

# KITTITAS COUNTY, WASHINGTON

## COMPREHENSIVE EMERGENCY MANAGEMENT PLAN

**\*\* HAZARD IDENTIFICATION AND VULNERABILITY ASSESSMENT 2012 \*\***

**(HIVA 2012)**

### **I. INTRODUCTION**

The purpose of this document is to identify and provide general information on hazards that may threaten or cause injury, the loss of life, or damage to property and the environment in Kittitas County. This information serves as the basis for county-level preparedness planning and as a foundation for initiating effective mitigation, emergency response, and recovery activities.

The natural and technological hazards listed below, though not inclusive of all that could affect Kittitas County, are the focus of this document. Concluding the document is an assessment of what the county can do to improve its state of readiness.

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Information about these hazards is presented from a historical perspective and provides a general overview of problems that could arise in the future.

### **II. AREA CHARACTERISTICS**

#### **A. Area location and makeup:**

Kittitas County is in the geographic center of Washington. Traveling east along the I-90 corridor, it stretches from the crest of the Cascades at Snoqualmie Pass to the Columbia River at Vantage. It is bound on the west by King County, on the

north by Chelan and Douglas counties, on the east by Grant County, and on the south by Yakima County. Encompassing 2,297 square miles, Kittitas is third largest county (by area) in the state. Its land is 67% forest, 6% agricultural, 2% urban areas, and 25% undeveloped or uninhabitable lands. Its major water sources include the Columbia, Yakima, and Cle Elum rivers and Lake Kachess, Lake Keechelus, and Lake Cle Elum.

**B. Geology:**

Bedrock geology in the county is varied. Underlying the Cle Elum River drainage is the non-marine sedimentary Swauk formation dating back to the Tertiary period of geologic time from 1.6 to 65 million years ago. Composed of conglomerate sandstone and shale interbeds, the Swauk formation extends as far north as Lake Wenatchee. As these interbeds were later subjected to the mountain-building forces during the emergence of the Cascades, a complex range of land forms was produced that created a history of geologic instability present to this day. Other major bedrock formations in Kittitas County include metamorphic rocks, granite intrusions, and thick sequences of volcanic and marine sedimentary rock of the Chumstick formations (Ciolek, 1975; Shank, 1983). Seismic activity in the county has been recorded from the 1930s through the present, though damage from earthquakes has been low.

**C. Physiography:**

For emergency planning purposes, important physiographical features of Kittitas County include elevation and slope. This county has extremely rugged topography marked by steep slopes and exposed rock faces. The county's elevation ranges roughly from 9,000 feet above sea level near the crest of the Cascades to 1,500 feet above sea level near the city of Ellensburg.

**D. Climate:**

Kittitas County has warm, dry summers and relatively cold winters. Hot, sunny summer days are common, reaching an average maximum July temperature of 87.6°F in lower elevations. The January minimum average is 19°F in lower elevations (Wenatchee NWS office, 1996).

The average annual precipitation in the lower elevations is 15 inches, increasing with elevation to about 35 inches. The bulk of this precipitation falls as snow, which can reach 100 inches or more in the upper watersheds (U.S. Forest Service, 1996). Snowmelt conditions do not always follow seasonal patterns. Several damaging floods have occurred in the months of November, December, June, and July. These were caused by different weather conditions, including rain on top of early or late snows.

July brings thunderstorms to this area. Dry lightning is most common and has caused major fires in the area. At times when these storms produce rain, they may cause flash flooding.

**E. Land ownership:**

Land-use practices in Kittitas County are closely related to land ownership. Within the county, land ownership can be grouped into four major categories: federal government (U.S. Forest Service and Bureau of Land Management), state government (Department of Natural Resources and Department of Fish and

Wildlife), corporate-private, and private. Most of the land within Kittitas County, 87%, is owned publicly, with the remaining 13% in some form of private ownership.

#### **F. Demographics**

In 2005, the county's population was 36,841, reflecting an increase of more than 6,600 people during the 1990s, according to the April 2005 U.S. Census Bureau. The population density is about 15 people per square mile, making it the 28<sup>th</sup> most densely populated county in the state. Most of the recent growth has been in rural areas of the county. Due to the presence of Central Washington University, the county's median age is five years younger than the state as a whole.

Various local events, such as the Ellensburg Rodeo and Kittitas County Fair, temporarily increase the county's population. On certain weekends scattered throughout the year, recreational use can increase in county's population by 4,000 to 8,000.

#### **G. Conclusion**

Increases in growth and development bring a greater degree of stress on the infrastructures of Kittitas County. So far, elected officials have not seriously looked at the effects of growth on emergency planning, although some consideration has been given to fire safety in the interface areas. Perhaps the only way to incorporate emergency planners into the overall planning process is to require their involvement by law.

With changes in the demographic makeup of rural residents, their attitudes are changing as well. They still want to be away from the population base and away from government control, but increasingly they are demanding more services from government, especially from public safety. People want the right to build where they choose, even in areas that are susceptible to natural disaster. Then, when disaster strikes, they want the government to make them whole again. This pattern is being played out with greater and greater frequency. Both the government and the public must realize the value of regulations to guide growth and the amount of aid people receive following a disaster. If there are no growth regulations, then people who choose to live in potentially hazardous areas must accept responsibility to take care of themselves after disaster strikes.

Disaster preparedness is a must. To survive disasters, people must be given the tools they need, and education is critical. A well-organized public preparedness education program will provide the public with the tools it needs.

**III. ABANDONED MINES****A. General Background**

Abandoned mines are old tunnels dug into hillsides or shafts that extend beneath the ground surface. The vast majority of mining activity in Kittitas County occurred in the upper county areas of Cle Elum and Liberty. Coalminers in the Cle Elum area excavated approximately 1,200 miles of shafts since the early 1880s.

