APPENDIX 1
KENTUCKY HAZARD ANALYSIS

A study of actual and potential hazards in Kentucky shows that no county, city, town or village is immune to disaster. The threat of accidents and natural disasters is a common concern to the citizens of Kentucky. The vulnerability, or hazard threat, varies according to region and community by season, and type of disaster.

During a calendar year, public hazards which concern most local officials change in priority. Although many hazards are continuous (earthquakes, landslides, transportation accidents, and human action emergencies) others vary according to seasonal and climatic factors.

The following hazards, or threats, have been identified for the State:

1. Floods
2. Tornadoes
3. Severe Weather
   a. Hurricanes
   b. Thunderstorms (and related phenomena)
   c. Winter Storms (ice and snow)
4. Earthquakes
5. Forest Fires
6. Landslides
7. Subsidence
8. Transportation Accidents
9. Energy-Related Hazards (and Power Shortages /Outages)
10. Water Shortages/Droughts
11. Nuclear/Conventional Attack

Following is a brief summary of the factors and conditions which influence the incidence of these various types of hazards, and the vulnerability of our State to each of them.

FLOODS:

Floods are probably the most common hazard to affect the State. Major flooding occurs within the state almost every year, and usually there are several floods within the course of a year. Significant floods occurred in 1973, 1975, 1977, 1978, 1979, 1982, 1984, 1989 and 1991.

Two types of flooding have been identified: Flash Floods and River Basin Floods.

Flash Flooding has occurred in all parts of the state as the result of excessive rainfall over short periods of time. This type of flooding is more prevalent, however, in eastern Kentucky, where its incidence is abetted by the region's mountainous terrain and the many narrow gorges and river beds.

Flash floods have occurred in all months of the year, but they are more prevalent during spring and summer months.

River Basin Flooding is more common during winter and early Spring - February to April. Flooding of this nature is common along Kentucky's major streams, particularly along the Ohio, Mississippi, Licking, Big Sandy, Cumberland, Green, Rolling Fork and Kentucky Rivers, along with other smaller streams. Cities such as Frankfort, Louisville, Owensboro, Paducah Hazard, Prestonsburg, Lebanon Junction and New Haven have been seriously affected by past flooding. Every two to three years serious flooding occurs along one or more of Kentucky's major streams, and it is to unusual for this to occur several years in succession.

TORNADOES:

Tornadoes may occur in any part of the state at any time of year. However, the western and central portions have been more frequently struck, and the months of March, April and May seem to have the most severe tornadoes. Tornadoes have been recorded in the state as far back as 1830, but they seem to have become more frequent in recent years.

Since 1950, there has been an annual average of 8.4 tornadoes in Kentucky. There were 19 tornadoes reported in 1973; in 1974 there were a total of 34.

Injuries, damages and fatalities attributed to tornadoes have also been on the increase in recent years. In 1971 there were 9 deaths and some 130 injuries from tornadoes; in 1974 there were 76 tornado fatalities and approximately 1,000 personal injuries from the exceptionally high number of tornadoes which affected the State that year.

SEVERE WEATHER:

This topic includes several locally severe weather phenomena.

Hurricanes:
Kentucky does not lie within the hurricane zone of the U.S.; however, hurricanes frequently follow a northeasterly path which take them across our state. These passing "cyclones" may produce excessively heavy amounts of rainfall, resulting in flash flooding for various communities in the state; or they may spawn deadly tornadoes, which wreak death and destruction on the state's inhabitants. Probably the most damaging - and best known - incidence of such hurricane - spawned tornadoes occurred on Palm Sunday, 1965, across several states of the Midwest, including Kentucky.

Thunderstorms:
Thunderstorms are quite frequent in our state. They normally produce little damage and few, if any, fatalities; however, a severe thunderstorm may be accompanied by strong winds, hail or other phenomena, which can produce considerable damage

to buildings and crops.

Hailstorms cause more dollar damage than any other type of windstorm.

Lightning is the most deadly phenomenon associated with thunderstorms, resulting in numerous deaths each year.

Additionally, thunderstorm conditions favor the formation of tornadoes, adding significantly to the hazard potential of these locally severe storms. Due to the close relationship of thunderstorms with tornadoes, thunderstorm warnings have acquired a special significance in our State, especially if they come in the mid-to-late afternoon.

Winter Storms:

Due to its mild, temperate climate, our State has experienced few severe winter storms. Occasionally, ice and/or snowstorms do occur, but they are commonly light and of short duration. Rarely does snow accumulate to depths greater that three (3) or four (4) inches. Our most severe winter weather conditions normally occur during the months of January and February; eastern Kentucky is more often affected by these severe weather factors than other parts of the State. The most severe recent winters occurred in 1976-77, 1977-78, 1978-79 and 1993-94, while record low temperatures were reached in the winter of 1983-84, 1984-85 and 1993-94.

