

**EARTHQUAKE DISASTER SCENARIO FOR THE STAR VALLEY AREA, WYOMING**

by

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### Background

The Star Valley is located in far west-central Wyoming and in the northwestern part of Lincoln County. The eastern side of the valley is bounded by the Star Valley fault, which has two main active segments. The southern active segment extends from Cottonwood Creek, near Smoot, in the south, to an area north of Grover, to the north. The northern active segment extends from an area east of Grover, in the south, to an area near the mouth of Prater Canyon and east of Freedom, to the north (Figure 1).

If the Star Valley fault activates from Smoot, in the south, to Prater Canyon in the north, it is capable of generating a magnitude 7.5, intensity X earthquake. Recent research indicates that the fault activates every 2,550-6,000 years, and that approximately 5,500 years has elapsed since the fault last activated.

A magnitude 7.5 earthquake would not only cause significant offsets along the surface trace of the fault, it would also cause damaging ground motions throughout the Star Valley area. Offsets along the fault trace will range from ten to fifteen feet, with the most significant offsets between Smoot and Grover. Most likely, the valley floor will drop ten to fifteen feet relative to the Salt River Range. Smoot, Osmond, Afton, Grover, Turnerville, and Bedford may all be subject to horizontal accelerations in the 0.7g (intensity X) or greater range. Fairview and Auburn may have horizontal accelerations in the 0.6g - 0.7g range (intensity X), Thayne and Freedom may be in the 0.5g - 0.6g range (intensity IX), Etna may be in the 0.45g- 0.5g (intensity VIII-IX) range, and Alpine may be in the 0.2g (intensity IV-V) range.

With intensity X earthquakes, some well-built wooden structures can be destroyed, and most masonry and frame structures will be destroyed. Landslides can be considerable on steep slopes. With intensity IX earthquakes, damage can be considerable in specially designed structures, well-designed frame structures can be thrown out of plumb, and most substantial buildings may partially collapse. The ground can be conspicuously cracked, and underground pipes can be broken. With intensity VIII earthquakes, damage may be slight in specially designed structures, but can be considerable in ordinary substantial buildings, with partial collapse. Panel walls can be thrown out of frame structures, and chimneys and walls can fall. With intensity V earthquakes, plaster can be cracked, and some dishes may be broken.

### Disaster Scenario

During the spring, and at 7:45 in the morning, the Star Valley fault activates and generates a magnitude 7.5 earthquake. Early reports from Lincoln County indicate that damage is extensive and that there are numerous fatalities. Access to the Star Valley by road is not currently possible. Most buildings in the Smoot, Osmond, Afton, Grover, Turnerville, Bedford, Fairview, and Auburn areas are either destroyed or severely damaged. Many buildings in the Thayne, Freedom, and Etna areas are severely damaged, although damage is not as extensive as in the towns listed above. Damage is minimal in Alpine. Students were entering the schools throughout the valley, and early reports indicate that most schools were severely damaged. Significant fires are reported in Afton, and Thayne. There is no electrical power in the Star Valley.

Based upon existing information, the following should be expected:

**Fatalities:** 5,000 Wyoming residents live in an area defined by Alpine to the north and Smoot to the South. Alpines 477 residents have not been significantly affected by the earthquake. In the Star Valley, there are 150 confirmed fatalities, and hundreds of serious injuries. 75 of the fatalities occurred in schools. Not all fatalities or injuries have been documented.

**Fires:** Fires have been reported throughout the Star Valley. The most significant are in Afton and Thayne. Ruptured propane and bulk gasoline tanks have led to significant fires in those areas. Many home fires throughout the Star Valley started because of water heaters overturning, resulting in ruptured gas supply lines. There are no known water supplies that are functional, and access to the fires is limited.

**Schools:** Students were just starting to enter the schools in the Star Valley. Most schools sustained damage that ranged from moderate to severe, with some experiencing partial collapse. Descriptions of damage are presented below:

**Afton:** 1) The Afton High School has approximately 800 students, 200 of which were inside the school at the time of the earthquake. The school was severely damaged, with portions of the school collapsing.

