

## Facilities and Utilities:

Major damage to housing, infrastructure and utilities can be observed in the two islands, which are of major economic importance for tourism. Homes have been destroyed or are severely damaged. Several shelters and Government buildings were damaged as well as Hotels. Inland, even though direct damage to housing was not extensive, water damage due to flooding and leaks are extensive. Data on amount of houses destroyed and or damaged is only available for the Cayes (676 houses). In the Belize, Corozal and Orange Walk districts it can be estimated that approximately 30% of the houses (7,377), suffered serious water damage. Important to mention is the extensive damage to pit latrines and sanitary facilities which will compromised the already lower coverage of sanitary services in the rural areas.

The International Airport, as well as the municipal airports in the islands are opened and did not suffer any damage. Nonetheless, at least four planes were destroyed in Ambergris Caye, and all the airports were closed from September 30 – October 3, 2000.

In the islands, roads are disrupted and totally blocked by electrical posts, trees, garbage and organic waste.



Caye Caulker, October 4, 2000



Caye Caulker, October 4, 2000

Inland, roads were disrupted and blocked due to the flooding. The Northern and Western Highways are still disrupted due to the flooding in some areas. Roads to communicate to small villages are also interrupted. The situation is worse in rural Belize, Corozal and Orange Walk Districts.



Corozal/Belize Highway October 3, 2000



Road to Crooked Tree Village, 14-16, feet of water, October 6, 2000

In relation to utilities, all telephone and electrical wiring are totally destroyed and services disrupted in the islands. Inland, electrical services and telephone services suffered minor damage and are totally restored.

## **ENVIRONMENTAL HEALTH ISSUES**

### **Water Supply and Sanitation**

**Safe drinking water is a critical issue.** Water supply systems were greatly affected by Hurricane Keith. The islands and four districts were completely flooded washing, dumpsites, sewer, lagoons and excreta from latrines and septic tanks into residential areas. This also caused contamination of wells used by the residents for drinking purposes. Chemical contamination from the dumpsites, chemical storage areas and gas stations also occurred in certain areas.

The water testing in the affected areas is limited to residual chlorine, lacking equipment and reagents to monitor other important parameters to determine degree of contamination (i.e. Nitrates, E. Coli). Portable water testing laboratories are urgently needed.



Latrine, May Pen Village,  
October 7, 2000



Septic tank totally cover by water, May Pen  
Village October 7. 2000

The poor environmental conditions, poor personal hygiene together with the unavailability of enough safe water also makes food safety a concern. Cases of food poisoning have already been reported.

Dead animals can be seen in affected areas (livestock, dogs, and birds, among others) which increases the level of water contamination and worsen sanitary conditions.

### **Vector Situation:**

The wet post hurricane environment is conducive to significant increase of the mosquito population in areas where malaria and dengue are endemic. The following conditions are evident:

- Widespread water-logged areas which could support the breeding of nuisance mosquito such as the salt marsh mosquito, *Aedes aegypti* and the *Anopheles*.
- Numerous water-holding containers, including discarded tires, capable of supporting *Aedes aegypti* (vector for dengue fever) reproduction.



Mosquito breeding site, Double Head Cabbage Village, October 7, 2000



Discarded tires, ideal for the reproduction of *Aedes Aegypti*

The potential for the occurrence of vector-borne diseases, particularly dengue fever is high, and population in flooded areas would be at risk of infection.

The proliferation and migration of rodents are expected from flooded areas to dry areas, increasing the risk for leptospirosis outbreaks.

#### **Food Safety:**

The wholesale and retail food stores are seriously damaged and disrupted in the islands. The distribution system is disrupted inland due to the extensive flooding. Some people are using food items available from before the hurricane. A concern is the storage and manipulation of fresh food items (such as meat and chicken), since there is no electricity and the water being utilized to cook is of questionable quality.



Kitchen in May Pen, October 7, '00

Due to the need to respond to the emergency in affected areas, the regular food inspection programme is disrupted. Large quantities of meat that was found spoiled have been condemned and destroyed in Ambergris Caye and Belize City. However personnel is not sufficient to conduct inspection of all food establishments.

A number of livestock animals have died and crops for domestic consumption have been destroyed. The nutritional status of the population living in these areas can be compromised.

## **HEALTH FACILITIES AND SERVICES**

### **Health Facilities:**

The Karl Heusner Memorial Hospital (KMH) is the national referral hospital in Belize. Immediately before and during Hurricane Keith some patients were discharged and some transferred to the District Hospitals in Belmopan and San Ignacio. From a patient count of about 90 early on Friday September 29, 2000 the number fell to a low of around 9 on Sunday, rising again to about 20 by Tuesday afternoon. The hospital remained functional throughout the storm, despite the fact that a large amount of water entered the buildings from the roof, windows, doors and from the floor.

