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The Emergency Response to the 2008 Wells, Nevada Earthquake Disaster

by

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ABSTRACT

The emergency response effort for the 2008 Wells earthquake disaster was generally considered a success. Emergency responders reacted quickly and professionally and the response was not overwhelmed in any capacity. Local personnel and residents handled all acute incidents immediately following the earthquake, which prevented these from growing into larger problems. The most critical incidents were a liquid propane tank leak that created a ground-hugging propane cloud, a house stove fire, and two natural-gas-line pipe breaks in homes. There were three injuries caused by falling nonstructural objects from the earthquake and slippage on ice during an individual's response to the earthquake. There was one additional HAZMAT incident where bottles with chemicals in a high school chemical store room fell and broke on the floor; this was cleaned up promptly by a HAZMAT team. The emergency response officially lasted for 84 hours.

Personnel from the surrounding region began arriving about 40 minutes after the earthquake to help with search and rescue; building evaluations; creating and maintaining an emergency perimeter; and creating, supporting, and participating in an incident command system. Approximately 600 safety inspections, where homes and businesses were rapidly inspected for any injured occupants or dangerous situations, were conducted on the first day. About 200 people responded to the earthquake over the first three days, approximately half of whom were emergency response personnel and the other half of whom were Red Cross, other relief, and government personnel.

The largest problem with the emergency response was difficulty in response communications. There was initially only one telephone line into the final location of the incident command post. Cell phones were relied upon by the local responders, and although the system did not go down, there were commonly long delays in getting a signal to make a call. There were also two principal emergency communication systems being used, a VHF system that most of the local and regional responders used and an 800 MHz system that the State of Nevada used. On Day Two, the Nevada Department of Transportation established a patch between these two systems.

The initial incident command post was in a basement, which proved too dangerous, or at least too frightening, during aftershocks for participants to use. Other possible command sites were in damaged buildings or had too much window glass to be considered safe from aftershocks. The elementary school ended up being the final incident command post, which worked, but initially had limited communication capabilities and was collocated with the emergency shelter which later impeded the resumption of school.

Several lessons learned from the Wells earthquake that will enhance emergency responses in similar events:

1. Emergency plans must include a prioritized, pre-inspected incident command post site. This is critical in the immediate post-earthquake environment. When there is a lack of facilities available (limited facilities in a small town or pre-designated sites are damaged) a mobile command post van may be an important emergency response asset.
2. Cell phones should not be used for a primary communication system for emergency response. The cell phone system can be easily overwhelmed and the system components, such as relay towers, are not always designed for earthquakes.
3. Familiarity amongst emergency responders and good working relationships can make for a very effective and comprehensive response.

INTRODUCTION

Wells, Nevada, is an incorporated city of 1,657 residents located at the crossroads of U.S. Highway 93 and Interstate 80, in the northeastern part of the state. There are seven other ranching communities and subdivisions within a twenty mile radius of the community. The City of Wells contracts with the Elko County Sheriff's Office for law enforcement services. Fire and ambulance services are all-volunteer units. The area is serviced by a county-wide emergency dispatch center, the Elko Central Dispatch. Wells is approximately an hour's drive from the neighboring cities of Elko and West Wendover and the town of Jackpot in Elko County.

The Wells earthquake occurred at 6:16 a.m. PST on Thursday, February 21, 2008, with an epicenter located approximately 5.5 miles (9 km) north-northeast of Wells. In Wells, the magnitude 6 earthquake caused the total and partial collapse of several buildings, damaged over 60 chimneys, and caused widespread displacement of and damage to nonstructural building contents. The event was strongly felt in northeastern Nevada and was felt as far away as Salt Lake City, Utah, Boise, Idaho, and Las Vegas, Nevada. Over the next several days numerous aftershocks occurred ranging from magnitude 3 to 5, causing additional damage and creating natural anxiety among residents about the possibility of larger earthquakes. The weather conditions at the time of the earthquake were cold with intermittent snow showers. Roads were commonly icy and had small amounts of snow on them.

The earthquake affected approximately 700 buildings, six earthen dams, and 15 bridges. This prompted a coordinated response of inspectors and structural engineers to evaluate the infrastructure in the area for damage. Also, approximately 25 buildings sustained major damage and were potential sites for injured and/or trapped victims.

There had been some emergency training and planning preparedness for earthquakes in Wells and the emergency response personnel were familiar with each other and had worked together on wild-land fire emergencies, all of which enhanced the efficiency of the emergency response.

SEQUENCE OF RESPONSE EVENTS AND COMMAND EVENTS

The following is an approximate sequence of response and command events to the Wells earthquake. In some cases, similar responses are grouped in a single discussion, even though they occurred at different times. The accounts are a combination of recollections and a review of Elko County Sheriff's Department communication transcripts.

Incident Response

The initial local response to the earthquake consisted of two local sheriff's deputies, an ambulance crew, a Nevada Highway Patrol trooper, the Wells Volunteer Fire Department, and technicians from Wells Propane and Wells Rural Electric. Wells has two ambulances, three fire trucks, one Nevada Department of Forestry fire truck and one emergency response vehicle. These first responders all experienced strong shaking and had some personal property damage, but they responded without hesitation.

One of the sergeants from the sheriff's office assumed command of the disaster. He completed an initial assessment, reported damage and potential life safety issues, and coordinated a search for victims in the collapsed buildings. Additional deputies were dispatched to the scene and a mutual-aid request was made to the Nevada Department of Public Safety for a strike team of twelve troopers.