2) The Afton Jr. High School has approximately 400 students, 100 of which were inside the school at the time of the earthquake. Portions of the school were severely damaged. Parts of the structure appear to be intact and sound. A building inspection is needed in order to determine the safety of the structure.

3) The Afton Elementary School has approximately 400 students, 50 of which were inside the school at the time of the earthquake. The school was severely damaged, with collapse occurring in a small part of the facility.

**Osmond:** 1) The Osmond Elementary School has approximately 300 students, 25 of which were inside the school at the time of the earthquake. The school was severely damaged, and partial collapse did occur.

**Thayne:** 1) The Holdaway Elementary School has approximately 300 students, 50 of which were inside the school at the time of the earthquake. The school was severely damaged, but collapse did not occur.

**Etna:** 1) The Metcalf Elementary School has approximately 200 students, none of which were inside the school at the time of the earthquake. The school did sustain damage, but the structure appears to be intact. A building inspection is needed in order to determine the safety of the building.

**Structures:** Structures include homes, City/County/State facilities, fuel storage tanks, water and sewer systems, and businesses. Schools and churches have a separate classification. Most structures in Smoot, Osmond, Afton, Grover, Turnerville, Bedford, Fairview, and Auburn, have been severely damaged or destroyed. Most structures in Thayne and Freedom have been severely damaged. Most structures in Etna have sustained damage, with some damage being severe. Minimal structural damage occurred in Alpine.

Summaries of damage to key structures, by town, are presented below:

**Afton:** There are approximately 160 businesses in Afton. Most have been severely damaged or destroyed. Buildings need emergency inspections in order to determine if any are safe to enter. Without the inspections, have to assume that most standing buildings are not safe to enter. No water or power are available to businesses. Select descriptions of damage are presented below:

- 1) The Afton City Hall, which houses the police department and the sheriffs office dispatch, has also been severely damaged, and is not operational.
- 2) Star Valley Hospital has partially collapsed
- 3) Afton's water supply pipelines have been severed where they cross the Star Valley fault trace. All other water supplies in town are not operational.
- 4) Schwab mortuary is severely damaged.
- 5) National Guard Armory has partially collapsed, with brick walls nearly destroyed.
- 6) Suburban Propane (1 mile north of Afton), which has two large propane storage tanks, has been severely damaged. One of the propane tanks has ruptured.
- 7) Bulk fuel tanks at Afton Chevron and Kellerstrass Oil (1/2 mile north of Afton) have been damaged, and fuel is leaking from the tanks.
- 8) Underground tanks at service stations are damaged, and some may be ruptured and leaking.
- 9) Afton's new natural gas delivery system has sustained numerous breaks in the delivery pipes.
- 10) Lincoln County Weed and Pest Control building destroyed. Pesticide and herbicide containers have ruptured.
- 11) Grocery stores and restaurants are severely damaged and are not operational.
- 12) All motels are severely damaged, and can not be used.
- 13) Septic and sewer systems are damaged, with many pipelines broken.
- 14) Radio station not operational
- 15) Post Office severely damaged
- 16) Fire fighting services limited
- 17) Waste water treatment plant is severely damaged, and sewage disposal ponds are leaking.
- 18) Solvent and paint drums at Aviot Manufacturing have ruptured. The building is severely damaged.

Most homes in Afton have sustained severe damage. Some homes have areas that may be safe for habitation, but inspections need to be done before residents enter those areas of the homes. No water or power is available to homes. Gas storage tanks damaged or ruptured at many rural homes.

Thayne:

There are approximately 30 businesses in Thayne. Most have been severely damaged, although only a few have been completely destroyed. Buildings need to be inspected to determine which, if any, are safe to enter. No water or power are available to businesses. Select descriptions of damage are presented below.

- 1) Thayne City Hall severely damaged.
- 2) T-7 (V-1 ?) Propane Services in Thayne severely damaged. Propane storage tank is leaking.
- 3) Underground tanks at service stations are damaged, and some may be leaking.

