Basic Seismological Characterization
for
Uinta County, Wyoming

by

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BACKGROUND

Seismological characterizations of an area can range from an analysis of historic seismicity to a long-term probabilistic seismic hazard assessment. A complete characterization usually includes a summary of historic seismicity, an analysis of the Seismic Zone Map of the Uniform Building Code, deterministic analyses on active faults, "floating earthquake" analyses, and short- or long-term probabilistic seismic hazard analyses.

Presented below, for Uinta County, Wyoming, are an analysis of historic seismicity, an analysis of the Uniform Building Code, deterministic analyses of nearby active faults, an analysis of the maximum credible "floating earthquake," and current short- and long-term probabilistic seismic hazard analyses.

Historic Seismicity in Uinta County

The enclosed map of "Earthquake Epicenters and Suspected Active Faults with Surficial Expression in Wyoming" (Case and others, 1997) shows the historic distribution of earthquakes in Wyoming. Twenty-three magnitude 1.5 and greater earthquakes have been recorded in Uinta County. Most of these were relatively small magnitude events and subsequently, not felt. These earthquakes are discussed below.

The first earthquake that was reported in Uinta County occurred on December 1, 1925. This intensity III earthquake was centered approximately five miles southeast of Evanston. People reported doors swinging and a sound similar to the passing of a fast train. (Neumann, 1927).

Several earthquakes occurred in Uinta County during the 1960s. On June 14, 1966, the U.S.G.S. National Earthquake Information Center reported a magnitude 2.6 earthquake approximately 9 miles west-northwest of Carter. No one reported feeling this event. The University of Utah Seismograph Stations detected a magnitude 2.4 earthquake in Uinta County on June 22, 1966.

This non-damaging earthquake was located on the Uinta County-Lincoln County border approximately 11 miles north-northwest of Carter. On April 24, 1967, a magnitude 3.4 event was recorded approximately 9 miles northwest of Carter (University of Utah Seismograph Stations). An explosion is the probable cause of this event. The final earthquake that occurred in the 1960s was detected by the U.S.G.S. National Earthquake Information Center on January 18, 1968. This magnitude 2.6 earthquake, centered approximately 3.5 miles south-southwest of Robertson, was not felt.

The University of Utah Seismograph Stations recorded seven earthquakes in Uinta County during the 1970s. A magnitude 2.1 earthquake occurred on July 26, 1972, approximately 9 miles south-southwest of Piedmont. On December 19, 1974, a magnitude 2.0 event was reported approximately 12 miles southeast of Evanston. Three magnitude 2.1 earthquakes occurred on August 2, 1975, June 26, 1976, and August 3, 1976. The August 2, 1975, event was located approximately 17-18 miles south of Evanston; the June 26, 1976 earthquake had an epicenter approximately 6-7 miles south-southeast of Piedmont; the August 3, 1976 earthquake was centered approximately 6 miles south of Piedmont. On September 10, 1977, a 2.2 event was detected on the Uinta County-Sweetwater County border, approximately 7 miles northeast of Lonetree. Finally, a magnitude 2.0 earthquake occurred on October 5, 1979, approximately 11-12 miles south of Piedmont. No damage was reported from any of these earthquakes.

On March 31, 1981, a magnitude 3.1 earthquake occurred near the Uinta County-Lincoln County-Utah border approximately 23 miles northwest of Evanston. A magnitude 2.5 earthquake was detected on August 13, 1985. This earthquake was centered approximately 7 miles southeast of Robertson. According to the U.S.G.S. National Earthquake Information Center, no one reported feeling either event. On December 24, 1989, the University of Utah Seismograph Stations detected a magnitude 2.4 earthquake. Its epicenter was located just to the northeast of Millburne.

Several earthquakes were reported in Uinta County during the 1990s. The first occurred on March 22, 1990 (University of Utah Seismograph Stations). This magnitude 1.7 event was located roughly 3 miles northeast of Millburne. On June 25, 1990, the U.S.G.S. National Earthquake Information Center recorded a magnitude 2.1 event approximately 5 miles south of Robertson. No one reported feeling the earthquake. The University of Utah Seismograph Stations detected the six other earthquakes that occurred in Uinta County in the 1990s. A magnitude 2.25 earthquake occurred on October 15, 1990, approximately 6 miles east-southeast of Piedmont. On December 4, 1990, a magnitude 2.5 event was recorded approximately 3 miles southeast of Robertson. A magnitude 2.2 earthquake occurred on April 16, 1991. Its epicenter was located approximately 14 miles south of Piedmont. On December 18, 1993, a magnitude 2.28 earthquake was recorded approximately 5 miles southwest of Robertson. A few days later, a magnitude 2.77 event occurred on December 27, 1993. This earthquake was centered approximately 5 miles west-northwest of Mountain View. On January 21, 1995, a magnitude 2.0 earthquake was reported near Fort Bridger.

Most recently, on July 5, 2002, the U.S.G.S. National Earthquake Information Center recorded a magnitude 2.8 earthquake 3 miles west of Lyman. No one felt this event and no damage was reported.