One of the first incidents local personnel responded to was a 500-gallon propane tank that had rolled over, severing its connecting hose. The hose was leaking highly expansive liquid propane that formed a ground-hugging propane gas cloud about three to four feet deep, and which was stationary because there was no wind. Further, the hand wheel to the valve had broken off when the tank rolled over. Fire personnel responded and called Wells Propane to help with the tank and Wells Rural Electric to disconnect the power to the site. Fire personnel established a 250-yard perimeter and requested that Interstate 80 be closed by the Nevada Highway Patrol, who also evacuated a nearby truck stop. An experienced propane technician walked the perimeter of the cloud, propped the tank up with 2 x 4 boards to gain access to the valve, and was able to close the valve using channel-lock pliers to grab what was left of the stem. After 10 to 15 minutes to allow the propane cloud to dissipate, the evacuation was lifted and Interstate 80 was re-opened.

The Sheriff's Department and the Incident Command Post made mutual-aid requests to the Nevada Division of Forestry, Elko Fire Department, Jackpot Fire Department, and West Wendover Fire Department to respond and assist with search efforts and possible confined-space rescue. Additional ambulances from Jackpot, Wells, and West Wendover were directed to the scene.

Outside help began to arrive on the scene about 40 minutes after the earthquake. Responders from the surrounding community didn't hesitate at all; they dropped what they were doing and immediately raced to Wells despite icy roads.

After the initial search, only three residents were identified as having significant injuries, none of which were major. Several other people were treated as "walking wounded" throughout the day at the first-aid station set up at the Wells Volunteer Fire Department.

One call was from the local grocery store where smoke was reported (figure 1). The smoke was caused by an electrical short. Power was disconnected from the building by the power company. Power was also disconnected from the damaged buildings in the historical district (figure 2).

Figure 1. Emergency response to smoke at Stuart's Store. The smoke was from an electrical short in a control panel. Note the snowy conditions during the response. *Photograph by Wells resident*.

Figure 2. Disconnecting power to damaged buildings in the historical district. *Photograph by the Utah Division of Homeland Security*.

Over two-dozen propane leaks were reported. Fire personnel, local propane technicians, and residents were able to control the leaks without any fires starting (figure 3). Response personnel also evaluated the status of propane tanks and related appliances in residences as they went door-to-door to check the safety and welfare of the citizens. No propane-related fires were confirmed, although three reports came in to dispatch. There was one known stove fire; spice containers that fell from an overhead cupboard turned on an electric stove. Additionally cloth pot holders fell on the burner and caught fire. The resident smelled the smoke, went to the kitchen, and tossed the pot holders into the sink, putting out the fire with water from the faucet.

School buses were used as road barricades for hazards, such as the broken water main in a street (figure 4).

On Day Two a hazardous material spillage was found in the science room of the high school and was reported by the State Disaster Assessment Team, which was inspecting the building. Within 10 minutes a hazardous materials team responded. After surveying the chemical store room, they removed some chemicals that had fallen and broken, and cleaned up spilled chemicals.

Figure 3. Fireman checking for leaking gases near a manufactured building that shifted on its support blocks. *Photograph by Wells resident*.

Figure 4. School buses were used as barricades to block roads with hazards. In this case there was a broken water main in the street behind the bus and the street was flooded with water.

Command Response

The Elko County Sheriff was near Wells and experienced the earthquake firsthand. The Sheriff immediately assigned an undersheriff to coordinate activation of the Emergency Alert System (EAS), assume Public Information duties and coordination, and respond to the scene as soon as he had everything situated in Elko. The undersheriff attempted to activate the EAS, but the call numbers were not current and he could not get the response activated. The undersheriff assigned a detective to coordinate calls from the national media.

Cell phones were inundated with national news calls, so to facilitate the emergency response, incoming calls were initially ignored unless the caller could be identified. In the process, several important pieces of information were not received in a timely manner.

Initially there was confusion on the Sheriff Department's mobile radio. The dispatch center was instructed to notify all responders in the area to report to the Sergeant acting as the incident commander in Wells.

An emergency was declared on the county tactical talk group and deputies were ordered to start setting up a perimeter around Wells. After the Sheriff received a briefing and did a "walk-through" of Wells, he decided to restrict access to the city. Only residents and emergency responders were allowed to enter the perimeter. The deputies coordinated with state authorities to shut down eight different entrances into Wells. The Sheriff also directed a mutual-aid response for fire resources and called out the county search and rescue personnel. Police tape was placed around damaged buildings to prevent any further injuries from aftershocks (figure 5).

The majority of first responders were deputies, search-and-rescue volunteers, state troopers, fire personnel, ambulance personnel, and Nevada Department of Transportation (NDOT) employees. Most of the responders operated on a VHF communication system, but the state responders operated on an 800 MHz system. There was no immediate way to establish common command and Tactical (TAC) frequencies between these systems.

At approximately 8:00 a.m. on the first day, a transition of command took place when a Nevada Division of Forestry (NDF) employee with National Type II Incident Command training and the Sheriff established joint command in Wells. Until liaisons from NDOT and Nevada Department of Public Safety (NDPS) arrived at the Incident Command Post (ICP), there was no direct communication with all of the personnel responding to the earthquake. By 10:00 a.m. we had approximately 40 personnel from five different departments and approximately 60 fire and rescue personnel from ten different departments on the ground assisting in the emergency effort. Incident command positions were filled with local, state, and federal personnel.

The initial ICP was set up in a basement conference room of the U.S. Forest Service building in Wells. The building, which had received minor damage from the earthquake, was determined to be potentially unsafe after several magnitude 4+ aftershocks shook the building in a threatening manner throughout the day. The ICP was relocated to the Wells Elementary School after it passed a safety inspection. The school was also used as the evacuation shelter, as the county-mandated

shelter locations had been severely damaged and could not be used. There was also a full-service kitchen set up at this location.

During the immediate response, cell phone usage was limited as the system was immediately overwhelmed. There was initially only one phone line available at the original ICP, and cell phones were the primary mode of communication for the Incident Command Staff. The system improved after the first day and the local telephone providers came supporting with a bank of telephones for the ICP. There was some damage to mountaintop cell phone relay tower sites in the area, but they remained operational.