Minor damage is reported for the KMH and much of this can be attributed to known "chronic" building problems that were exacerbated by the Hurricane (e.g. roof drainage system, window and doorframe leaks, etc.). No serious damage to equipment was reported, although the immediate and long-term effects of the water seepage on the floor and ceiling tiles will undoubtedly be a problem (See Annex VI)

The Rock View Hospital (Psychiatric Hospital) was flooded and patients were sheltered in Belmopan. The Hospital is being restored and no damage assessment has been conducted yet.

A total of 11 health centers suffered minor water damage, particularly due to flooding and leaks.



Crooked Tree Village Health Center, Oct. 6, 00



Medical services provided in an "outdoor clinic", May Pen, October 7, '00

## **The Central Medical Laboratory and Blood Bank**

The damage for the Central Medical Laboratory and Blood Bank can be estimated at US\$ 102,000. The Central Medical Laboratory and Blood Bank lost approximately 50% of its reagents and 20% of supplies due to electricity failure and flooding (Estimated cost US\$33,000). The Generator was not functioning and is lacking an automatic switch. Approximately 40 units of blood (50% of units on stock) were damaged due to the electricity failure. Water damage on all three floors with major leaks also damaged some equipment.

Several equipment are malfunctioning or damaged since Hurricane Keith, some of them essential such as: the Blood Bank Unit (Refrigerator), the ELISA washer (for HIV, hepatitis and dengue testing) and the autoclave, two large capacity storage refrigerators (bacteriology and chemistry), the Histo-center and two microscopes from the Histology/Cytology Department. The estimated cost of malfunctioning and damaged equipment is US\$60,000. Blood safety is a major area of concern.

Minor water damage to ceiling, roof and floor was reported on the three floors, particularly in the staff room, bacteriology, and wash room. Other equipment was damaged such as computers and accessories (two computers and four UPS), and four air conditioners (US\$ 9,000).

Shortage of staff is a major area of concern, in serology and bacteriology, particularly to intensify surveillance.

### **Medical Supplies and Equipment:**

No damage was reported to the central medical supplies storage and distribution unit in Belize City. However, all medical supplies were evacuated to Belmopan in containers due to the high vulnerability of the existing storage unit (50 meters from the sea in Belize City). At least five health centers lost their three months medical supplies, vaccines and basic equipment.

### **Provision of Health Services and Availability of Health Personnel:**

The provision of public health services, particularly primary care services has been seriously affected due to the isolation of rural communities in rural Belize, Corozal and Orange Walk districts. Health Personnel have been deployed to the more affected areas for the provision of mobile essential health services and there is presently a shortage of health personnel, primarily general practitioners, practical nurses, laboratory technicians, public health inspectors and health educators. The provision of essential health services to isolated communities and the functioning of the existing public health programmes, particularly vector control, prevention of outbreaks and public education, remains the biggest challenge. The vector control programme is presently lacking of essential equipment and supplies to conduct aggressive emergency interventions.

## VI MINISTRY OF HEALTH RESPONSE

Ministry of Health activated its Hurricane Plan on Friday, September 29 at 2:00 p.m.

The Ministry of Health Emergency Command Center was established in Belize City on Friday, September 29 at 2:00 p.m., under the direction of the Permanent Secretary, and relocated to Belmopan on Saturday September 30 at 10:00 p.m. Due to duty travel, the Minister of Health, the Director of Health Services and the Deputy Director of Health Services were out of the country. Three of them came back as soon as the airport was opened and reported to work on Wednesday October 4.

During the Hurricane, the MOH Emergency Command Centre received telephone reports from the various District Medical Officers and from the staff stationed at KMHM. Surveillance forms were distributed for daily shelter surveillance and a surveillance protocol developed and distributed after the Hurricane.

The Ministry of Health established an Assessment Team, which initiated field visits on October 4. The Assessment Team provided information daily to the MOH Emergency Command Center, to support the decision making process during the emergency.

Ten health teams comprised of a medical doctor, a public health nurse, a public health inspector and a vector control officer visited affected communities to provide essential health services and to complete needs assessment (Annex VII).

Two mental health teams were dispatched to the islands to conduct mental health assessment, and provide post disaster stress management sessions to the health teams, armed forces and members of the community. Mental health services to individuals were also provided.

Isolated communities were accessed by helicopter and boat, and other communities by road (when ever possible).