Regional Historic Seismicity

Several earthquakes have also occurred near Uinta County. The first took place on October 3, 1956, in far western Sweetwater County, approximately 7 miles southwest of Little America. The earthquake was felt as an intensity IV event in Opal, where windows, doors, and dishes rattled and walls creaked. Loud “earth noises” from the west were heard one second before the shock (Brazee and Cloud, 1958).

On September 10, 1977, the University of Utah Seismograph Stations recorded a non-damaging magnitude 2.2 earthquake on the Uinta County-Sweetwater County border. The epicenter was located approximately 18 miles east-southeast of Robertson.

The U.S.G.S. National Earthquake Information Center detected a magnitude 3.5 earthquake in southern Lincoln County, approximately 27 miles north-northwest of Evanston, on February 24, 1979. No one reported feeling the earthquake.

On August 1, 1979, the University of Utah Seismograph Stations recorded a magnitude 2.2 earthquake near the Wyoming-Utah border. This event was centered approximately 17 miles south of Evanston.

On September 23, 1985, a magnitude 2.5 earthquake occurred in Lincoln County, approximately 22 miles northwest of Carter (University of Utah Seismograph Stations). The University of Utah Seismograph Stations also detected a magnitude 2.0 event on February 5, 1988. Its epicenter was located approximately 18 miles south-southwest of Evanston.

On June 22, 1991 (University of Utah Seismograph Stations). This magnitude 2.0 event was centered just over the Wyoming border approximately 15 miles south-southwest of Evanston.

On February 3, 1994, a magnitude 5.9, intensity VII earthquake occurred near Draney Peak, Idaho, west of Auburn, Wyoming. The earthquake was felt in Wyoming, Idaho, Colorado, and Idaho. The earthquake was felt in Evanston.

On February 3, 1995, one of the largest historic earthquakes in southwestern Wyoming occurred near Little America, Wyoming. A magnitude 5.3, intensity V earthquake was associated with the collapse of a 3,000 foot wide by 7,000 foot long portion of a trona mine operated by the Solvay Minerals, Inc. One miner lost his life as a result of the collapse. Minor damage was reported at a school administration building in Green River and at a motel near Little America. The earthquake was felt in Rock Springs and in Salt Lake City. An indisputable triggering mechanism for the collapse has not been determined, although the U.S. Mine Safety and Health Administration (1996) feels that the most likely failure trigger was “the degradation of the strength of the pillar-floor system over a long period of time”.

Uniform Building Code

The Uniform Building Code (UBC) is a document prepared by the International Conference of Building Officials. Its stated intent is to "provide minimum standards to safeguard life or limb, health, property, and public welfare by regulating and controlling the design, construction, quality of materials, use and occupancy, location and maintenance of all buildings and structures within this jurisdiction and certain equipment specifically regulated herein."

The UBC contains information and guidance on designing buildings and structures to withstand seismic events. With safety in mind, the UBC provides Seismic Zone Maps to help identify which design factors are critical to specific areas of the country. In addition, depending upon the type of building, there is also an "importance factor". The "importance factor" can, in effect, raise the standards that are applied to a building.

The current UBC Seismic Zone Map (Figure 1) (1997) has five seismic zones, ranging from Zone 0 to Zone 4, as can be seen on the enclosed map. The seismic zones are in part defined by the probability of having a certain level of ground shaking (horizontal acceleration) in 50 years. The criteria used for defining boundaries on the Seismic Zone Map were established by the Seismology Committee of the Structural Engineers Association of California (Building Standards, September-October, 1986). The criteria they developed are as follows:

Zone	Effective Peak Acceleration, % gravity (g)
4	30% and greater
3	20% to less than 30%
2	10% to less than 20%
1	5% to less than 10%
0	less than 5%

The committee assumed that there was a 90% probability that the above values would not be exceeded in 50 years, or a 100% probability that the values would be exceeded in 475 to 500 years.

Uinta County is primarily in Seismic Zones 2 and 3 of the UBC. Except for Evanston and Bear River, all towns are in Seismic Zone 2. Since effective peak accelerations (90% chance of non-exceedance in 50 years) can range from 10-20%g in Zone 2, and since there has been historic seismicity and exposed active faults exist in the county, it may be reasonable to assume that a maximum peak acceleration of 15%g-20%g could be applied to the design of a non-critical facility located in the county if only the UBC were used. Such acceleration, however, is significantly less than would be suggested through newer building codes.

Evanston and Bear River are in Seismic Zone 3. Since effective peak accelerations (90% chance of non-exceedance in 50 years) can range from 20-30%g, and there are significant active faults nearby, it may be reasonable to assume that a maximum peak acceleration of 25%g could be applied to the design of a non-critical facility located in the county if only the UBC were used.