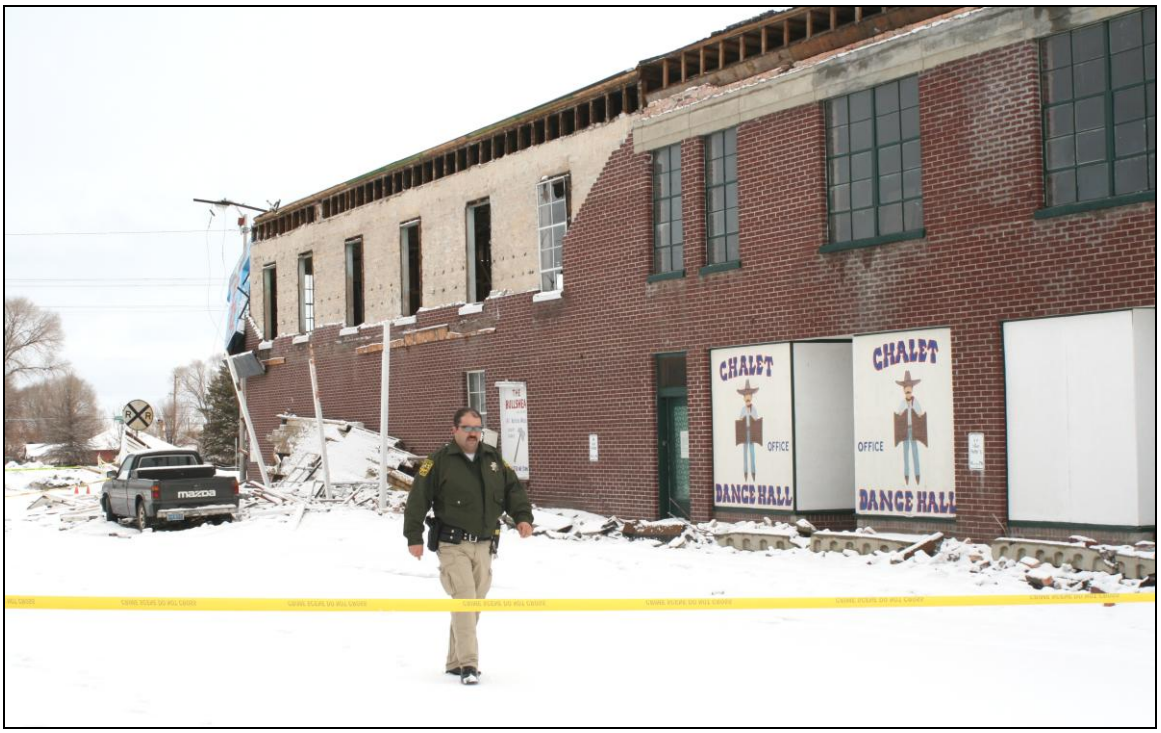


Figure 5. Damaged parts of town were cordoned off with police tape and patrolled to keep people out. Only local police and officials and outside personnel with a bright green Elko County Sheriff access badge were allowed behind these lines.

Wells was divided into quadrants and safety inspection teams were assigned to, and coordinated within, each quadrant. Several safety instructions were given to emergency responders and safety inspectors including, "use the two [responders] in [a structure] and two out" rule when inspecting buildings, and "post lookouts when working around tall structures [that are] watching for falling debris" (taken from the *Health and Safety Message* from the Incident Command Post, dated 2/21/08).

On Day Two, approximately 100 relief workers and American Red Cross workers from three chapters arrived to staff the shelter and provide for the needs of the victims. The shelter and staffing, particularly the councilors, were a valuable asset for the response and for aiding the earthquake victims. This large staffing turned out to be more than the disaster required, however, and it became an immediate challenge to find space for them to operate. Had the power failed and more gas lines broken, the shelter needs could have increased dramatically, so it was good to have this many relief workers available; a consideration should be given to staging some of these workers in the nearest unaffected town (Wendover or Elko in this case) for rapid deployment as needed.

On Day Two, an NDOT radio technician established a patch between VHF and 800 MHz and we had direct communication between all responders. An NDF TAC frequency and a NDOT TAC frequency were used for the communication patch.

By Day Three the controlled perimeter around the town was lifted and local perimeters were set up with police tape around damaged areas. The largest of these was the damaged historical district where the "media alley" was also set up. This area needed to be patrolled by Sheriff Deputies for a few weeks until a chain-link fence was installed and earthquake activity tapered off.

The rescue and emergency operation officially lasted until Sunday at 7:00 p.m., and was a total of 84 hours long.

On Monday, Day Five, the ICP was scaled down and moved from the elementary school to allow classes to resume. The new location was the Wells Volunteer Fire Station. The shelter was closed down and people without a place to stay were moved to hotel rooms.

On Thursday the ICP was moved to the Wells City Hall for two more days and then was closed. Building inspections and other activities were managed out of city hall for the early recovery period.

THE EMERGENCY RESPONSE

On the first day, about 100 personnel and approximately 30 pieces of equipment responded to the Wells earthquake within four hours. This included fire, law-enforcement, medical and ambulance personnel; a HAZMAT team; utility technicians; and personnel from the Nevada Division of Forestry, the Nevada Department of Transportation, and the U.S. Bureau of Reclamation. The search-and-rescue phase of the emergency response was mostly over after the first day, when there was a gradual transition to stabilizing the situation through safety inspections of homes and buildings and taping off damaged areas.

Local mutual-aid agreements were in place and were rapidly engaged with good success. Most responders had felt the earthquake, so they were naturally alerted ahead of an emergency call that an event had occurred that might require a response and were ready to go very quickly.

The incident command structure for the disaster worked the way it was supposed to. Trained people from different agencies were able to populate the different stations in the ICP and easily worked together. The command structure increased with the needs of the incident and scaled down when appropriate. This successful command structure was partly due to the familiarity people had with one another, having worked previously together on wild-land fire emergencies.