**B. Effects**

Several instances of collapsing mineshafts have been reported over the years. These generally occur in the area of the slag piles and have been filled in by the landowners. Most of these collapses were thirty to forty feet across and about the same depth.

**C. History and Vulnerability**

Mining for gold and other precious minerals occurred along Swauk Creek and in the Liberty area primarily between the 1870s and the 1930s. Gold mining still occurs in parts of Kittitas County on small claims, and the Swauk Mining District remains organized under federal and state laws.

Although this activity produced some mineshafts, the coalmining industry that thrived about the same time around Cle Elum resulted in vast underground catacombs. In their heyday, the Cle Elum mines produced more than a million tons of coal annually. Some mines ran until the 1970s. The many miles of underground shafts left behind create an unseen hazard in the Cle Elum area.

**D. Hazard Areas**

Mine hazards are an ongoing threat in the county. Although it is unknown if there have been any instances of people being injured in mines, it appears the biggest threat is property damage from collapsing mineshafts that could leave large craters in the ground.

**E. Conclusion**

Public awareness is the best defense to mitigating any future problems with mineshafts. Landowners need to be aware that living and building in these areas could pose problems, and they should be aware of the dangers of having an open shaft on their property or the possibility of a shaft collapse.

**IV. CIVIL DISTURBANCE****A. General Background**

A civil disorder is a public disturbance involving acts of violence by a group of people. Such disturbances create the threat of danger or results in the damage or injury to people and property. A civil disturbance can cover a wide range of violence and disruptive behavior, from full-scale rioting or picket line violence to public demonstrations and unruliness at public parks and festivals.

**B. Effects**

Violence can flare up with little or no provocation or without apparent cause. Widespread violence and vandalism can spread rapidly and result in death and injuries, destructive fires, or the disruption of services. Secondary effects can include loss or damage to private and public property, a lowered tax base, and other long-term economic losses.

**C. History and Vulnerability**

Past civil disturbances in Kittitas County have been relatively minor in scope and have resulted in less than significant damages. Unruly and violent group incidents have occurred at picket lines and in local outlying areas during the annual Ellensburg Rodeo, Central Washington University events, upper county festivals (such as Pioneer Days), and spring/summer weekends on the Quilomine sandbar, Getty's Cove, and other Vantage areas.

**D. Hazard Areas**

The hazards of civil disturbances cannot be limited to geographical boundaries. However, the potential for damages seems greater in the populated areas of the county.

**E. Conclusion**

A civil disturbance can occur due to a variety of reasons. They often start as a public gathering and can erupt into protest demonstrations or riots with little warning. There are various events occurring throughout Kittitas County annually. Although peaceful in nature, there remains the potential for violence and/or general unruliness. The occurrence of a violent demonstration seems remote; however, the concern needs to be addressed. Preparation for festivals and high use weekends must include local level planning of traffic control, additional security, fire precautions, and increased law enforcement activities.

## V. DAM FAILURE

### A. General Background

A dam is a barrier of earth, rock, or other material that obstructs the flow of water. In the past, dams have failed because of flooding, operation errors, poor construction, lack of maintenance or repair, vandalism, terrorism, earthquakes, and other reasons. Following an increase in dam failures nationwide, Congress passed the National Dam Inspection Act of 1978 (PL 92-367), which called for an inventory of all dams in the United States and inspections of 8,639 non-federal dams nationally.

### B. Effects

The failure of a dam can result in the loss of life and property, damage to crops and streambeds, and utility outages as significant primary effects created by the flash flood. Secondary effects include the lack of irrigation or power profits and other long-term economic, recreational, and wildlife habitat losses.

### C. History and Vulnerability

A dam failure has never occurred in Kittitas County. However, most of the six major dams in the county are over 50 years old. And most are used for irrigation and are constructed of earth and cement.

The Dam Safety Division of the Washington State Department of Ecology reports that dam failures, historically, divide equally into three categories:

1. Overtopping with erosion
2. Slope instability within the dam structure
3. Water intrusion via percolation

### D. Hazard Areas

The list below shows floodplains downstream from dams in Kittitas County:

Dam	Downstream communities	River
Kachess	Cle Elum, Easton, Ellensburg	Yakima
Cle Elum	Cle Elum, Easton, Ellensburg	Cle Elum
Keecheluss	Cle Elum, Easton, Ellensburg	Yakima
Roza	Selah, Yakima	Yakima
Thorp Diversion	Thorp, Ellensburg	Yakima
Wanapum	Auvil Fruit Orchards, Tri-Cities	Columbia

### E. Conclusion

There are many older dams located on streams in Kittitas County. Those dams older than fifty years are potential hazards during certain climatological situations or during and after an earthquake. Presently, the state Department of Ecology, Dam Safety Division is responsible for inspecting private and other non-federal dams for safety conditions.

The federal Energy Regulatory Commission requires non-federal hydroelectric dam owners to develop emergency response procedures as a licensing requirement.

**VI. DROUGHT****A General Background**

A drought, or any protracted period without rain, can be severe enough to threaten lives and property. A drought occurs when soil moisture and water levels in the ground and on the surface fall below a minimum for sustaining plant and animal life. Ground moisture deficiencies affect dryland agricultural crops and often disrupt normal human activities.

Worldwide desertification and/or extremely protracted droughts occur when the prevailing westerly winds or jet stream currents in the Pacific Ocean reorient themselves in new positions on a long-term basis. The effects of El Niño's warm equatorial currents (or, conversely, La Niña's cold currents) cause some regions to experience drier-than-normal conditions while others, thousands of miles away, experience wetter-than-normal conditions.