Getting ready to go to River Valley, BDF Helicopter and MOH/PAHO Team, October 6, 2000



MOH/PAHO team, taking the boat to the Belize River

The health team conducted testing and treatment of water sources in visited communities. Chlorine has been provided to the affected population. Communities were advised on basic sanitation and hygiene practices including the use of chlorine for domestic water consumption.



As per the advice of the health team, I am using my rubber boots to prevent diseases, October 5, 2000

Essential medical services and medication were provided by physicians and nurses for common illnesses such as fever, common cold, vomiting and diarrhea, skin infections, asthma, respiratory infections, hypertension, diabetes among others.

To date, 71 communities have been visited by a health team and basic data collected on the various areas included in the assessment (see annex IV). Advisory messages have been put through the radio warning the public to keep off the flooded areas and to take the necessary actions to prevent water-borne diseases.

The MOH prepared a preliminary report on October 3, and launched an appeal for external assistance on Wednesday, October 4. By October 11, several donors have confirmed their contribution through the Pan-American Health Organization as follows: OFDA, US\$232,000; DFID, US\$150,000; and CIDA, CAN\$ 50,000 (US\$33,333), for a total of US\$415,333.

The Ministry of Health had received the solidarity support of **the Government of the Bahamas** (donation of medication and deployment of a Health Team for the provision of medical services to affected communities); **the Government of Mexico** (donation of medication); and **the General Consul of the Assembly of God** (deployment of a Health Team for the provision of medical services to the affected population).

Management and distribution of donated medical supplies are totally integrated in the SUMA system, which was established on Thursday, October 5. During and after the Hurricane, the MOH has maintained close coordination with the Pan-American Health Organization. The PAHO/WHO Disaster Team for the Caribbean arrived on October 3, and provided support to both, MOH and the local PAHO/WHO Office in the mitigation phase.

The Ministry of Health Emergency Command Center has maintained close coordination with National Emergency Management Organization, and has shared the information obtained on a day to day basis during the rapid assessment with relevant Ministries.

## VII CONCLUSIONS:

1. At least 72,092 have been put at high risk of health impairments as a direct impact of Hurricane Keith.
2. **The population living in flooded areas will be at risk of being affected by possible outbreaks of diseases**, particularly dengue fever, malaria, hepatitis A, cholera, leptospirosis, and gastroenteritis. However, this can be prevented with the intensification of existing public health programmes, particularly vector control, water quality monitoring and treatment, public health education and epidemiological surveillance.
3. Even-though the cayes are the areas with major infrastructural damage, from the public health point of view, **the cayes are not at high risk of outbreaks**, the biggest challenge remains in-land due to the extensive flooding and isolation of rural communities.
4. Nutritional status of the population living in affected areas, particularly those flooded areas where livestock and crops for domestic consumption were destroyed, is a major area of concern.
5. The impact of Hurricane Keith in the mental health of the affected population is yet to be determined. The socioeconomic conditions will be of particular importance in this respect as people move from “survival” to “normal” modes of functioning.
6. Public Health Programmes have been affected due to deployment of personnel to attend the emergency situation. Lack of appropriate equipment and supplies in some areas is of concern.
7. Primary Care services are constrained due to the deployment of medical and nursing personnel to the isolated communities.
8. Laboratory services are constrained due to the damage of equipment and lost of reagents. Blood safety is of concern.

## **VIII RECOMMENDATIONS:**

1. Establish post disaster epidemiological surveillance in affected communities for early detection of outbreaks, and develop contingency outbreak control plans. Intensify and restore regular epidemiological surveillance system as soon as possible.
2. Immediate restoration and intensification of public health programmes, particularly monitoring water quality, food inspection, and vector control.
3. Address environmental conditions in affected areas.
4. Conduct intensive public awareness campaigns on post disaster health issues and training at community level.
5. Replace damaged equipment and supplies in health facilities affected.
6. Immediate restoration of the equipment and supplies for the Central Medical Laboratory and the Blood Bank, particularly those concerning with blood screening and testing for laboratory confirmation of communicable diseases under surveillance in the post disaster phase.
7. Intensify and maintain mobile services to those communities isolated due to the flooding.
8. Implementation of an aggressive emergency Vector Control strategy.
9. Intensify nutrition surveillance and micro-nutrient programmed in affected areas.
10. Monitor closely the mental health of the affected population and ensure provision of post-traumatic counseling services specifically, violence, drug abuse and depression.
11. Increase disaster response capacity at national level based upon the lessons learned from Hurricane Keith (update contingency plans).