(s): PAHO/WHO guidelines

Observation(s): Calculations are available

INDICATOR INFORMATION FILE

Indicator: List of unacceptable foods

Program Area: Emergency Food

Data Source(s): community members

Method(s) of Collection: interview

Level(s) of Aggregation: community

Information Required for Policy Decision:
Types of foods that are culturally appropriate to a community

Time (periodicity): 0-7 days

Policy Decision(s):
Solicitation of culturally appropriate foods

Reference(s): Disaster Needs Assessment Conference, May 1984

Observation(s):

INDICATOR INFORMATION FILE

Indicator: Morbidity by age

Program Area: Epidemiologic Surveillance

Data Source(s): health service records

Method(s) of Collection: survey

Level(s) of Aggregation: community

Information Required for Policy Decision:
- Determination of existence of an epidemic
- Requirements for medication and supplies

Time (periodicity): 0-365 days

Policy Decision(s):
- Requirements for vaccination
- Requirements for quarantine
- Solicitation of local or outside aid

Reference(s): PAHO Scientific Publications
Inundaciones 1982. Ministerio de Salud - Bolivia

Observation(s): Consolidate information at central level;diseases i
nclude respiratory,GI,malaria,snake and dog bites

INDICATOR INFORMATION FILE

Indicator: Estimation of damages of hospital's electrical system, %

Program Area: Infrastructure

Data Source(s): hospital administration/maintenance records

Method(s) of Collection: interview
survey

Level(s) of Aggregation: community

Information Required for Policy Decision:
Estimation of magnitude of damage to electrical system

Time (periodicity): 0-7 days, daily

Policy Decision(s):
Utilization of backup generators

Reference(s): Disaster Needs Assessment Conference, May 1984

Observation(s):

INDICATOR INFORMATION FILE

Indicator: Estimated repair time (TR, days and TRC, days)

Program Area: Infrastructure

Data Source(s): National Emergency Committee records

Method(s) of Collection: survey

Level(s) of Aggregation: community/national

Information Required for Policy Decision:
Requirements for rehabilitation: execution plan

Time (periodicity): 31-365 days

Policy Decision(s):
Execution plan

Reference(s): Disaster Needs Assessment Conference, May 1984

Observation(s): TR = rehabilitation time
TRC = combined rehabilitation time