The State of Washington has had 19 droughts since 1901. Typically, they last for a couple of months to a couple of years.

**B. Effects**

Locally, droughts have left a major impact on individuals and the agriculture, timber, and hydroelectric industries. Lack of snowpack has forced ski resorts and other recreation-based companies into bankruptcy. The primary effects of drought in Kittitas County include loss of fruit and dryland crops, loss of range and domestic animals, loss of wildlife and wildlife habitat, and extreme danger from wildland fires. Secondary effects involve social and economic hardships due to crop losses, energy curtailment, temporary unemployment, domestic and municipal water shortages, and increased number of major wildfires.

**C. History and Vulnerability**

All areas of Kittitas County and the State of Washington are vulnerable to drought conditions. Although not subject to severe annual precipitation deficiencies, periodically Kittitas County experiences seasonal dry spells lasting two to three months. However, since the early 1920s approximately 13 droughts have particularly affected Kittitas County. During these low water years, agriculture, forestry, and hydroelectric interests have felt the impact, especially on dryland farms, ranges, and forested areas.

**D. Hazard Areas**

Because of the increased fire danger, forested and grassland areas of Kittitas County can become extremely hazardous areas during prolonged drought situations. Populated areas in the county and in the cities can be directly affected by low stream flows. Hazardous conditions, including domestic and municipal water shortages, affect the ability of local government to fight fires effectively or provide sufficient water and sewage services.

**E. Conclusion**

Kittitas County and the State of Washington are vulnerable to drought conditions. Significant mitigation measures taken by federal, state, and local agencies to lessen the effects of drought have included water surveys and measuring snowpacks, studying weather conditions, closing roads to unnecessary activities, limiting irrigation and power usage, establishing minimum stream flows for fisheries, prohibiting logging, mining, and recreation in national and state forests, and providing disaster funds to farming areas.

Additional mitigation strategies for the future should include development of a good disaster response plan, public education in conservation and fire prevention, and coordination between federal, state, and local planning.

**VII. EARTHQUAKE****A General Background**

Earthquakes are unpredictable and strike without warning. Until recently, the cause of earthquakes has not been understood. In the 1970s geologist developed the theory of plate tectonics, which is now commonly accepted by the scientific community. This theory states that the surface of the earth is comprised of about ten fifty-mile thick plates that rotate and drift upon the earth's mantle of molten rock. Individual plates, which lie primarily under bodies of water, normally rotate about five times faster than land bearing plates. This is an average of four inches per year compared to three-fourths of an inch annually (Row, 1983). The release of energy in the weaker areas where the plates contact each other is now thought to be the cause of earthquakes.

Where are future earthquakes likely to occur in the State of Washington? Historically, the Puget lowland from Olympia to the Canadian border has been the most seismically active part of the state. More than half of the thirteen most strongly felt earthquakes have occurred within that region (Noson, 1980). Earthquakes in Eastern Washington have been generally small in magnitude and shallow in depth. These shallow, moderate magnitude earthquakes often cause considerable damage in the immediate vicinity of the earthquake (Noson, 1985).

**B. Effects**

Earthquakes can range in intensity from slight tremors to great shocks and may last from a few seconds to as long as five minutes. After the initial shock, additional shocks (aftershocks) may occur over a period of several days. Depending upon the magnitude of a given earthquake, the primary effect of actual ground movement may include fatalities and/or injuries from collapsed buildings, bridges, dams or other structures; landslides or avalanches severing transportation routes; and disruption or failure of electric, telephone, gas, water, sewer, and other essential utilities.

Secondary effects in an earthquake-damaged area can include fires from ruptured gas mains or downed power lines, contamination or lack of water from ruptured water and sewer lines, hampered rescue efforts due to damaged equipment or roads, and the risk of aftershocks creating more damage.

**C. History and Vulnerability**

From the early 1900s to the present, most of the seismic activity in Kittitas County has occurred in the western part of the county. Damage by earthquakes has been low in the county.

**D. Hazard Areas**

Although earthquakes are unpredictable and can occur anywhere at any time, historical and scientific data suggest there are western areas of Kittitas County may have a higher potential for future seismic activity.

**E. Conclusion**

Earthquakes can occur anywhere, at any time, without warning. Because many earthquakes are not associated with known faults, they are also very unpredictable. Past geological studies indicate areas prone to earthquakes may experience long periods of inactivity. These areas may be building tension, which can lead to a major earthquake.

Due to the unpredictability of earthquakes, forecasting when or where the next one will occur in Kittitas County is impossible. Although past earthquakes have been in the form of milder tremors, the potential for a major earthquake cannot be ruled out. The probability that an earthquake will occur in Kittitas County is high. When, where, and of what magnitude remains to be seen. Land-use planning and building codes should reflect potential effects of earthquakes in Kittitas County. Development of disaster response plans and general preparedness of emergency response agencies are effective mitigation techniques that may lessen the confusion and damages prior to a major earthquake incident.

Public education and preparedness are areas of effective mitigation. The public must be made aware of what could happen and how they can prepare for such events. They must realize that after an earthquake, or any other disaster, government may not be able to assist them immediately. Citizens must be able to take care of themselves for three days after a disaster.

**VIII. FLOOD****A. General Background**

Flooding is one of the most common naturally occurring hazards in Kittitas County. The steep drainages typical in much of central Washington have presented reoccurring problems throughout the history of the area. Basically, the two types of flooding common in the county are stage and flash flooding.

Stage flooding is usually seen during periods of heavy rains, especially upon existing snow packs during early winter and late spring.

Flash floods are more likely to occur during the summer months, during thunderstorm season.