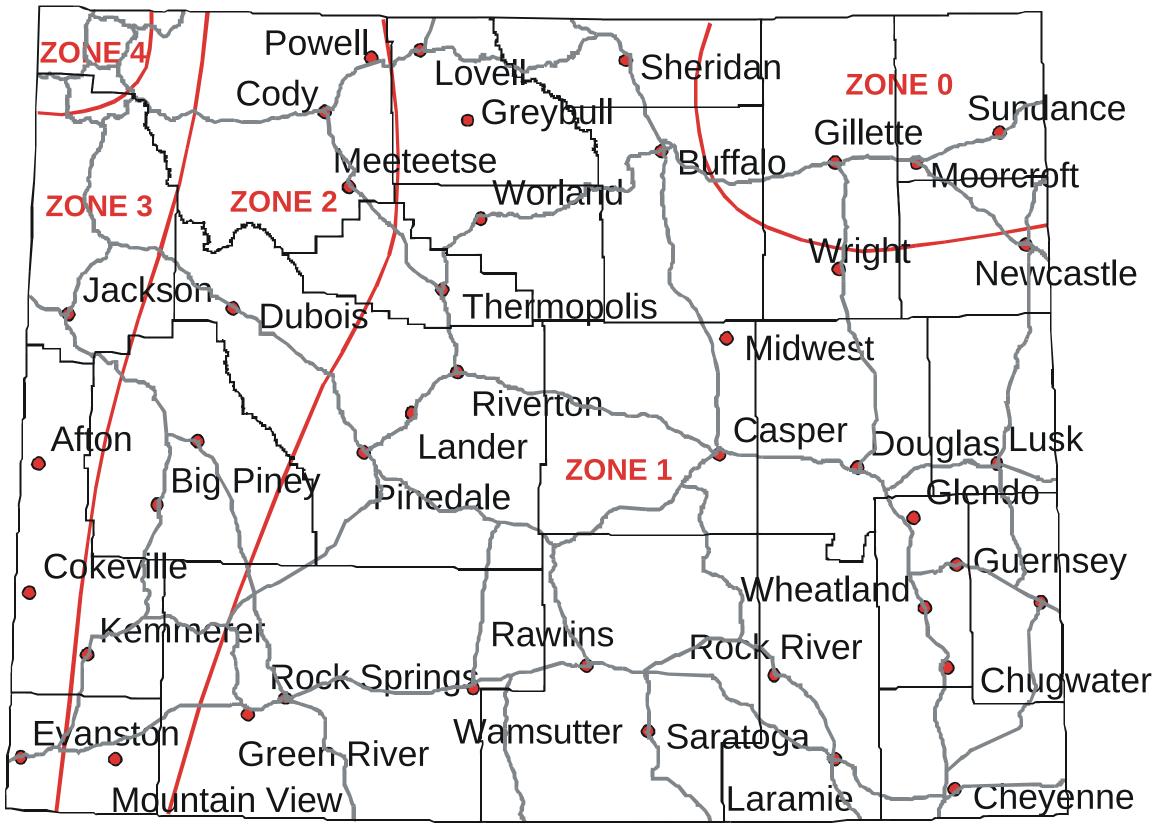

Figure 1. UBC Seismic Zone Map.

Such acceleration, however, is significantly less than would be suggested through newer building codes.

Recently, the UBC has been replaced by the International Building Code (IBC). The IBC is based upon probabilistic analyses, which are described in a following section. Uinta County still uses the UBC, however, as do most Wyoming counties as of October 2002.

Deterministic Analysis of Regional Active Faults with a Surficial Expression

Uinta County has two exposed active fault systems that should be included in a deterministic analysis. The Bear River fault system is composed of a series of short, north-trending faults and associated scarps in southwestern Uinta County. West (1989) found evidence of Quaternary-age movement on this fault system. A minimum recurrence interval of 1800 years can be inferred for the Bear River fault system. Over 2320 years have elapsed since the last event. West (1994) estimates that the Bear River fault could generate a maximum magnitude 7.5 earthquake. A magnitude 7.5 event could generate peak horizontal accelerations of approximately 79%g at Sulphur Creek Reservoir Dam, approximately 27 %g at Evanston, approximately 26%g at Meeks Cabin Dam, approximately 13%g at Mountain View, approximately 11%g at Lyman, and approximately 9%g at Bear River (Campbell, 1987). These accelerations are roughly equivalent to an intensity IX earthquake at Sulphur Creek Reservoir Dam, an intensity VII earthquake at Evanston and the Meeks Cabin Dam, and intensity VI earthquakes in Lyman, Mountain View, and Bear River. Heavy damage could occur to the Sulphur Creek Reservoir Dam, while Evanston and the Meeks Cabin Dam may sustain moderate damage. Light damage may occur at Lyman, Mountain View, and Bear River.

In addition to the ground shaking hazards associated with the Bear River fault system, numerous pipelines cross the fault traces. If an earthquake occurred on this fault system, the pipelines could potentially rupture. Shut-off valves can minimize the effect of pipeline rupture.

