

accident, as well as economic and political changes in the nation as a whole, also have raised levels of anxiety about the future.

#### *Nutrition and Growth*

Because food was the primary source of radiation exposure for most people, two areas of inquiry specifically concerned nutrition. First, the restricted diet that had been imposed by the Government to prevent people from eating contaminated food may have affected the people's general health, especially the children's. Second, were the Soviet people complying with these restrictions? The investigators could not find any evidence of problems from the new diet. Also whole-body radiation counts were performed by Task 2 and 3 investigators. It was surmised that most were complying with the prescribed diet.

Levels of food consumption were compared for control and contaminated villages and no differences were found. Comparisons of height and weight also showed no deficiency in nutrition in any of the age groups examined.

#### *Cancer*

Task 4 found no clear evidence of increases of either leukaemia or thyroid cancer in the village populations, as some Soviet physicians had reported. However, the Soviet tumour data collection system used a limited number of tumour categories; it was therefore not possible to exclude the possibility of small increases in these types of cancers.

The Task 4 researchers found no evidence to suggest an increase in congenital disease from radiation, but data received were limited, and future work needs to be done in this area.

#### *Genetic Effects*

No quantitative proof of effects on somatic mutation were identified. Many factors may have affected these findings.

However, only small amounts of data were obtained and many samples degenerated during shipment. Future work is needed to better determine the genetic effects.

#### **Summary**

This study did not confirm many of the widely publicized media reports about the substantial health effects as the result of the Chernobyl accident to the general population residing in contaminated areas. This is not surprising because: 1) not enough time has elapsed since the accident for all potential radiological effects to be seen; and 2) The magnitude of the doses the population has received to date is lower than originally thought. The doses are somewhat lower than expected mostly due to the ability of the Soviet Government to bring clean food into the highly-contaminated region, and thus, limit the amount of radioactive material consumed.

None of the Project teams attempted to reach a conclusion as to what course of action should be taken in the future. This decision is properly the province of the respective governmental authorities based upon their economic realities and scientific and socio-political considerations. Recommendations were made relative to the need for more modern scientific and medical equipment, improved scientific methodology, quality assurance, and education. In addition, recommendations for follow-up monitoring of specific high risk groups were suggested.

The village population does face some risks in the future as a result of radiation exposure. There are other populations, such as the decontamination workers and the initial firemen and plant workers, some of whom already have experienced acute radiation effects, who may be at higher risk of long-term induction of tumours than is the general population. Future health

studies have been planned involving both bilateral agreements between the Russian government and many individual governments and the World Health Organization.

Chernobyl represents a unique and gigantic problem in terms of health issues. Much useful data has been collected on the many health aspects of the accident. However, some information about the ultimate consequences never may be obtainable. This primarily is due to the complexity and scope of the accident and its effects.

Technological disasters have human consequences that are very different from those of natural disasters. At Chernobyl, there was a severe loss of expected control. This produced psychological consequences markedly different from those encountered after floods, earthquakes, and volcanic eruptions. No one expects to control such natural disasters. Another important psychological factor is that most natural disasters are observable to everyone: victims, relief workers, and authorities. Their effects also are relatively easy to see and understand, as are the measurements and directions of experts. By contrast, the ultimate effects of technological disasters may take years to emerge and their explanations and countermeasures to them are unfamiliar and mysterious.

However serious a natural disaster may be, recovery usually is steady and often rapid. Perhaps, Chernobyl's worst feature is its continuous threat, and the continuing fear it has generated in people. Their main fear is that the future will be blighted by cancer or genetic effects. These fears actually may have increased since the accident and show little sign of abating. Let us hope that some of these fears may be ameliorated by studies such as the one carried out by the Task 4 teams, other Project Task teams, and other objective scientific studies in the future.