**B. Effects**

Floods have caused personal injuries and damage to property, the infrastructure (roads and bridges), and utility systems. Secondary events from major flooding include the spread of disease and contamination by polluted water. This increases the health risk for people returning to their homes following a flood.

**C. History and Vulnerability**

Historically, flooding has been one of the most common natural hazards in Kittitas County.

Stage flooding is becoming increasingly common. Recent episodes in 1990 and 1996 exceeded 100-year flood expectations. This type of flooding has caused extensive damage along the Yakima River drainages; however, no lives have been lost to stage flooding in Kittitas County.

**D. Hazard Areas**

The Columbia, Yakima, and Cle Elum rivers, and other perennial streams in Kittitas County, follow an annual cycle of peak stream flow in April and May and low stream flow in August and September. Normally, stream flow in many of the smaller drainages is seasonally intermittent, while drainages in lower elevations are often dry. Hazardous areas for most types of residential or recreational development include lands within the 100-year flood plain boundaries. Present problem areas involving damages to public facilities include the Columbia River, Yakima River, Cle Elum River, Wilson Creek, and Mercer Creek.

The primary cause of flash flooding, which can occur in any drainage area in the county, is high-intensity rainfall. Although infrequent and usually of short duration, high-intensity rainfall has been recorded in all seasons. Of special concern are the months of July and August, during the thunderstorm season.

The threat of flash flooding increases in areas burned by a major wildland fire. Not only is there a greater amount of loose debris, but the natural ground cover has been mostly or completely burned away. This allows the soil and debris to flow away with water and increases the risk that debris dams may form. Historically, major flash floods and mudflows have occurred following major wildland fires in the county.

Depending upon the characteristics of a particular watershed, peak flows may be reached from less than one hour to several hours after rain begins. The debris dams and mudslides accompanying rapid runoff conditions make narrow canyons and alluvial fans at the mouth of the canyons extremely hazardous areas.

Present problem areas for flash flooding include all the side tributaries to the major drainages and some secondary streams in the county. Stage flooding is a concern along the Yakima, Cle Elum, and Columbia rivers as well as Wilson and Mercer creeks in the Ellensburg area.

The increasing population and correlating scarcity of available land makes development along the hazard areas likely to continue until land use planning addresses this issue in Kittitas County.

**E. Conclusion**

Historically, Kittitas County has some of the highest incidences of flash flooding in the state. These flash floods are usually associated with cloudburst type rainstorms and often involve ice or debris dams. Due to the county's topography and climate, stage and flash flooding will continue to be a threat in most parts of the county.

Mitigation and preparedness practices to reduce the potential for private and public damages should reflect:

- Strict floodplain zoning/regulations, including flash flood hazard areas.
- Public education to alert the public of flooding hazards.
- Requirements for flood insurance for building in flood plains.
- Establishment of a system to monitor watersheds that have been recently burned or significantly clear-cut of timber.
- Good rehabilitation practices after a major fire.
- Continued emergency response planning.
- Compliance with Growth Management regulations.

**IX. HAZARDOUS MATERIAL****A. General Background**

Today there are several thousand substances in daily use that can cause local emergencies or adversely affect a substantial number of people. An increasing number of chemicals, petroleum products, radioactive materials, biological toxins, and other hazardous substances spill because of accidents on highways, railways, waterways, and in other places. On occasion, these events can reach major disaster proportions. The manufacture, use, transportation, storage, and disposal of hazardous materials and dangerous wastes pose a risk to the public health, safety, and the environment. Dangerous substances are found throughout the state and county in all modes of transportation shipments, as well as in manufacturing and storage facilities.

**B. Effects**

Any incident involving hazardous materials can rapidly escalate into a full-scale disaster. The hazardous properties of chemicals, motor fuels, radioactive substances, and other dangerous materials range from explosive or highly flammable to poisonous. They have the capability of contaminating the air, water, and ground. The potential loss of life, extensive property damage, and other environmental contamination is always high when hazardous materials are present. The effects of a hazardous materials incident can vary, depending on which substance is involved and in what quantity, where the incident occurs and at what time of day, what the weather conditions are, and what the proximity is to populated areas.

Effects from the release of a hazardous substance may cause immediate health concerns, death, chronic health problems, and may interfere with the development of a human fetus.

**C. History and Vulnerability**

Major transportation routes, a natural gas pipeline, and the agricultural-based economy make Kittitas County vulnerable to incidents involving hazardous materials. Statewide, transportation-related spills of petroleum products account for the majority of incidents involving hazardous substances. This is also true for Kittitas County. However, the potential for incidents involving other substances remains high.

**D. Hazard Areas**

All areas of the county are vulnerable to the effects of a hazardous materials incident. This vulnerability increases in areas adjacent to:

**Ag-chemical warehouses**, where many toxic materials are stored. Most are in wettable powder form, but liquids and compressed gases are also kept at these sites.

**Water treatment facilities**. Most potable water and wastewater treatment sites use chlorine. In addition to these sites, places such as public swimming pools keep and use water treatment chemicals.

**Major transportation routes**. Kittitas County has several major highways, I-90, I-82, SR821, SR10, and SR97. Interstate 90 at Ellensburg has a traffic count of 25,000 vehicles per day. Interstate 82 has a traffic count of 14,000 vehicles per day. On state route 97, 4,900 vehicles crest the summit at Blewett Pass. A Burlington Northern Railroad line travels through Kittitas County transporting hazardous materials such as anhydrous ammonia, chlorine, liquefied petroleum gas (LPG), hydrogen peroxide (greater than 52%), and molten sulfur. In addition, a high-pressure natural gas pipeline passes through Kittitas County.