The second exposed active fault system in Uinta County is the Northern Bear River fault system. It is located north of Evanston along the margins of the Bear River Valley. Evidence of recent, late-Quaternary movement has been identified on several north-trending faults (Gibbons and Dickey, 1983). Previous investigations on the Northern Bear River fault system have not determined a maximum possible magnitude that would be produced by this system. Because a magnitude 6.5 event is usually required to expose faults at the surface, however, it may be reasonable to assume that the Northern Bear River fault system could generate at least a magnitude 6.5 earthquake. A magnitude 6.5 earthquake could in turn generate peak horizontal accelerations of 70%g at Bear River, up to 28%g at Evanston, approximately 10%g at the Sulphur Creek Reservoir Dam, approximately 4.3%g at the Meeks Cabin Dam, approximately 3.5%g at Mountain View, and approximately 3.3%g at Lyman (Campbell, 1987). These accelerations are roughly equivalent to an intensity IX earthquake at Bear River, an intensity VII earthquake at Evanston, an intensity VI earthquake at the Sulphur Creek Reservoir Dam, an intensity V earthquake at Meeks Cabin Dam, and intensity III earthquakes in Lyman and Mountain View. Bear River could sustain heavy damage, while moderate damage could occur at

Evanston. Some light damage could occur at the Sulphur Creek Reservoir Dam and the Meeks Cabin Dam, but no significant damage should occur at Lyman and Mountain View.

Pipelines also cross the Northern Bear River fault traces. If an earthquake occurred on this fault system, the pipelines could potentially rupture. Again, shut-off valves can minimize the effect of pipeline rupture.

An active fault system is also present near Uinta County in western Lincoln County. The Rock Creek fault system is a north-south-trending normal fault located approximately 15 miles west of Kemmerer, Wyoming, near Fossil Butte National Monument. McCalpin and Warren (1992) found evidence of late-Quaternary movement on this system. Based upon a surface rupture length of 24 miles (38 km) and Quaternary displacement amounts, Chambers (1988) estimates that the Rock Creek fault is capable of generating a magnitude 6.9 to 7.2 earthquake. A maximum magnitude 7.2 earthquake could generate peak horizontal accelerations of approximately 5.8%g at Evanston, approximately 4.9%g at Lyman, and approximately 4.5%g at Mountain View (Campbell, 1987). This acceleration is roughly equivalent to an intensity V earthquake, which may cause some light damage.

Floating or Random Earthquake Sources

Many federal regulations require an analysis of the earthquake potential in areas where active faults are not exposed, and where earthquakes are tied to buried faults with no surface expression. Regions with a uniform potential for the occurrence of such earthquakes are called tectonic provinces. Within a tectonic province, earthquakes associated with buried faults are assumed to occur randomly, and as a result can theoretically occur anywhere within that area of uniform earthquake potential. In reality, that random distribution may not be the case, as all earthquakes are associated with specific faults. If all buried faults have not been identified, however, the distribution has to be considered random. “Floating earthquakes” are earthquakes that are considered to occur randomly in a tectonic province.

It is difficult to accurately define tectonic provinces when there is a limited historic earthquake record. When there are no nearby seismic stations that can detect small-magnitude earthquakes, which occur more frequently than larger events, the problem is compounded. Under these conditions, it is common to delineate larger, rather than smaller, tectonic provinces.

The U.S. Geological Survey identified tectonic provinces in a report titled “Probabilistic Estimates of Maximum Acceleration and Velocity in Rock in the Contiguous United States” (Algermissen and others, 1982). In that report, Uinta County was classified as being in a tectonic province with a “floating earthquake” maximum magnitude of 6.1. Geomatrix (1988b) suggested using a more extensive regional tectonic province, called the “Wyoming Foreland Structural Province”, which is approximately defined by the Idaho-Wyoming Thrust Belt on the west, 104° West longitude on the east, 40° North latitude on the south, and 45° North latitude on the north. Geomatrix (1988b) estimated that the largest “floating” earthquake in the “Wyoming Foreland Structural Province” would have a magnitude in the 6.0 – 6.5 range, with an average value of magnitude 6.25.

Federal or state regulations usually specify if a “floating earthquake” or tectonic province analysis is required for a facility. Usually, those regulations also specify at what distance a floating earthquake is to be placed from a facility. For example, for uranium mill tailings sites, the Nuclear Regulatory Commission requires that a floating earthquake be placed 15 kilometers from the site. That earthquake is then used to determine what horizontal accelerations may occur at the site. A magnitude 6.25 “floating” earthquake, placed 15 kilometers from any structure in Uinta County, would generate horizontal accelerations of approximately 15%g at the site. That acceleration would be adequate for designing a uranium mill tailings site, but may be too large for less critical sites, such as a landfill. Critical facilities, such as dams, usually require a more detailed probabilistic analysis of random earthquakes. Based upon probabilistic analyses of random earthquakes in an area distant from exposed active faults (Geomatrix, 1988b), however, placing a magnitude 6.25 earthquake at 15 kilometers from a site will provide a fairly conservative estimate of design ground accelerations.