All critical incidents were handled professionally and effectively, and none developed into larger problems. For example, the liquid propane leak was isolated and stopped, and the propane cloud dissipated; this could have caused a significant explosion and likely additional fires if it was handled incorrectly and ignited.

Local residents engaged in their own informal emergency response. A resident put out a small stove fire. Two residents with broken gas lines smelled the propane and immediately shut off their gas. A girl was trapped in her bed by a fallen bookcase and was freed by family members. Undoubtedly many other "small" incidents occurred – people were reluctant to talk about these specific earthquake effects in their homes because they considered them private matters. Nevertheless, it is clear that many common-sense approaches were engaged in by people dealing with situations in their homes.

On Day Two the emergency shelter and provide for the needs of the victims and responders. About eight people used the emergency shelter the first few nights. Most people remained in their homes.

Incident Command Post Location

There was some planning for potential sites for an ICP, but potential earthquake damage and safety from aftershocks were not considered in this planning; consequently several sites were considered and rejected before finding a suitable location. The first ICP was in the U.S. Forest Service building's conference room, which was in the basement of the building. After several magnitude 4+ aftershocks frightened the people staffing the post, it was considered potentially unsafe and moved. The high school was a designated ICP location, but it was partially damaged. The local Mormon Church was also a possible location, but it was also damaged. The clubhouse at the golf course was considered, but it had too much glass around the perimeter of the building to be considered safe during a strong aftershock. The elementary school building was inspected, undamaged, and also was being used as an emergency shelter, so this was used for the ICP for five days (figures 6–9). Following this, the ICP was moved for two days to the Wells Volunteer Fire Department and then moved to City Hall for two more days.

The co-location of the ICP and other response activities with the emergency shelter did cause some issues with victim privacy. For example, the elementary school auditorium was used to house earthquake victims. Because of limited undamaged space, this auditorium was also used for feeding emergency responders and public meetings, so it was a relatively busy room at times. There were only eight people using the shelter and these were relocated to hotel rooms after a few days.

Potential earthquake damage and operation in a post-earthquake environment should be considered in planning potential ICP locations for a community, and a priority given to these locations for safety inspections. A mobile command post with satellite communications capabilities may be a useful option until a safe ICP location can be established or more room is needed for the response.

Communications

There were several problems with emergency response communications during this event, and other communities and jurisdictions in Nevada should evaluate their communication capabilities to try to avoid some of these. One of the goals of emergency response is that there is no further death, injury, or major property loss because of inadequate response. To accomplish

this, emergency responders and commanders need to be able to talk to one another with professional speed (not waiting for a dial tone), there needs to be an emergency telephone system that is uncluttered and prepared to take emergency calls, and the emergency broadcast system needs to be able to be rapidly and effectively activated. All of these aspects could have been improved upon during the Wells earthquake.

Figure 6. Emergency response vehicles in the Wells Elementary School parking lot. The school was used as the location of the Incident Command Post and the emergency shelter.

In the Wells earthquake the cell phone system remained functional, but was moderately saturated with caller traffic, causing delays of minutes in getting dial tones or service. There was reportedly some repeater tower damage, but this did not compromise the system. A robust radio communication system is needed for emergency response personnel, including volunteer fire departments. Cell phones or land telephone lines should not be used as the primary means of emergency communication and have an uncertain capacity as a secondary means. Conceivably, misalignments of antennas, equipment damage, and power failures during an earthquake could cause the cell phone system to go down entirely for a period of time, rendering it totally unusable.

The communication systems used by different response agencies need to be identified, and if these agencies are supposed to cross-communicate during an emergency response, patches for different systems should be pre-made so they can be engaged as quickly as possible. The regional VHS system and the 800 MHz state system were patched together on Day Two. In a larger earthquake disaster with more incidents, the inability of two systems to cross-communicate could have more serious consequences.

Elko Central Dispatch immediately began receiving 911 calls that reported building collapses, fires, propane leaks, and burglar alarms going off. About 300 calls were received by the dispatch center in the first hour. Most of the calls, however, were not emergency calls, but rather were from local citizens wanting information. This continues to be a problem in earthquake after earthquake. People do not use the 911 system solely for emergencies. In nearly every historical large earthquake we see a strong need for humans to talk to other humans. Getting information about the event is important to people as well, but doesn't entirely replace this need. Three approaches may help this situation: (1) Distribute information about the earthquake out quickly using the emergency broadcast system, an emergency earthquake web page, a local 3-1-1 system that has earthquake information, and additional media messages. Because the public needs information following a traumatic event like an earthquake to help cope with it, this information will help calm some anxieties. Part of the message would be "do your part and please leave 911 for emergencies" As a contemporary reminder; (2) Encourage people to check on their neighbors after the event. This has the obvious benefit of getting problems reported faster, but it also solves the need for people to talk to other people following an earthquake. We speculate that this may reduce intrusion on the 911 system to satisfy this need; (3) Better, more direct education of the public is needed on leaving the 911 system for emergency use only. If Nevadans have heard the message, they do not appear to have taken it to heart. We need to get this message out more clearly and frequently to the public and have more information sources available and advertised to help people with post-earthquake stress.

Figure 7. Emergency response personnel check-in station. Media representatives had a separate check-in station and staging area near the front of the school.

Figure 8. The Incident Command Post was located inside a classroom. Here, the morning situation and operations meetings were held to brief the responders and agencies of the status of the disaster and the day's goals and activities.