Another area of hazard is the lack of resources and advanced trained personnel. Most area fire fighters have been trained to the First Responder - Operational level. This means they can only respond in a defensive manner to a chemical release. In the event of a large scale hazardous materials incident, outside resources will have to be called in through the Department of Ecology. This response takes time, so if there is no responsible party to mitigate the release, local responders will have to allow the release to continue until properly trained personnel can arrive.

**E. Conclusion**

As the population increases, so does the demand for products that require hazardous chemicals. This increase in the amount being shipped and, as stated before, the BNSF RR main line and the high-pressure natural gas pipeline coming through Kittitas County, lends itself to a potential hazard. Although safety is constantly stressed in the transportation industry, equipment malfunctions and human error can occur, making the potential for a hazardous materials incident quite high. Any local incident has the potential of becoming a large-scale disaster. Today the quantity of materials being transported, plus the complex nature of these hazardous materials, presents a problem so large that no single agency or industry is capable of handling all of the possible problems that may arise.

**X. SEVERE STORMS****A. General Background**

Washington is subject to a number of severe storm conditions, including thunder and lightning, wind, snow, ice, and hail. Since severe weather disturbances often represent the extremes in wind, cold, and precipitation, direct damage to the natural and built environment may occur statewide.

Depending upon the time of year, hazards resulting from a severe storm can include wildfires, flash floods, avalanches, or landslides. Severe thunder, hail, winds, and winter storms are common in all parts of Kittitas County. Severe local storms occur when the interior of British Columbia is under the influence of high barometric pressure and a deep low-pressure center approaches the Washington coast from the Pacific. At this latitude, severe storms normally approach Kittitas County from the south or southeast. Although the intensity of major storms is often reduced by the Cascades, winds crossing the mountains can reach 100 MPH or greater, with peak gusts of 125 to 150 MPH as the storm moves inland.

The four types of severe storms that commonly occur in Kittitas County are snowstorms, ice storms, thunderstorms, and windstorms. Snowstorms can drop 6 inches or more in a 24-hour period. Full-scale blizzards may produce winds of 35 MPH or more. Freezing rain or drizzle is called an ice storm. Moisture falls in liquid form but freezes on impact. Severe thunderstorms produce sustained winds or gusts of 50 knots (58 MPH) or greater and/or hail of 3/4 inch or larger in diameter. Past major windstorms in the area have ranged from 45 to 69 MPH, with gusts to 116 MPH (National Weather Service, 1995).

**B. Effects**

The primary effect of a severe local storm is immobility due to the disruption of transportation and utility systems. Primary effects normally vary with the intensity of the storm. In some cases, transportation accidents can occur from accumulation of snow, ice, hail, or dust from accompanying winds. Other primary effects may include loss of life and injury from accompanying flash floods, fires, or avalanches.

Secondary effects can include severe wind erosion of dry soils, overtaxing of electric utilities during storms, damage to crops, inflated agricultural prices, and temporary shortages of necessities in the area affected by the storm.

**C. History and Vulnerability**

Historically, Kittitas County has been affected by many types of storms with varying intensities. Common types of storms in this area include thunder, hail, wind, and winter-related storms such as blizzards.

A few notable storms are listed below.

<u>Date</u>	<u>Type</u>	<u>Effects</u>
Oct. 1950	Wind	Max. velocity 57-60 MPH
Mar. 1956	Wind	Max. velocity 48-60 MPH
Dec. 1968	Snow	Extensive snowfall
Jan. 1997	Snow	Passes closed 2 days; avalanche danger
Nov. 2005	Rock Slide	Closed 1-90 for ~2 days
Dec. 2006	Snow-Wind	Major power outage - county wide

*Source: U.S. Department of Commerce, NOAA, National Weather Service*

#### **D. Hazard Areas**

All areas of Kittitas County are vulnerable to the threat of severe storms. Due to topography and climatological conditions, the higher mountainous areas are often the most exposed to the effects of these storms. Normally the mountainous terrain and the north/south orientation of the Cascades tend to isolate severe storms into localized areas of the county. Periodically though, individual storms can generate the force to affect the entire County at one time.

Although the topography of this area isolates it from most severe storms, the mountainous terrain, coupled with the right weather factors, lends itself to increased chances of high winds in the county.

#### **E. Conclusion**

The potential for a severe storm always exists. Although most storms in Kittitas County create only minor problems, emergency plans should reflect weather warnings and other procedures to notify the public. Public agencies and departments should develop emergency response plans and coordination procedures. The development of public education and preparedness programs can help mitigate hazards prior to major storms.

## **XI. SLIDES (AVALANCHE AND LANDSLIDE)**

#### **A. General Background**

Slides are the occurrence of materials or debris flowing down steep slopes, including snow, rocks, mud, and other natural materials.

Snow slides or avalanches may involve loose snow or slabs of hardened snow. Loose snow avalanches generally start at one point or over a small area. Slab avalanches occur when a large area of packed snow begins to slide. Avalanches grow in size, encompassing more and more snow as they descend. Steep slopes (usually from 30 to 50 degrees) and snow are the only requirements for an

avalanche. The forces generated by moderate or large avalanches can damage or destroy most built structures (U.S. Forest Service, Knipple, 1996).

Landslides of rock, mud, and other earthen materials can range in size from thin masses of soil a few yards wide, to deep-seated bedrock slides greater than six miles across. Travel rates may range from only a few inches per month to many feet per second. Earthquakes or unusually wet winters can reactivate old slide areas and slumps. These areas are also more susceptible than adjacent undisturbed material to slides triggered by construction (Satterlund, 1972).

Increasingly, and often with little caution or preparation, people are recreating, working, and building in potentially hazardous slide areas. Development pressure in rural areas and at recreation sites in the mountains increases the risk to people and structures.