Probabilistic Seismic Hazard Analyses

The U.S. Geological Survey (USGS) publishes probabilistic acceleration maps for 500-, 1000-, and 2,500-year time frames. The maps show what accelerations may be met or exceeded in those time frames by expressing the probability that the accelerations will be met or exceeded in a shorter time frame. For example, a 10% probability that acceleration may be met or exceeded in 50 years is roughly equivalent to a 100% probability of exceedance in 500 years.

The USGS has recently generated new probabilistic acceleration maps for Wyoming (Case, 2000). Copies of the 500-year (10% probability of exceedance in 50 years), 1000-year (5% probability of exceedance in 50 years), and 2,500-year (2% probability of exceedance in 50 years) maps are attached. Until recently, the 500-year map was often used for planning purposes for average structures, and was the basis of the most current Uniform Building Code. The new International Building Code, however, uses a 2,500-year map as the basis for building design. The maps reflect current perceptions on seismicity in Wyoming. In many areas of Wyoming, ground accelerations shown on the USGS maps can be increased due to local soil conditions. For example, if fairly soft, saturated sediments are present at the surface, and seismic waves are passed through them, surface ground accelerations will usually be greater than would be experienced if only bedrock was present. In this case, the ground accelerations shown on the USGS maps would underestimate the local hazard, as they are based upon accelerations that would be expected if firm soil or rock were present at the surface. Intensity values can be found in Table 1.

Based upon the 500-year map (10% probability of exceedance in 50 years) (Figure 2), the estimated peak horizontal acceleration in Uinta County ranges from approximately 8%g in the eastern potion of the county to over 20%g in the southwestern corner of the county.
These accelerations are roughly comparable to intensity V earthquakes (3.9%g – 9.2%g), intensity VI earthquakes (9.2%g – 18%g), and intensity VII earthquakes (18%g – 34%g). Intensity V earthquakes can result in cracked plaster and broken dishes. Intensity VI earthquakes can result in fallen plaster and damaged chimneys. Intensity VII earthquakes can result in slight to moderate damage in well-built ordinary structures, and considerable damage in poorly built or

badly designed structures, such as unreinforced masonry. Chimneys may be broken. Evanston would be subjected to an acceleration of approximately 16%g or intensity VI.

Based upon the 1000-year map (5% probability of exceedance in 50 years) (Figure 3), the estimated peak horizontal acceleration in Uinta County ranges from over 10%g in the eastern third of the county to over 40%g in the southwestern corner of the county. These accelerations are roughly comparable to intensity VI earthquakes (9.2%g – 18%g), intensity VII earthquakes (18%g – 34%g), and intensity VIII earthquakes (34%g – 65%g). Intensity VI earthquakes can result in fallen plaster and damaged chimneys. Intensity VII earthquakes can result in slight to moderate damage in well-built ordinary structures, and considerable damage in poorly built or badly designed structures, such as unreinforced masonry. Chimneys may be broken. Intensity VIII earthquakes can result in considerable damage in ordinary buildings and great damage in poorly built structures. Panel walls may be thrown out of frames. Chimneys, walls, columns, factory stacks may fall. Heavy furniture may be overturned. Evanston would be subjected to an acceleration of 25%g or intensity VII.

Based upon the 2500-year map (2% probability of exceedance in 50 years) (Figure 4), the estimated peak horizontal acceleration in Uinta County ranges from approximately 17%g in the northeastern corner of the county to over 80%g in the southwestern corner of the county. These accelerations are roughly comparable to intensity VI earthquakes (9.2%g – 18%g), intensity VII earthquakes (18%g – 34%g), intensity VIII earthquakes (34%g – 65%g), and intensity IX earthquakes (65%g-124%g). Intensity VI earthquakes can result in fallen plaster and damaged chimneys. Intensity VII earthquakes can result in slight to moderate damage in well-built ordinary structures, and considerable damage in poorly built or badly designed structures, such as unreinforced masonry. Chimneys may be broken. Intensity VIII earthquakes can result in considerable damage in ordinary buildings and great damage in poorly built structures. Panel walls may be thrown out of frames. Chimneys, walls, columns, factory stacks may fall. Heavy furniture may be overturned. Intensity IX earthquakes can cause considerable damage in specially designed structures and great damage and partial collapse in substantial buildings. Well-designed frame structures could be thrown out of plumb. Buildings can be shifted off their foundations. The ground can crack and underground pipes could be broken. Evanston would be subjected to an acceleration of approximately 35%g, or intensity VII.

As the historic record is limited, it is nearly impossible to determine when a 2,500-year event last occurred in the county. Because of the uncertainty involved, and based upon the fact that the new International Building Code utilizes 2,500-year events for building design, it is suggested that the 2,500-year probabilistic maps be used for Uinta County analyses. This conservative approach is in the interest of public safety.