- 4) Volunteer Fire Department equipment can not be immediately mobilized as building housing equipment is severely damaged.
- 5) Septic and sewer systems are damaged.
- 6) Post Office is severely damaged.
- 7) Approximately 300 RV's are at the Star Valley Ranch RV Park. Some RV's have been turned on their side.

Most homes in Thayne have been severely damaged. Some homes have areas that may be safe for habitation, but inspections need to be done before residents enter those areas of the homes. No water or power is available to homes. Gas storage tanks damaged or ruptured at many rural homes.

**Etna:** There are approximately ten businesses in Etna. Most have been damaged or severely damaged. Building inspections are needed to determine safety of buildings. No water or power are available to businesses. Select descriptions of damage are presented below:

- 1) Blue Flame Propane (1-1.5 miles south of town) damaged. Status of propane tank unknown.

Many homes in Etna damaged. A few homes may be safe to occupy, but inspections are needed. No water or power is available to homes. Gas storage tanks damaged at many rural homes.

**Freedom:** There are approximately twelve businesses in Freedom. Most have been severely damaged, although only a few have been completely destroyed. Buildings need to be inspected to determine which, if any, are safe to enter. No water or power are available to businesses. Select descriptions of damage are presented below.

- 1) Freedom Arms, Inc. has been severely damaged. Status of gunpowder and ammunition on site has to be determined.
- 2) Telephone company not operational.

Most homes in Freedom have been severely damaged. Some homes have areas that may be safe for habitation, but inspections need to be done before residents enter those areas of the homes. No water or power is available to homes. Gas storage tanks damaged or ruptured at many rural homes.

**Bedford:** There are fewer than ten businesses in Bedford. Most have been severely damaged, although only a few have been completely destroyed. Buildings need to be inspected to determine which, if any, are safe to enter. No water or power are available to businesses. Select descriptions of damage are presented below.

- 1) Lower Valley Power and Light - Strawberry Plant completely destroyed.

Most homes in Bedford have sustained severe damage. Some homes have areas that may be safe for habitation, but inspections need to be

done before residents enter those areas of the homes. No water or power is available to homes. Gas storage tanks damaged or ruptured at many rural homes.

**Other Towns:** Smoot, Osmond, Grover, Turnerville, Fairview, and Auburn each have two or fewer businesses. Existing businesses have been severely damaged or destroyed. Buildings need to be inspected to determine which, if any, are safe to enter. No water or power are available to businesses. Select descriptions of damage are presented below.

1) Post Office buildings in Smoot, Grover, Fairview, and Auburn have been severely damaged.

Most homes in these towns have sustained severe damage. Some homes have areas that may be safe for habitation, but inspections need to be done before residents enter those areas of the homes. No water or power is available to homes. Gas storage tanks damaged or ruptured at many rural homes.

**Highways and roads:** U.S. Highway 89 between Afton and Smoot is severely disrupted, especially near Osmond and Smoot. The highway was vertically offset by 12 feet south of Osmond (T 31 N, R 118 W, Sections 7 and 18). The highway was severely disrupted with a series of 3 to 5 foot offsets just north of Smoot (T 31 N, R 118 W, Section 31). Once the highway is temporarily repaired near Smoot, State Highway 241 can be used to bypass the severe damage near Osmond. State Highway 241 has been disrupted, but is more easily repaired than the portion of US Highway 89 near Osmond.

US Highway 89 has been severely damaged between Grover and Thayne. The highway is covered by multiple landslides (T 33 N, R 119 W, Section 1) north of The Narrows and approximately 3 miles south of Thayne. The Salt River has been diverted and partially dammed by the landslides, and the highway bridge over the Salt River has been moved and severely damaged. At The Narrows, rockfalls have blocked the US Highway 89. Just north of The Narrows, there is a gravel road that possibly can be used to bypass the damaged highway and bridge. The road parallels Willow Creek to the east for about 4 miles, and then turns north to Bedford. From Bedford, a gravel road trends to US Highway 89 to the west and an improved road goes to Thayne. The gravel road is partially blocked by rockfall where it parallels Willow Creek (T 33 N, R 118 W, Sections 7, 9, 16, and 17).