#### **B. Effects**

Slide effects on individual or public organizations include partial damages or destruction of significant portions of highways and railroads, utility lines, and private and public property. Other major effects involve the loss of natural resources and the cost of debris removal.

#### **C. History and Vulnerability**

Kittitas County is particularly vulnerable to slide hazards. The Cascade Mountains receive extensive precipitation due to their size and orientation to the flow of Pacific marine air. The winter snowpack is the deepest recorded in the United States. In Kittitas County, avalanche season can begin in November and continue into early summer. In the higher alpine areas, the avalanche season continues year-round. Because of increased winter recreational use in the Wenatchee National Forest and other adjacent lands in Kittitas County, an increasing number of people are becoming exposed to avalanche risks. Landslides can occur in almost any part of the county.

Areas vulnerable to landslides are identified largely by steep slope classifications, soil types, conditions of bedrock materials, and water content or unstable soils.

Some damaging slides have occurred in and near to Kittitas County.

In the winter of 1996–97, I-90 closed over Snoqualmie Pass because of avalanches and avalanche hazard. This stranded hundreds of travelers during the holidays.

On January 18, 1998, a snowmobiler died when an avalanche buried him and his sled in the Drop Creek area. During the winter of 2001, an Ellensburg snowmobiler was killed in the Lake Ann area of upper Kittitas County in an avalanche.

Several other snowmobilers have been caught in and survived avalanches in Kittitas County. Because many popular riding areas are in avalanche-prone areas, there is a real possibility of a multiple injury or fatality avalanche incident in the county.

**D. Hazard Areas**

Under the right conditions, any steeply sloped area of Kittitas County is a potential hazard area. The ever-increasing pressure for development in or near the mountains and narrow valleys increases the risk of slides to people and structures.

**E. Conclusion**

Slides are usually the cumulative result of a series of events. Slides often occur on steep slopes after severe storms, wildfires, earthquakes, irrigation canal breaks, or construction activity in slide-prone areas. Because of the steep topography and narrow valleys of Kittitas County, the potential for slides is high year-round. Land use controls in highly vulnerable areas, development of a good disaster response plan, and public education can reduce the potential for property damage and loss of life due to slide hazards.

Recognition of hazardous conditions and identification of historically prone landslide areas are especially important for future land-use development planning. Both public and private structures constructed on top of or below bluffs and slopes are subject to landslides. Additional development is occurring on alluvial plains and at the mouths of narrow, restricted canyons. Other areas subject to landslides are mountain highways and areas below watersheds that have little or no vegetation because of wildfires or logging.

**XII. TERRORISM****A. General Background**

The U.S. Department of Justice defines terrorism as "a violent act or an act dangerous to human life, in violation of the criminal laws of the United States or any segment to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives". The FBI defines terrorism as "the unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives."

**B. Effects**

The scope of damage terrorists can create is limited only by their goals and imaginations. Primary effects of terrorism may include kidnapping; death; illness; arson; bombings; releasing of toxins, vectors, and biological agents; and disruption of services.

**C. History and Vulnerability**

Although there have been few acts of terrorism in Kittitas County, the potential for this type of incident is increasingly present. Kittitas County is vulnerable to many terrorist acts from global or local groups or even individuals. These acts may include bombings, arson, radionuclide or toxin dispersal, or the dispersal of biological agents. Various events within the county can assemble in excess of

100,000 people for a weekend, and other gatherings may assemble as many as 25,000 people in a three-block area. These assemblies, as well as county infrastructures such as dams and bridges, could be potential terrorist targets.

**D. Hazard Areas**

Depending on the individual or group cause, almost any facility, organization or event in Kittitas County could be a potential target for terrorism. Likely targets in Kittitas County include political figures; infrastructure; events; children; animals; local, state, and federal facilities; hydroelectric facilities and the associated distribution infrastructure; major industry and warehouses; and communications facilities. The Mink farms of the upper county have been and could continue to be targets for acts by animal-rights groups.

**E. Conclusion**

Little terrorist activity has occurred in Kittitas County; however, as we participate increasingly in the global society, this issue must be addressed. Terrorist acts are difficult to prevent; however, mitigation may limit the effects of terrorist activities. Mitigation precautions should involve the training of response personnel and elected officials and the development of policies and procedures relating to the response to suspected terrorist acts.

### **XIII. URBAN FIRE**

**A. General Background**

While the probability of a major urban conflagration is low, large fires are possible in many older buildings within urban areas and in outlying areas next to grasslands and forests.

Fire hazards in older buildings are high because of the construction materials in use at the time (such as sawdust insulation), antiquated electrical wiring, and minimal spacing between buildings.

Fire hazards to homes built in or near grasslands and forests are somewhat high because of the local environment, the use of combustible roofing materials, and the lack of a defensible space or buffer zone surround the homes.

**B. Effects**

The most significant effect of a structure fire is the potential for the loss of life and injuries, because fires can occur without warning. Secondary effects include damage to personal property, loss of housing, and short- or long-term economic and employment losses.

**C. History and Vulnerability**

Major urban fires can occur any time of year in any Kittitas County community. Most urban fires, however, have been limited to single structures. Most of the small communities in Kittitas County cannot afford to maintain the standing fire department required to meet a major fire situation so they rely on volunteer firefighters and mutual aid for handling major incidents.

Kittitas County has not seen many major urban fires. It's most notorious urban fire occurred July 4, 1889, and destroyed ten city blocks of mostly wooden structures.