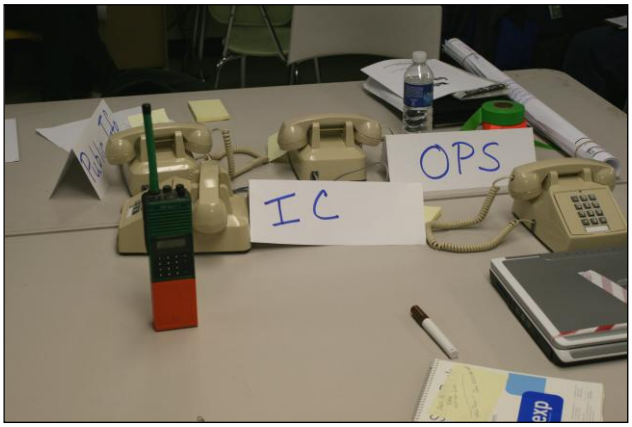


Figure 9. Communications stations were set up with the telephones and radio labeled as shown here for the incident commander (IC) and operations (OPS).

Thirty minutes after the earthquake, calls were coming in to the dispatch center from the national media wanting information. This also began to tie up emergency and dispatch lines. Although a plan needs to be developed to better handle the media and get information to them, it should be noted that it is never appropriate for the media to call a 911 emergency line for information, and the media should be more sensitive to response efforts than to inundate a local or county law enforcement agency with calls following a disaster. The national media need to use local media more effectively and wait until information lines or sites are established. Immediately following a disaster there is a fine line between the value and need for information by the media and public and potentially endangering the response situation; the media needs to respect is. Officials need to get information to the media as quickly as possible, including important messages for the public.

Information about the response was communicated to the public via house fliers, posters, community television channel broadcasts, and public meetings. An example of an informational poster is show in figure 10.

Injuries

There were three reported injuries and one case of trauma caused by the earthquake. There were no injuries during the emergency response and early recovery activities. A girl's arm was broken when an object fell on it during the event. Her arm was set in a temporary cast and she went to Elko for X-rays. A man received a head laceration from a falling object and had stitches sewn by the local doctor. A boy reportedly slipped on the ice when going to turn off the propane to his home and injured his leg; he did not enter the response system. A woman was traumatized by the earthquake and had breathing difficulty; after some attention and calming down, she was released.

There were no deaths directly caused by the earthquake. The owner of the largest losses from the event had a heart attack and died one month following the event; it is possible, if not probable, that the earthquake was a major causative factor of this attack.

Building Safety Inspections

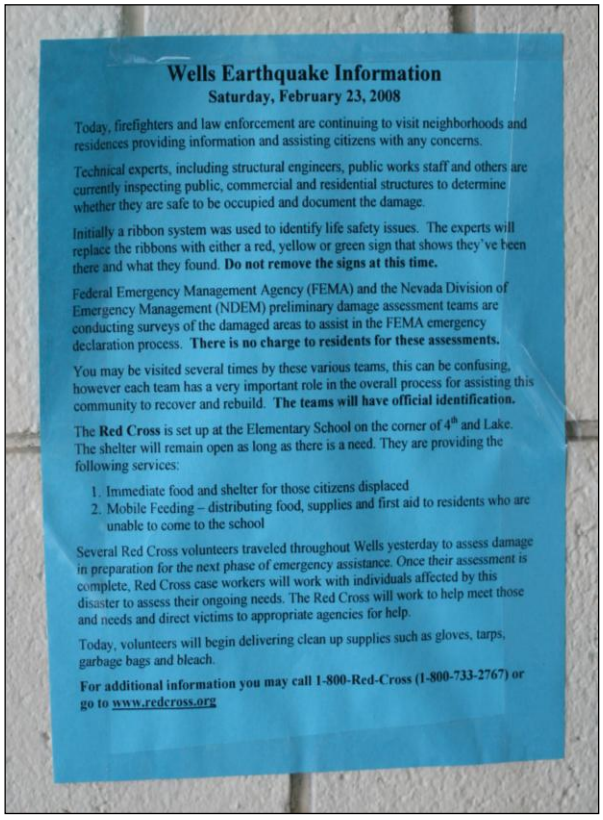
The first inspections were part of the emergency response where firemen and sheriff deputies went from house-to-house and building-to-building looking for injured people, broken gas lines, and precarious/threatening damage. In general, people were more comfortable with the firemen making the initial contact. About 600 safety inspections of this kind were conducted in Wells and the immediately surrounding area on the day of the earthquake.

Building inspections were conducted for potential ICP locations, shelter locations, local businesses, and other buildings where recovery operations were going to occur (e.g., figure 11).

Symbols were spray-painted on the snow in front of a building to indicate that it had been inspected and what its condition was. This was partly done because the responders had only spray paint available and did not want to deface the owner's property. The symbols used were: (1) an open circle for inspected and ok, (2) a circle with a slash for inspected and one issue/problem, (3) a circle with two slashes for inspected with two issues/problems, and (4) a circle with an "X" inside for inspected and not for human occupancy (figure 12). That night it snowed and covered many of these markers, so subsequent markings were made using available flagging. The flagging was more permanent, but was confusing at times because multiple shades were used for some colors and different colored flags were combined. The flagging strategy used was: green flagging – all OK, orange flagging – some issues, red/white candy-stripe flagging – do not enter, and green and orange flagging together – no one home, hasn't been checked (figure 13). Green, yellow, and red placards began to arrive in town on the second and third days following the earthquake and were used from then on (figures 14 and 15).

Placards are the most effective way to mark building condition and do not deface the owner's property. Supplies of green, yellow, and red inspection placards should be stored in a couple of locations in each county and available for distribution to the affected area within 24 hours or sooner.

Buildings were inspected a second time more carefully during the following weeks by trained building inspectors and engineers to assess whether any earthquake damage had occurred (figure 15).



Wells Earthquake Information

Saturday, February 23, 2008

Today, firefighters and law enforcement are continuing to visit neighborhoods and residences providing information and assisting citizens with any concerns.