Table 1:

Modified Mercalli Intensity	Acceleration (%g) (PGA)	Perceived Shaking	Potential Damage
I	<0.17	Not felt	None
II	0.17 – 1.4	Weak	None
III	0.17 – 1.4	Weak	None
IV	1.4 – 3.9	Light	None
V	3.9 – 9.2	Moderate	Very Light
VI	9.2 – 18	Strong	Light
VII	18 – 34	Very Strong	Moderate
VIII	34 – 65	Severe	Moderate to Heavy
IX	65 – 124	Violent	Heavy
X	>124	Extreme	Very Heavy
XI	>124	Extreme	Very Heavy
XII	>124	Extreme	Very Heavy

Modified Mercalli Intensity and peak ground acceleration (PGA) (Wald, et al 1999).

Abridged Modified Mercalli Intensity Scale

Intensity value and description:

I Not felt except by a very few under especially favorable circumstances.

II Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.

III Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing automobiles may rock slightly. Vibration like passing of truck. Duration estimated.

IV During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make creaking sound. Sensation like heavy truck striking building. Standing automobiles rocked noticeably.

V Felt by nearly everyone, many awakened. Some dishes, windows, and so on broken; cracked plaster in a few places; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.

VI Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster and damaged chimneys. Damage slight.

VII Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving cars.

VIII Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving cars disturbed.

IX Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.

X Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed, slopped over banks.

XI Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.

XII Damage total. Waves seen on ground surface. Lines of sight and level distorted. Objects thrown into the air.

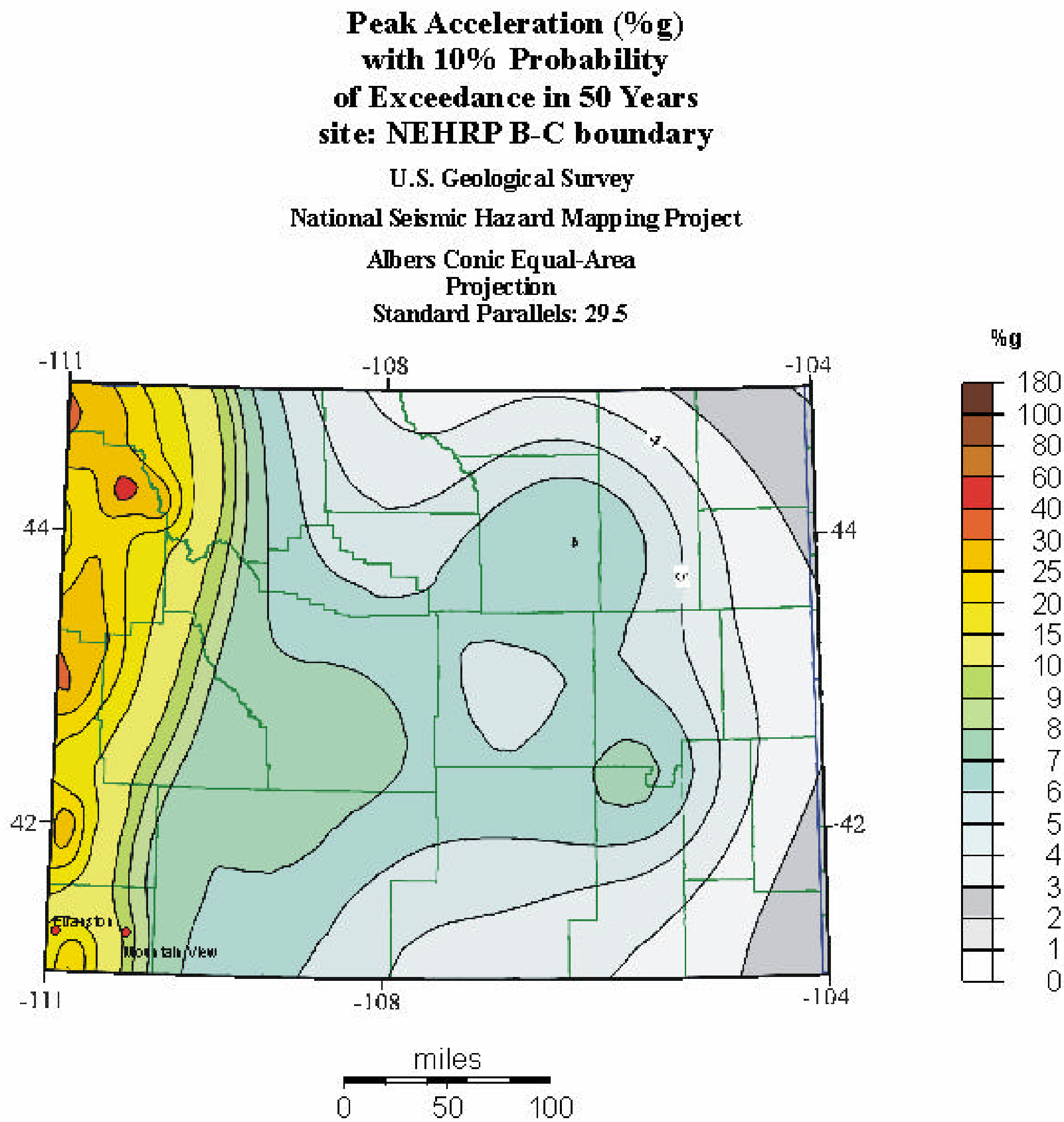

Figure 2. 500-year probabilistic acceleration map (10% probability of exceedance in 50 years).