**D. Hazard Areas**

Every incorporated and unincorporated community in Kittitas County has a potential for a major urban fire. Areas where older structures constructed primarily of wood stand extremely close together are at the greatest risk for a major structural fire; such residential, commercial, and industrial structures exist in every community and populated area of the county.

**E. Conclusion**

Although the probability of a large-scale urban fire is slight, the possibility exists. Mitigation of losses by local fire agencies can occur in two areas of activity: fire prevention and pre-planning of fire responses. An important aspect of planning for major fire response is the development of mutual aid agreements with nearby local, state, and federal fire agencies, as appropriate. This strategy expedites response time and helps contain or control fires before they spread to major size. Fire prevention and public education on fire hazards are effective measures in reducing the number of fires within a community. In addition, the continued enforcement of fire and building codes is successful in reducing future fire hazards in newer buildings and those presently under construction.

## **XIV. UTILITY OUTAGES**

**A. General Background**

During the 1970s, a number of events collectively called the "energy crisis" resulted in the public focusing attention on future energy supplies. These events included the OPEC oil embargo, rapid increases in fossil fuel prices, inflation effects on thermal-generation facilities, a period of low-water years in the Pacific Northwest, and a growing public concern with the safety and cost of nuclear power plants. The public expressed its concern in as many forms as there are energy sources and causes for their shortages.

By the mid-1980s, the Pacific Northwest was again facing an energy crisis, although of a different nature. This crisis was primarily the result of the overreaction to the events of the 1970s. Recent events have seen the collapse of the regions joint hydrothermal program, (BPA and public and private utilities), which brought about the largest default of public bonds in the nation's history.

**B. Effects**

In the majority of cases, long-term energy emergencies in Kittitas County are due to world and regional politics. At the same time, temporary or short-term consequences are often due to disruption of services by storms and other weather conditions. The primary effects of energy emergencies include inconvenience to customers, reduced home heating capability, reduced agricultural capability, commercial and industrial cutbacks, and increased unemployment. Secondary effects include an impact on alternate energy resources, supplies, and costs. For example, the effect of large numbers of

individuals converting to wood fuel as a heating source increases air pollution and inflates the cost of firewood. Additionally, this diminishes firewood supplies on public lands.

**C. History and Vulnerability**

Petroleum shortages can occur at any time, depending on events in the politically volatile Middle East. Although imports have decreased substantially, the United States remains dependent upon imports for approximately 35% of its petroleum needs. Hydroelectric dams produce roughly 80% of the electricity in the Pacific Northwest. Low-water years in the 1970s, and the resulting overbuilding of regional thermal (coal-fired and nuclear plants) power facilities at a time coinciding with low power demands, resulted in a default of the bonds financing Washington nuclear plants four and five. Questions concerning the region's electric utilities liability for repayment are currently being resolved. This may result in significant rate increases in the region for an extended period.

With the exception of rationing during World War II, specific energy shortages in Kittitas County were uncommon until the 1970s. Then petroleum shortages occurred during the 1973–74 OPEC oil embargo and the Iran cut-off of 1979. Electrical shortages also occurred in 1973-74 and 1977-78 due to drought conditions and insufficient water to operate hydroelectric dams at the needed capacity.

**D. Hazard Areas**

Short-term power outages can occur in Kittitas County at any time. Normally this is the result of a storm, auto accident, or human error. This type of temporary energy loss generally affects service in isolated portions of the county and is of relatively short duration. Long-term shortages of imported petroleum products, however, will affect Kittitas County, the State of Washington, and the United States overall. Judging from past events, future petroleum shortages will likely stem from political incidents in the Middle East and result in long trade embargoes.

**E. Conclusion**

Future energy emergencies are likely to occur due to numerous factors. Locally, energy emergencies can occur because of a drought affecting the generating capacity at hydroelectric facilities, tremendous increases in local power rates, or as the result of a worldwide energy embargo. Because of this, most facilities or entities that require uninterruptible power must plan an alternate power supply system that could take over in emergencies. Additional local government provisions should be made for the effective conservation of available energy resources in the area. In a large-scale energy emergency, local government would also be involved with public education programs on energy conservation and establishing priorities for restoration of energy resources at vital facilities.

## **XV. VOLCANO**

**A. General Background**

The Cascade Mountain range contains many dormant or extinct volcanoes that have shown no signs of activity within the past 10,000 years. Although most

volcanoes located in Washington State are inactive, authorities classify five as active because of their historical, current, or potential for activity. These five volcanoes are Mt. Adams, Mt. Baker, Mt. Rainier, Mt. St. Helens, and Glacier Peak. Mt. Hood, just across the Columbia River in Oregon, is also active. Both the active and dormant volcanoes of Washington are of the composite category. This means an explosive issue of steam, cinder, ash, or lava usually accompanies their eruptions.

**B. Effects**

The degree of hazard depends on the kind of eruption and proximity to the eruptive vent. Most of the danger applies to people in the near vicinity of the volcano. As demonstrated by the 1980 eruption of Mt. St. Helens, the primary effects in Kittitas County are likely to result from ash fallout. Depending upon the severity of the eruption and the areas of the downwind plume, these effects may include immobilization of transportation, telephone communication short-circuits, power failures, and respiratory or other health problems. Secondary problems include economic costs for cleanup, ash disposal problems, and structural failures due to the density of ash; one inch of ash weighs ten pounds to the square foot.

**C. History and Vulnerability**

All of the active volcanoes in the state indicate the presence of heat and, on occasion, emit steam and hydrogen sulfide gas. Mt. St. Helens is currently the most active volcano. Studies indicate that it may have been active every few hundred years for centuries, with the most recent series of eruptions occurring in the early 1980s to present.