## **Issues Related to the 1993 Mississippi Floods**

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*This presentation discussed the enormity and duration of the Great Mississippi Floods of 1993, the role of the American Red Cross, the differences from other disasters, and the emotional responses of victims.*

#### **Enormity and Duration**

The Great Mississippi Floods of 1993 were among the worst floods in the history of the United States. In fact, the floods affected many rivers that feed the

Mississippi. Almost every river feeding the Mississippi from the West was out of its banks for eight weeks or more. Many rivers were a mile or more out of their banks for several weeks. Many levees collapsed and many threatened to do so for several weeks. Homes along smaller rivers re-flooded as many as seven and eight times. People who never were flooded remained out of their homes for several weeks because of threatened levee breaches.

Farm crop damage was estimated in the billions of dollars. For many, an entire season's crop was lost. Fortunately, 1994 produced almost ideal crop conditions.

### Role of the American Red Cross

The American Red Cross (ARC) participated in this disaster as they do in all disasters. Since 1905, the ARC has been charged by Congress with responding to America's disasters. For this flood, three headquarters were established by the ARC to respond to the floods: Bettendorf, Iowa; St. Louis, Missouri; and Kansas City, Kansas. Some 250 ARC Chapters were affected. It was estimated that more than 60,000 families were impacted by the floods. More than 28,000 families were served by the Red Cross.

My experience was in Iowa in July and August and in St. Louis in December and January. In Iowa, it began as service to families in about two dozen counties in Iowa and Illinois. Eventually, all 99 counties in Iowa, one county in South Dakota, and 12 counties in Illinois were served from the Bettendorf, Iowa ARC headquarters.

The Mississippi River crested in Bettendorf 15 feet above flood stage on 09 July 1993, and remained above flood stage until late in August. Many rivers feeding the Mississippi crested on

repeated occasions. The Red Cross provided family assistance, physical health, and mental health services throughout the affected areas.

### Differences from Other Disasters

Differences between the Mississippi Floods and other disasters were many. My experience spans more than 30 disasters; including hurricanes, tropical storms, coastal storms, a hail storm, a gas explosion, tornadoes, and many flash floods. Most other disasters come and go, and recovery can begin.

However, the Mississippi Floods continued for many weeks. Water stood in most areas continually. In other areas, the water left, recovery began, water returned, left again, perhaps recovery again began, and then water returned. Still other flooding was caused by levee collapses. Additional water threatened the collapse of levees, yet never flooded.

Part of the Red Cross's damage assessment is based on the height of water in homes. Minor damage is at one level; major damage at another. These standards are based on relatively quickly receding waters. In these floods, minor damage became major because of the lingering waters.

The delays in recovery were obvious. When jobs were lost because of the flooding, there was almost nothing to do for many long weeks. Security of property continually concerned victims. Evaluation of disaster needs was suspended for weeks, awaiting receding waters.

### Emotional Response

The Mississippi Floods caused emotional responses both alike and different from other disasters. Response was similar in terms of the many stresses created by abnormal conditions. Also alike were the post-traumatic stress responses

(PTSR) suffered by many victims, dictating interventions in an attempt to avoid the possible development of post-traumatic stress disorder (PTSD). Further similarities included all the problems and responses dictated by any disruption of usual daily routines.

Differences in emotional responses included the "waiting for the other shoe to fall" by those whose homes were re-flooded, or whose homes were under the threat of failing levees for several weeks, or people having absolutely nothing to do to help themselves for weeks on end, or working many long hours sandbagging to protect property only to have the efforts fail.

I returned to the flooded areas in December to assist Red Cross workers who were finding that families were unable to assist themselves in recovery because of the belief that Spring would bring the same series of rains and cause the same problems. Discouragement and depression in victims were well beyond what experienced Red Cross workers had found in past disasters.

A particular problem for families was the "government buy-out system" and its establishment during recovery from these floods. Whole towns were being considered for movement to higher ground. The decision date for the buy-out was delayed several times. Hopes for recovery were put on hold, and then postponed again and again. After the government decision was made, each family had to decide whether to accept the buy-out or not.

The Great Mississippi Floods of 1993 offered many similarities to and differences from other disasters. The extensiveness and severity of these floods increased the complications for the victims and resulted in more complex interventions for those involved as workers.

## Portraits of Survival: A 20-year Follow-up of the Children of Buffalo Creek

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