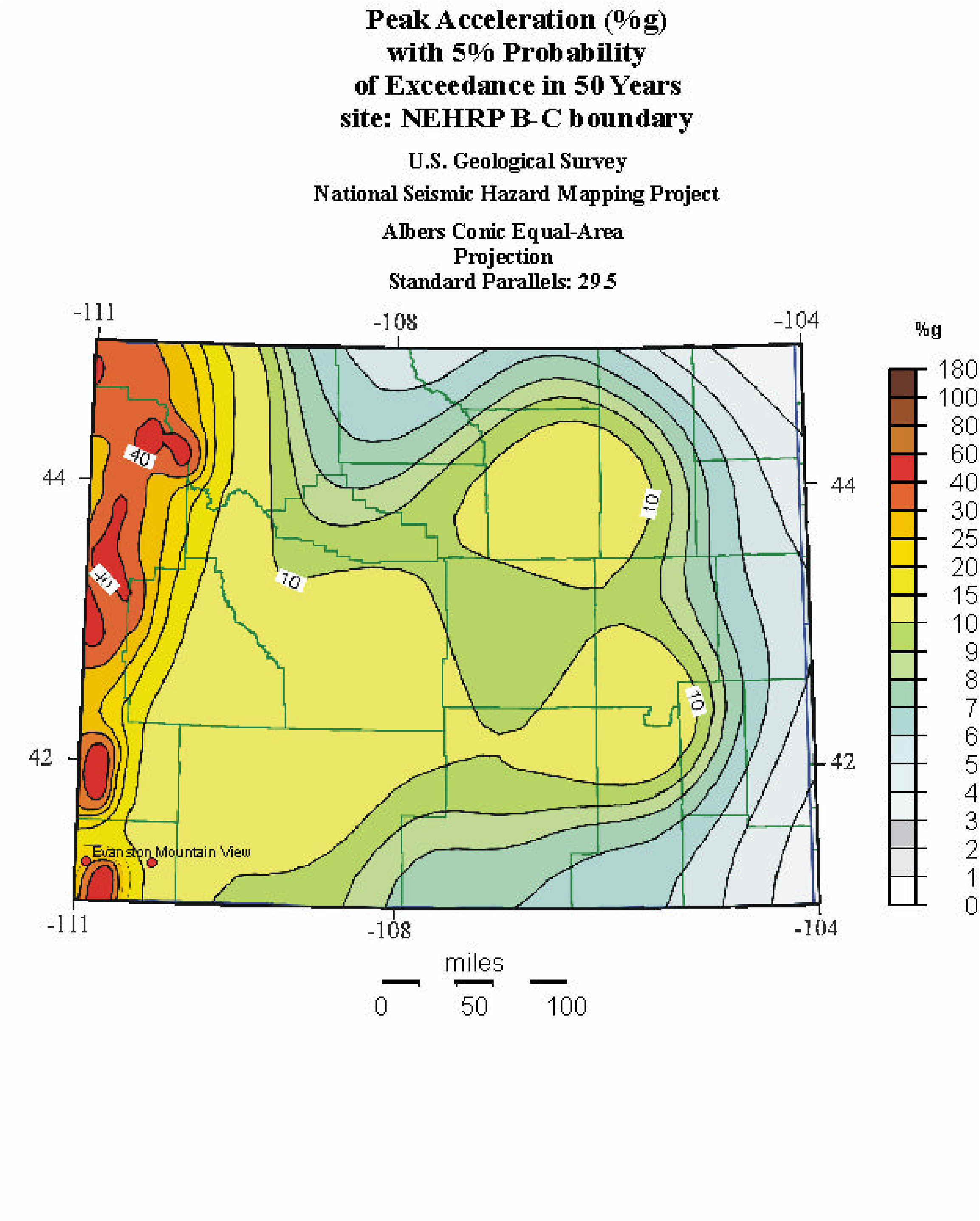

Figure 3. 1000-year probabilistic acceleration map (5% probability of exceedance in 50 years).