Technical experts, including structural engineers, public works staff and others are currently inspecting public, commercial and residential structures to determine whether they are safe to be occupied and document the damage.

Initially a ribbon system was used to identify life safety issues. The experts will replace the ribbons with either a red, yellow or green sign that shows they've been there and what they found. **Do not remove the signs at this time.**

Federal Emergency Management Agency (FEMA) and the Nevada Division of Emergency Management (NDEM) preliminary damage assessment teams are conducting surveys of the damaged areas to assist in the FEMA emergency declaration process. **There is no charge to residents for these assessments.**

You may be visited several times by these various teams, this can be confusing, however each team has a very important role in the overall process for assisting this community to recover and rebuild. **The teams will have official identification.**

The **Red Cross** is set up at the Elementary School on the corner of 4th and Lake. The shelter will remain open as long as there is a need. They are providing the following services:

1. Immediate food and shelter for those citizens displaced
2. Mobile Feeding – distributing food, supplies and first aid to residents who are unable to come to the school

Several Red Cross volunteers traveled throughout Wells yesterday to assess damage in preparation for the next phase of emergency assistance. Once their assessment is complete, Red Cross case workers will work with individuals affected by this disaster to assess their ongoing needs. The Red Cross will work to help meet those and needs and direct victims to appropriate agencies for help.

Today, volunteers will begin delivering clean up supplies such as gloves, tarps, garbage bags and bleach.

For additional information you may call 1-800-Red-Cross (1-800-733-2767) or go to www.redcross.org

Figure 10. Public informational poster put up on Day Three.

Figure 11. Family cats that were hiding and did not come out during the evacuation of the El Rancho Hotel immediately following the earthquake were taken out two days later by firemen following a building inspection.

Figure 12. A spray painted circle with an "X" in it on the sidewalk indicates the building was inspected and is too damaged for human occupancy.

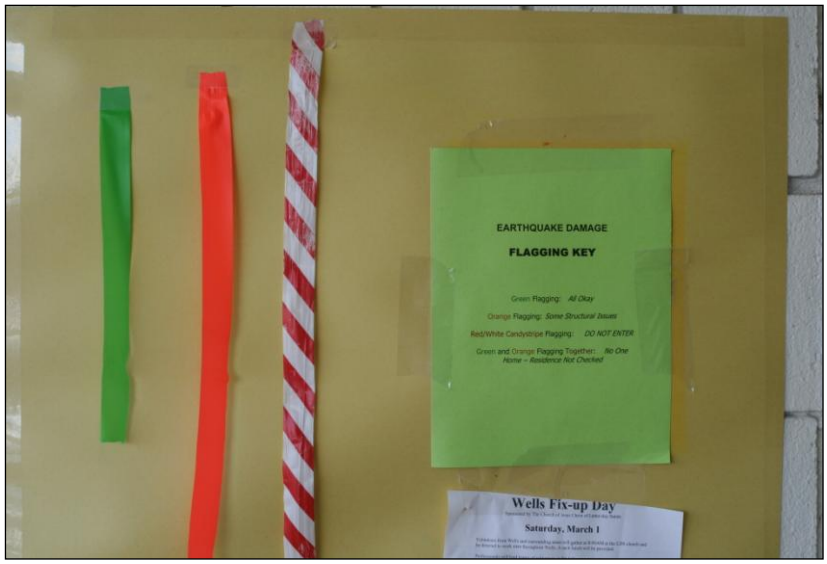


Figure 13. Examples of the flagging used to indicate inspected houses and their post-earthquake condition are shown.

Figure 14. A public display board explains the meaning of the different colored placards used to indicate inspected houses and their post-earthquake condition.

Figure 15. A building inspector calling on a house to conduct a post-earthquake inspection. The green flag indicates the house was deemed inhabitable by the initial safety inspectors.

Media Activity

The media, especially national media, initially created some problems, but were brought under control without too many further issues. The initial problems stemmed from the need for information, which tied up the Elko County Dispatch in the early hours of the event, and from the desire for access to the disaster area. The failure of the Emergency Alert System activation compounded this situation. A communications glitch prohibited the local media initial entry into the area; this slowed information getting out to the public and national media.

Figure 16. Media reporter in front of the historical district. *Photo by Utah Division of Homeland Security*.

Figure 17. "Media alley" set up next to the damage in the historical district. This road was off the main route and did not restrict access to emergency vehicles.

The media were managed with a Public Information Officer (PIO) and were contained in a "media alley" near the damaged part of the historical district. An undersheriff was designated as the PIO for the incident. He was available around the elementary school (ICP) for interviews, finding out information, and led several news conferences and public meetings. He assigned a detective to coordinate calls from the national media. A PIO from the State of Nevada was also available to answer questions, particularly about the state and federal disaster assessments taking place.

A "media alley" was designated adjacent to the damaged historic district, which provided a backdrop for press activity (figure 16), but was on the edge of town and in a location that could be easily bypassed (figure 17). "Media alley" filled with many national and local satellite trucks and news vans for two days. Partly a testament to the well-executed response was that most of the media left late on Day Two. There were several "media imposters" that just wanted closer access to the damage and there were a few incursions beyond the police tape by media personnel (evidenced by footprints in the fresh snow).

Information about an earthquake needs to be made available as fast as possible, a strategy needs to be developed to use local media to help national media, and event badges may help limit people pretending to be the press. A public and media website or hot-line with information that could be activated within minutes of an event would have helped keep the emergency lines open at this critical time in a disaster, potentially in coordination with the Nevada Seismological Laboratory. A plan should be developed to use local media to report for national media; the local media may be able to serve as the "eyes on the ground" enough to satisfy the national media's needs and limit the number of media immediately responding to the event in person. Clearly identifiable event badges for reporters may be used to filter out people trying to access restricted areas by posing as reporters.