Past studies of Mt. Rainier and Mt. Baker, outlined in the Washington State Hazard Identification and Vulnerability Assessment, indicate their most recent activity may have occurred in the early and mid-1800s. Many geologists believe these volcanoes will erupt again; the question is when.

**D. Hazard Areas**

Presently there are no active or dormant volcanoes in Kittitas County.

**E. Conclusion**

Because of the distance from the state's active volcanoes to Kittitas County, the largest potential threat is volcanic ash. Thus, the effects of volcanic activity upon Kittitas County depend on the location of the erupting volcano and the prevailing wind direction. Under certain conditions, heavy ash fallout in Kittitas County would have the same effects as the 1980 Mt. St. Helens ash fall in adjacent Eastern Washington counties.

Since scientists expect volcanoes to provide some indicators prior to erupting, there should be time to prepare, warn, and inform the public. In the interim, local departments should develop good disaster response plans and procedures to cope with the various problems presented by an eruption.

**XVI. WILDLAND FIRE****A. General Background**

The wildfire season in Washington normally runs from mid-May through October. In Eastern Washington, any prolonged period of low precipitation presents a potentially dangerous problem. In Kittitas County, the probability of a wildland fire starting at a particular location depends upon fuel and weather conditions, topography, time of year, and the level of human activity occurring that day.

**B. Effects**

The effect of wildland fire on Kittitas County varies with the intensity of the fire, which is affected by fuel types, topography, and time of year. Significant effects of wildland fire include loss of lives, personal injury, damage to private and public property, and economic impact. Fires in the past, especially the 1994 fires, caused economic hardships on local businesses as well as government, due to a loss of tax revenue.

Wildland fires also have an adverse effect on watersheds because they increase soil erosion and stream degradation, which contributes to potential flooding in the county.

**C. History and Vulnerability**

The location and climate of Kittitas County make the entire county vulnerable to wildland fires. Although many wildland fires have been human caused, naturally occurring fires also can be devastating. The thunderstorm season of late July and early August brings dry lightning and produces hundreds of ground strikes annually.

Recent fires have shown that Kittitas County is extremely vulnerable to wildland fires and that their effects are devastating.

**D. Hazard Areas**

Kittitas County's topography, natural vegetation, and dry summer climate combined with heavy recreational use make the entire county susceptible to wildland fire. Wildfires in the summer months are difficult to suppress. This has resulted in long-term resource losses, increased flood potential, and damage to private and public property.

As Kittitas County grows and development encroaches into forested or interface areas, where the homes meet the forest, the potential for a major conflagration grows. Building in the interface areas adds to the human factor and increases the chance of fire starts. This, coupled with a lack of understanding of what fire can do in the wildlands and the use of combustible roofing materials, increases the potential of devastating losses.

This lack of knowledge is prevalent among rural residents and elected officials and planners alike; they often fail to consider fire behavior, construction techniques, and the resources needed to combat a fire (water supply, road access, defensible spacing, and equipment) when allowing development.

**E. Conclusion**

The short- and long-term consequences of wildland fire on people and the natural environment has made it necessary to develop a strategy for reducing the potential of large-scale fires. To reduce the potential for loss of life and property, Kittitas County needs to:

1. Development and maintain a strong fire prevention plan that involves all levels of government.
2. Enhance interlocal agreements on all levels of government, to ensure a more efficient fire response and provide a better sharing of resources.
3. Enhance and maintain disaster procedures, including communications, for multi-agency responses to wildland fires.
4. Develop interagency suppression pre-fire plans and initial attack agreements for firefighting in the interface areas.
5. Develop zoning and building codes for high-hazard areas.
6. Offer wildfire prevention education to homeowners and recreationalists.

**XVII. FINDINGS AND RECOMMENDATIONS**

The information presented in this document indicates Kittitas County has been and will continue to be vulnerable to many natural and technological emergencies and/or disasters.

Today, with higher population densities and the increasing use of Kittitas County as a year-round recreation area, the potential for loss of life or damage to property and the natural environment in a disaster situation is becoming greater than ever before. This poses many problems for those involved in disaster response and recovery operations because of limitations imposed by several conditions; for example, because responders cannot perform most emergency operations without sufficient preparation time, the geographical remoteness of the county can limit their response time and/or capabilities. Also, because major emergencies occur infrequently, many responders are unpracticed or unfamiliar with disaster procedures. Finally, resources are limited at the local level for dealing with major incidents. In a disaster, federal, state, and local jurisdictional questions compound these problems.

To prepare for and to help mitigate the effects of a disaster:

1. County and city comprehensive plans and zoning ordinances need to further identify or regulate development in known hazard areas throughout the county.

2. Planning, response, and recovery procedures need ongoing review and development. This pertains especially to:
  - a. Direction and control in the Incident Command System (ICS).
  - b. Resource management.
  - c. Warning.
  - d. Emergency public information.
  - e. Communications.
  - f. Training and education.
3. Developing local, state, and federal interagency relationships.
4. The Emergency Management Council needs to review its goals and define Emergency Management's direction and priorities.
5. Elected officials need to support and direct departments to participate in disaster planning for the county.
6. Public education programs need to address home preparedness and to stress the importance of citizens being self-sufficient for at least 72 hours.

This Hazard Identification and Vulnerability Assessment provides a general overview of natural and technological hazards that may affect Kittitas County in the future. At present, this information reflects the need for further preparedness.

The Kittitas County Comprehensive Emergency Management Plan (CEMP) needs ongoing comprehensive review and revision to address these conditions. To be effective, agencies and departments that would normally respond in a disaster situation must participate in the emergency planning, updating, and revision process. Their participation not only promotes a better understanding of the plan but also provides them with realistic objectives of local capabilities and of each individual department's responsibilities in a disaster.