EARTHQUAKES:

Kentucky has not experienced an earthquake of major proportions since 1812. However, this violent form of natural disaster poses a great hazard to certain regions of the State, in particular the Jackson Purchase region and the extreme southeastern section of the state. Geologic faulting in the Jackson Purchase region makes this a high "seismic risk" zone, with the potential for an earthquake which could literally wipe out certain of the region's urban centers, and quite probably produce considerable damage to other areas of the State. An earthquake on the scale of the New Madrid Quakes of 1811-1812 (VII or VIII magnitude) can be projected to cause panic and produce serious damage as far away as Louisville and Lexington. There have been numerous tremors over the years, to serve as reminders of this threat, while a significant earthquake occurred in north-central Kentucky in 1980.

FOREST FIRES:

The chief hazard, or threat, of forest fires in Kentucky exists in the eastern part of the State. This is due to the extensively forested areas in the region and the poor accessibility of many areas, making fire suppression more difficult.

A fire threat does exist for other areas of the state (all but seven of the State's 120 counties have reported fires of some magnitude within the past few years); however, the State, as a whole, has had a fairly good wildfire record. There has been no major fire

(affecting as much as 5,000 acres) in the past decade.

The fire hazard is at its zenith during prolonged periods of drought, or at times of increased incendiary activity (trash and field burning etc.). The peak "fire seasons" in Kentucky occur in the Spring and Fall.

LANDSLIDES:
Landslides have been a common hazard in the past. Various landslide-prone areas have been identified throughout the state. Eastern Kentucky has had a long history of landslides, particularly in the Pine Mountain region.

Other areas where landslides has been problematic in recent years are: (1) Northern Kentucky: Boone, Kenton and Campbell counties primarily along the Ohio River (2) Parts of Northeastern Kentucky: Bath, Rowan and Carter counties; (3) Central Kentucky: Nelson and Hardin counties; and, (4) Western Kentucky, along the Tradewater, particularly in Grayson and Caldwell counties.

SUBSIDENCE:
Subsidence, or land settlement, has been problematic in many parts of western and south-central Kentucky, particularly in the Mississippian Plateau region, where the combination of loose soils, soft limestone, and heavy precipitation have resulted in "cave-ins" and "sinkholes" throughout the area-producing "karst topography". Damage has been limited primarily to roadways and gas and sewer mains; however, buildings are occasionally damaged and have to be reinforced, or relocated to firmer grounds.

TRANSPORTATION ACCIDENTS:
These are one of the constant hazards to affect our state. They occur daily, throughout the State. They most commonly take the form of motor vehicle collisions involving two or more cars, objects, or persons. These account for 99% of all transportation accidents and 90% of all fatalities.

Rail accidents represent a portion of these accidents. Rail accidents have the potential to become major incidents. Air and water accidents are less frequent, but they do occur.

The most serious threat from a transportation accident arises when chemicals or other hazardous materials are involved. These have the potential of affecting great numbers of people, over large distances. This hazard potential is most serious in the state's metropolitan areas, (e.g. Louisville, Covington, Ashland, Paducah, Lexington, etc.) due to the number of people who might be affected.

ENERGY HAZARDS:

Petroleum and Natural Gas:
The movement and flow of energy (primarily petroleum and natural gas) throughout our State present us with several potentially hazardous situations. Most of these are concerned with transportation of natural gas and petroleum products across the

State. The hazard threat produced by accidental rupture of a gas-laden tank truck or rail car, or a petroleum laden barge is considerable, particularly in the State's urban areas where the potential for such accidents is high and where greater numbers of people are likely to be involved.

Other hazardous situations arise from possible rupture of the many pipelines and gas lines which crisscross the State. Accidental rupture of these can result in fire, explosion or both, resulting in property damage and possible injuries or loss of life to inhabitants. Another major hazard involves the accident potential within refineries and storage areas. The potential is especially great for fires and explosions in these areas where careless handling or improper use of fire can produce catastrophic accidents.

Thus far, the natural gas and petroleum related industries operating in Kentucky have had an excellent safety record, and the State has not experienced major fires or explosions of this nature, but the potential remains and will require very close attention to those communities having concentrations of these industries or storage areas, within or in approximately to their borders.

ELECTRICAL HAZARDS:

Electrical transmission within the State creates some additional energy hazards. Rupture or breakage of transmission lines is probably the most common hazard; this may result in structural fires or loss of life. Additionally, death or injury from electrocution can result.

Probably the greatest hazard is associated with electrical generation arising from the release of environmentally polluting combustion products and large quantities of heat which must be disposed of. These waste products possess the potential for contamination of a community's water supply and atmospheric pollution. They may post a threat to the State's wildlife and natural resources, as well as to the health and well-being of its inhabitants.

Power Shortages/Outages:

Due to the current restrictions on energy nationwide, the possibility of power shortages or outages in our state has become a real threat. These can occur throughout the State; however, metropolitan areas would be more seriously affected simply because more people would be involved. Energy allocation plans, in the event of a severe shortage or outage, will have to take this into account.

WATER SHORTAGES:

Due to the State's ample water resources (surface and ground water), it rarely experiences severe periods of drought or water shortage.

Occasionally, drought conditions do occur in the State, but they are usually regional and short-lived. Water shortages affecting city water supplies occur frequently during summer months, usually in areas served by reservoirs or wells. Often they happen due to equipment failure or contamination.