Response Personnel Support

Many of the response and relief personnel were from Wells and the surrounding area and were able to just go home for the night, but roughly 125 people needed lodging during the height of the emergency response. Local hotels were cleaned up after about a day but were under a boil-water order for the first day and a half. People were housed in Wells hotels or went to Elko, where there were plenty of hotel rooms.

The initial number of rooms needed for logistics, meetings, and staging of emergency and relief personnel was not anticipated, and the challenge of obtaining sufficient space was complicated by the need for buildings to be confirmed safe locations. This was dealt with as the needs arose and most needs were taken care of by Day Two with rooms in the elementary school.

Damage assessment teams from the State of Nevada and the Federal Emergency Management Agency arrived on Day Two to inspect earthquake damage and estimate potential costs (figures 18 and 19). The mayor assisted in getting access to buildings, such as the damaged high schools. Firemen assisted as liaisons to residents with damage to help explain why the assessment team was there and what they needed to do.

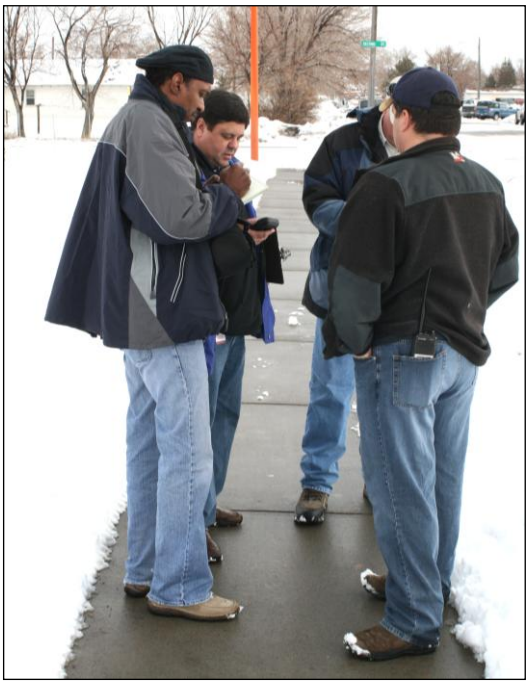


Figure 18. Disaster assessment teams from the State of Nevada**.** These teams assessed the level of damage and the abilities of the community and state to handle the disaster.

Figure 19. Disaster assessment teams from the Federal Emergency Management Agency and the State of Nevada (right photo). These teams assessed the level of damage and the abilities of the community and state to handle the disaster.

Cost of the Emergency Response

When all the costs of the emergency response are added up, the sum is about $300,000. The emergency response costs included incident command and response personnel, inspecting engineers, meals for volunteers, communication equipment, emergency supplies, landfill fees, and the repair of the water main breaks. About $252,000 of this cost was initially borne by the City of Wells. The balance of about $50,000 emergency response costs were to State and Federal agencies, such as the U.S. Bureau of Land Management, that sent response personnel. Of the $252,000 cost to Wells, $145,000 (approximately 58%) was reimbursed by the State of Nevada from an Emergency Assistance Account.

PEOPLE'S RESPONSES TO THE EARTHQUAKE

The citizens of Wells were subjected to strong, prolonged shaking and reacted to this in many different ways, except "Drop, Cover, and Hold". Many people just rode the earthquake out where they were, but with as much as 40 seconds of shaking, several moved around, checking on their kids and/or grabbing the expensive big-screen television to protect it. Several people who felt their lives were in danger ran outside of their houses. Two of the three injuries that occurred were from falling contents and additionally there was a girl trapped in her bed by a fallen bookcase. Few people appear to have "Dropped, Covered, and Held On." This was partly due to the early morning hours when many were still in bed, but at least one person said that there is no way they are going to just Drop, Cover, and Hold during an earthquake – they were going to get out of the building. "Drop, Cover, and Hold" was perceived as too much of a loss of control over the situation. There didn't seem to be much consideration given to earthquakes in Wells prior to the 2008 event, so there may have been a limited understanding of this procedure.

Adults and children from damaged houses, who live alone, or were home alone during the mainshock appeared to experienced more anxiety and post-traumatic stress from the mainshock and had the hardest time dealing with the aftershocks (renewed anxiety, sleepless nights, difficulty in mentally recovering and thinking about other things).

At least two rumors spread following the Wells earthquake, one that a larger earthquake was imminent and a second that the triangle-of-life approach to responding to an earthquake was best. Scientists in Wells were able to counter the imminent earthquake threat of a larger earthquake using an interview with the local media. The second rumor started a couple weeks after the event. It was not specifically countered but official Nevada preparedness literature was distributed to the community through the school system, which promotes a "Duck, Cover, and Hold" response.

Public meetings and fliers were used to get information to people (figure 20). The more people understood what was happening with the earthquakes, the response, and the recovery activities, the more they appeared to be able to cope with the situation.

The human spirit, the "can-do" attitude, the "we-are-all-in-this-together" effort was remarkable in the emergency response and the recovery efforts of the Wells earthquake. This unquestionably contributed to the effectiveness of the actions that were undertaken. A pioneering spirit was alive and well in Wells and Elko County, which created community resilience, and a relatively rapid recovery of the city.

Figure 20. A public meeting held on the night of Day Three. Local officials briefed the community about the earthquakes, the conditions of the town, the response, and recovery.

DISCUSSION

There is an urgent need for a handbook on recommended procedures for responding to an earthquake disaster. This was a request from the Incident Commander from the Wells earthquake. He noted that there are handbooks for fighting wildfires (e.g., Fireline Handbook – National Wildfire Coordinating Group, 2004) and something similar for earthquakes would be important to have. Although an expert in incident command and ultimately making sound decisions, he wished he had guidance on issues such as "At what magnitude size of an aftershock should safety inspections be started over? Does every building need a safety inspection? What are the most logical priorities?' A handbook written by experienced earthquake experts would be critically useful for an incident commander who hadn't dealt with an earthquake before; such unfamiliarity is likely common for potential incident commanders of rural earthquake disasters.