US Highway 89 is disrupted where it crosses Flat Creek, just south of Thayne. The highway has shifted laterally in a number of locations due to liquefaction in the underlying sediments.

Just south of Alpine Junction, the US Highway 89 bridge over the Snake River has sustained minor damage, and appears to have shifted laterally a few inches.

Rockfalls have blocked the Snake River Canyon highway (US Highway 26/89) at a number of locations.

**Landslides:** Landslides have occurred at a number of locations in northern Lincoln County. A number have closed roads. Those landslides, which are described in the highways and roads section, are also described below:

1) US Highway 89 has been severely damaged between Grover and Thayne. The highway is covered by multiple landslides (T 33 N, R 119 W, Section 1) north of The Narrows and approximately 3 miles south of Thayne. The Salt River has been diverted and partially dammed by the landslides, and the highway bridge over the Salt River has been moved and severely damaged. At The Narrows, rockfalls have blocked the US Highway 89. Just north of The Narrows, there is a gravel road that possibly can be used to bypass the damaged highway and bridge. The road parallels Willow Creek to the east for about 4 miles, and then turns north to Bedford. From Bedford, a gravel road trends to US Highway 89 to the west and an improved road goes to Thayne. The gravel road is partially blocked by rockfall where it parallels Willow Creek (T 33 N, R 118 W, Sections 7, 9, 16, and 17).

2) Rockfalls have blocked the Snake River Canyon highway (US Highway 26/89) at a number of locations.

Other landslides have occurred in narrow valleys, and have dammed streams. Those landslides are as follows:

1) Cottonwood Creek, southeast of Smoot, has been dammed as a result of the reactivation of an older landslide sequence. The dam topped within a few hours of being formed, and a drainage channel is being cut naturally through the dam. The stability of the dam is unknown.

2) Swift Creek, east of Afton, has been dammed by a landslide. The landslide dam, which is approximately 1.5 miles upstream of the Periodic Spring, is 40 feet high. The lake forming behind the dam is slowly filling. The dam may fail. Swift Creek flows into Afton.

**Airports:** The airport in Afton has severely cracked and disrupted runways. Access is possible only by helicopter. The airport in Kemmerer has not been affected by the earthquake, but can not accommodate C - 130's.

**Dams:** Palasades dam and reservoir have not been significantly affected by the earthquake. Swift Creek Lake, above Afton on Swift Creek, has been severely cracked and will fail.

**Churches:** Most of the churches in the Star Valley are more than ten years old, and many are of brick construction. As a result, most of the churches in the Star Valley suffered severe damage, with some partially collapsing. None can be used as shelters. The church in Alpine was not significantly damaged, although cracks are evident.

**Hazardous Materials:** Many hazardous materials have been released as a result of the earthquake. A partial list of materials released is presented below:

**Propane:** Released from tank ruptures at Suburban Propane in Afton and at T-7 Propane in Thayne. Status of Blue Flame Propane tank in Etna unknown.

**Gasoline:** Bulk fuel tanks at Afton Chevron and Kellerstrass Oil are damaged and leaking. Underground tanks at service stations in Afton and Thayne are leaking.

**Solvents/paints:** Solvent and paint containers at Aviot Manufacturing in Afton have ruptured.

**Sewage:** Waste water treatment plant in Afton is leaking sewage, and sewage disposal ponds are significantly compromised. Septic systems in rest of the Star Valley are not functional.

**Fertilizers:** Local usage of fertilizers not documented, but could pose a problem.

**Gunpowder:** Unknown stockpiles of gunpowder at Freedom Arms in Freedom.

**Pesticides/  
Herbicides:** Pesticide and herbicide containers ruptured at Lincoln County Weed and Pest Control in Afton.

**Communications:** Telephone service is not functional in the Star Valley. There is no functional communications equipment left at the Police Department/Sheriff's Office Dispatch in Afton. Cellular phones are still functional. Ham radio operators with mobile communication centers have communication with Kemmerer.