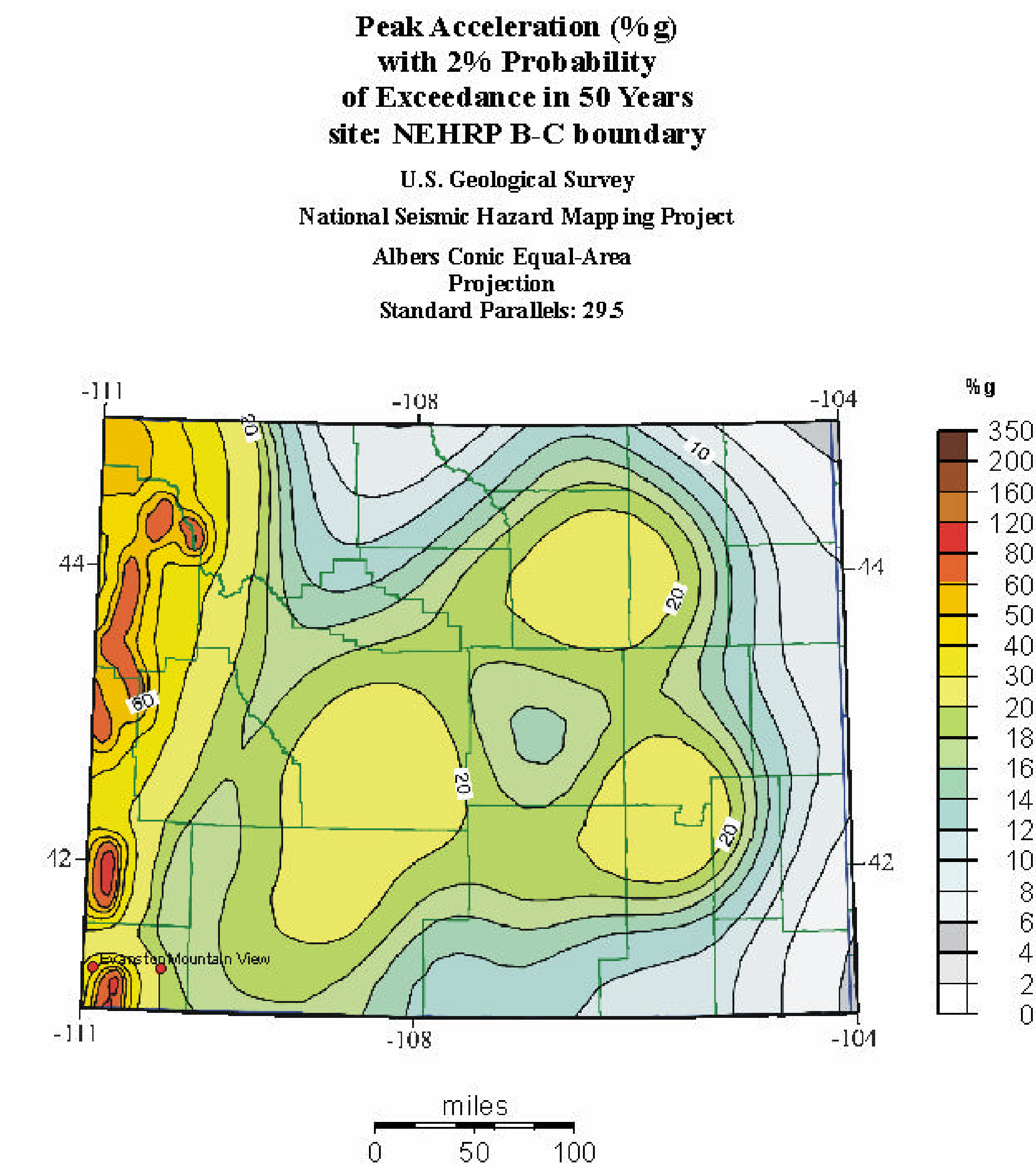

Figure 4. 2500-year probabilistic acceleration map (2% probability of exceedance in 50 years).

Summary

There have been thirty-one historic earthquakes with a magnitude greater than 1.5 recorded in and near Uinta County. Because of the limited historic record, it is possible to underestimate the seismic hazard in Uinta County if historic earthquakes are used as the sole basis for analysis. Earthquake and ground motion probability maps and specific fault analyses give a more reasonable estimate of damage potential.

Current earthquake probability maps that are used in the newest building codes suggest a scenario that would result in moderate to heavy damage to buildings and their contents, with damage increasing from the northeast to the southwest. More specifically, the probability-based or fault activation-based worst-case scenario could result in the following damage at points throughout the county:

Intensity IX Earthquake Areas

Bear River
Sulphur Creek Dam

Intensity IX earthquakes can cause considerable damage in specially designed structures and great damage and partial collapse in substantial buildings. Well-designed frame structures could be thrown out of plumb. Buildings can be shifted off their foundations. The ground can crack and underground pipes could be broken.

Intensity VIII Earthquake Areas

Evanston
Piedmont

Intensity VIII earthquakes can result in considerable damage in ordinary buildings and great damage in poorly built structures. Panel walls may be thrown out of frames. Chimneys, walls, columns, factory stacks may fall. Heavy furniture may be overturned.

Intensity VII Earthquake Areas

Carter
Fort Bridger
Lonetree
Lyman
Meeks Cabin Dam
Millburne
Mountain View
Robertson
Urie

In intensity VII earthquakes, damage is negligible in buildings of good design and construction, slight-to-moderate in well-built ordinary structures, considerable in poorly built or badly designed structures such as unreinforced masonry buildings. Some chimneys will be broken.

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