NUCLEAR/CONVENTIONAL ATTACK:

According to current National guidance, a strategic nuclear or conventional attack on the United States will most likely be preceded by a period of high international tension and crisis. This crisis period will provide the time required for protective actions, including the relocation of the residents of risk areas to areas of lower risk. This strategic relocation of the civilian population is contained in the Emergency Operations Plans of the state and counties.

A nuclear attack against this country might not be preceded by a crisis period, or the state may receive nuclear fallout from outside Kentucky. Sufficient time for relocation might not be available, or relocation might not be judged necessary. The recommended procedure will be to take shelter in place. This protection is provided in the in-place protection plans of the state and counties. The in-place plan will also be used during relocation to make up for the deficit in fallout shelters.

The potential adversaries of the United States who are capable of initiating an intercontinental nuclear attack have well established plans to relocate residents of major urban areas or shelter in place, should an international crisis occur. These relocation plans anticipate relocation of the population in three or more days. The United States crisis relocation plan calls for the relocation of the risk population in three days.

Other situations under which crisis relocation may be applicable include: an ultimatum by any nuclear power, major conventional war, or threat by a terrorist organization.

Kentucky has seven conglomerates: Paducah, Owensboro, Louisville, Northern Kentucky, Ashland, Lexington/Richmond and Fort Campbell. A conglomerate is a risk area and the associated host counties. There are four types of counties within any conglomerate:

1. Risk County - A county which might receive a direct attack.

2. Risk/Host County - A county which has a portion of the jurisdiction at risk, but is primarily a host county. A risk/host county could receive up to two pounds-per-square-inch over pressure. This over pressure would result in moderate damage to the part of the county at risk.

3. Host County - A county which has the responsibility for the reception and care of relocatees from risk counties.

4. Reserve County - A county whose resources are held in reserve until needed in the host counties. Such counties may be used for the reception and care of relocatees.

The order to relocate the risk counties will be issued by the Governor after such an order is issued by the President.

There are approximately 1.6 million persons at risk in Kentucky. Identification of the conglomerates with population allocations is contained in Appendix One of Annex Y.

Kentucky's Emergency Operations Plan provides for the redistribution of food, fuel, essential goods and services from risk areas to host areas during crisis relocation.

Certain critical governmental and industrial organizations must continue to operate in the risk areas during crisis relocation to preserve the integrity of the area, maintain the national economy, or to assist in providing essential goods and services to the host areas. Employees and dependents of these services will, where possible, be relocated to specific congregate care facilities in host areas.

Relocatees will be instructed to bring sufficient bedding, clothes, special medicines, and at least a three day food supply with them to the host areas.
The implementation of crisis relocation can result in either a peaceful resolution of the crisis, or extend through a nuclear attack and after. Both contingencies are considered in the Ky EOP.

Return of the relocated population to their homes following the crisis resolution will occur only at the direction of the Governor, after the order is issued by the President. Kentucky Disaster and Emergency Services will advise local authorities of the order at least six hours prior to public announcement.

Although the counties will have identified enough shelter spaces for the population assigned, host county residents will be requested to house relocatees to ease the reception and care requirements in the host county. County residents will also be asked to assist relocatees by providing fallout shelters.

During crisis relocation, there will be no requirements for goods or services in any risk area except as necessary to protect property and to support identified critical industries and government agencies remaining in the area. The supply of food, fuel, and essential supplies to risk areas will be coordinated by KyDES, using established public and private distributors and resources. Supplies of essential supplies and equipment, in the risk area, will be transferred to host areas during crisis relocation if time and circumstances permit.

Military assistance will probably not be available. Requests for military assistance must come from the proper officials through KyDES.

POPULATION ANALYSIS: SUMMARY

Population wise, the hazard potential for most types of disasters is greatest for the state's metropolitan areas - simply because more people would likely be affected in the event of a disaster. This is not to say that these areas are necessarily more likely to be stricken by disaster than rural areas, although certain factors and conditions do make urban centers more prone to certain types of hazards. For example, flooding has been a serious problem for most of the state' urban centers since most of them have developed partially

or totally in low-lying areas near major streams, with little regard to existing flood plains.

An unusually high percentage of transportation accidents seem to occur in the state's urban areas, where the potential for major disaster is greatest. Explosions (chemical, gas, industrial, etc.) and chemical leaks or spillage are most likely to occur in the metropolitan areas due to the heavy concentration of plants and transportation facilities in or near these areas.

Human-related emergencies (resulting from accidents, fires, explosions, etc.) would also be more likely to occur in the larger urban areas as a result of transportation and industrial concentrations, or extreme smog conditions. Mass poisonings, epidemics, and water pollution threats would also be greatest for these centers; urban centers would also be most susceptible to power and water shortages/outages.

Other disasters, such as tornadoes, thunderstorms, earthquakes, etc., usually occur without regard to urban-rural classifications; however, their hazard potential is much greater when they strike urban areas. Forest fires, or wildfires, are more likely to occur in rural areas; these generally do not affect large numbers of people.