When considering the success of this response, we are sobered that the effects of the earthquake could have been much worse, and the challenges to the response system could have multiplied quickly. The earthquake could have been larger in magnitude, making the shaking duration longer and causing more damage, or it could have occurred closer to town, causing more violent shaking. It could have occurred at a time of day when people were in locations of damage and been injured or killed. The propane cloud could have exploded or runaway fires might have occurred, causing greater loss of property, injuries, or even possibly loss of life. Multiple injuries, fires, and other incidents could have overwhelmed the system in place. The Wells earthquake demonstrated that the Wells and Elko County personnel were well trained, practiced, and prepared for an emergency event that they may not have envisioned could "happen here." The emergency response

community will have to prepare for disasters much worse than the Wells earthquake, however, because it is easy to see how the earthquake and its effects could have been worse than they were.

The Wells earthquake occurred during intermittent snow showers, and although snowy and icy roads were passable, they made travel to Wells slower and increased the risk of an accident by emergency crews. It may seem obvious that emergency responders would drive appropriately for the conditions, but when they are responding to an emergency they commonly push the safety limits with a focus on a faster, better response. In Wells, the wintry conditions were handled well by emergency responders who were used to these conditions and there were no driving incidents.

Nevada residents are not prepared to Duck, Cover, and Hold; this needs to be a greater part of the cultural mindset. In Nevada, most buildings are expected to remain standing during earthquakes, so contents that are falling will likely cause most of the injuries. Duck, Cover, and Hold protects people from the objects that are thrown around during an earthquake. The best strategy is to secure, remove, relocate, and replace dangerous objects that can fall where people spend time or along passageways. A girl trapped in bed by a fallen bookcase during the Wells earthquake is an example of a hazard that could have been avoided. There needs to be a stronger, more convincing case made for Duck, Cover, and Hold, and getting people to practice this would help reinforce this response.

People have run out of buildings during earthquakes all throughout history and it is hard to believe they will stop doing so in future earthquakes. They have commonly concluded their life is threatened and they want to get out to safety. Consequently, more effort should be made to make exits safe from falling objects in earthquake country.

LESSONS LEARNED AND RECOMMENDATIONS

- An incident command handbook for earthquake disasters should be created before the next earthquake to help incident commanders and others that are not highly familiar with earthquakes respond to them. There are many post-event activities that are detailed and have specific approaches or tactics of execution which can be laid out.
- The Emergency Alert System could not be immediately triggered by emergency personnel because of outdated telephone numbers. This system can be an extremely valuable source of information for the public immediately post-emergency so the activation abilities by emergency personnel should be effective and routine. This system needs to be kept up-to-date and exercised regularly.
- Cell phones should not be used as the primary means of emergency communication during an emergency. Cell phones can be anticipated to be overwhelmed during an emergency and when cell phones are accessible by the media, they may be rendered useless for emergency response because of inundation of calls. Earthquake damage can also occur to the cell phone infrastructure that can debilitate it. Radio systems work best for emergency response.
- An operational satellite-equipped communications vehicle would have improved incident command communications. Initially there was only one telephone line available at the Incident Command Post and cell phones had to be used. A mobile incident command post may be an excellent option in an earthquake environment where buildings may be damaged, continued shaking is a threat, and local utilities and communications can be compromised. Keep in mind that although this can be a decision and communication center, additional space will be needed for larger responses.
- The Incident Command Post and response activities should ideally be in a separate location from the shelter facilities. The co-location caused some issues with victim privacy and interruptions in service to them.
- State and local responders should use the same radio systems or have patches pre-setup for emergency response. Not doing so creates the lack of a single uniform communication system, resulting in confusion about orders and delay in critical information exchange. Emergency communication plans for a major disaster should facilitate rapid communication abilities and highlight potential weaknesses to be addressed.
- Communication abilities should be further addressed in training and tabletop exercises. Earthquakes, their effects, and their aftermath should also be specifically trained for and exercised.
- The public and media need to be further educated that the 911 and emergency lines should only be used for emergencies and to do otherwise may delay a real emergency call where response time is critical. The lack of the Emergency Alert System activation following the Wells earthquake compounded this problem and contributed to a knowledge vacuum for the event. People’s need to talk to one another following a strong earthquake is predictable and people should be encouraged to physically check on their neighbors post-event to help promote more human interaction and alleviate this need. An informational web site that people and media can be directed to should be quickly established.

- Green, yellow, and red building inspection placards should be stored in at least two locations in each county and be able to be transported to an earthquake-affected community within 24 hours. The Applied Technology Council ATC 20 placards work well. Colored placards help those who don't understand the placard language to still be able to readily interpret it.
- The financial expenses of the emergency response need to be tracked and receipts kept during the disaster so that costs are not a major surprise after the response has concluded. It would also help facilitate decisions on reducing the emergency response effort commensurate with need. An emergency response can cost a few hundreds of thousands of dollars, not all of which will be reimbursed. Rural community funds are limited, so protocols for ordering emergency resources should be understood to minimize unanticipated reimbursement impacts.
- Community emergency response plans in Nevada should include specific plans for responding to an earthquake disaster. The specific types of effects and settings, approaches to response, and a strategy and potential locations for setting up an incident command post in a post-earthquake environment (possible shaking damage and aftershocks).
- When sending relief resources to a rural earthquake disaster a "Goldilocks approach", that is sending just the right amount of resources and not too little and not too much, should be used. There certainly need to be the resources required and not fewer, but more resources that are needed complicate the setting in a rural community, which has limited support capacity. A good deal of intelligence (information in perspective) initially should be used to make sure resources are adequate. Additional, potentially needed resources might consider staging in a nearby, but undamaged, town to minimize their impact yet still have the ability to be rapidly deployed when needed.

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