



What Businesses Learned From The Nisqually Earthquake Of February 28, 2001

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The Cascadia Region Earthquake Workgroup
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Final Report

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FOREWARD... or HOW WE GOT FROM THERE TO HERE!

The magnitude 6.8 Nisqually Earthquake struck western Washington on Wednesday morning, February 28, 2001 at 10:58 AM. The quake was centered beneath Puget Sound off the Nisqually Delta, thirty-five miles beneath the earth's surface. The point of origin (aka. epicenter) of the earthquake, was located about 39 (*11*) miles NE of the State Capitol in Olympia, 37 (*16*) miles SW of downtown Tacoma, and 51 (*40*) miles SSW of downtown Seattle. *The distances in italics are to the surface above the point of origin.*

More than 400 were injured, but there was only one fatality, from a heart attack. The damage caused by the quake is estimated at more than \$3.5 billion, yet only some \$350 million of the loss was insured.

Businesses interviewed for this document ranged from one person businesses to large national companies, from SW Washington to British Columbia. Between 250 and 300 businesses were invited to participate. To encourage participation, no questionnaires were presented and interviews were short. Most were done via email, with some visits and a few by telephone. All were promised confidentiality, and told their responses would be used to help their fellow businessmen. They were asked “tell me about your experiences, e.g., what worked, what didn't work, what broke or fell over, what surprised you, etc. I'll be especially interested in stories/anecdotes about the quake that you'd like others to hear.” Their responses have been organized into categories that seemed to make sense.

This document discusses the “lessons they learned” from the quake. It is not an in depth dissertation on the behavior of different types of quakes or buildings, but a practical look at what worked and what didn't. It is designed to help businesses decide where to spend their resources to protect their business from the next quake. Most of the recommendations contained are what those businesses have decided to do to protect against the next event. If each business in “earthquake country”¹ would do just one or two of the recommendations contained within, their future earthquake damages would be reduced, their employee safety improved, and the likelihood that their business will survive enhanced.

The Cascadia Region Earthquake Workgroup (CREW), Federal Emergency Management Agency (FEMA), and the University Of Washington's Geophysics department wish to thank the many businesses and employees who shared their experiences to help protect us all.

¹ If you've read this far, you ARE in “earthquake country”.

EXECUTIVE SUMMARY

- **SEISMIC RESTRAINTS PAID OFF:** Inexpensive earthquake straps and quake mats saved a lot of equipment and downtime. Seismic retrofits were proven in several companies. *Those who had retrofitted (or built to seismic specifications) couldn't stop talking about how well it paid off.*
- **CEILING GRIDS AND LIGHT FIXTURES:** Many suspended ceilings and light fixtures that weren't seismically restrained dropped, endangering people and sprinkler systems.
- **SHELVING SECURING & BRACING:** Freestanding shelving should be secured to the wall and/or floor. Tall shelving, like in warehouses and warehouse clubs, should be secured to the floor, and from the top, and/or be diagonally braced.
- **DON'T GET RED TAGGED NEEDLESSLY!** Simple nonstructural hazards could red tag a building, even if no significant structural damage occurred.
- **DISASTER/CONTINGENCY PLANS:** Simple is better! *A hospital supervisor said it best... "Our disaster script needs to be rewritten with the highlights on ONE page at the beginning of the plan – we missed the highlights and got lost in the huge volume of words in the plan!"*
- **EARTHQUAKE TRAINING:** Trained employees immediately dropped under desks or tables and hung on ("Drop, Cover & Hold"). They emerged uninjured and ready to help after the quaking stopped.
- **EMERGENCY DRILLS:** Whether fire drills, evacuation drills or disaster testing... practice, **practice, practice:** When a disaster hits, many people go into "shock," so knowing where to go/what to do has to be automatic. *Heard from companies many times... "you can not practice too often!" To be effective, drills must be a mandate of management... and management must participate.*
- **EXPECTATIONS:** Fright and panic are reduced when employees know what to expect. Document what you learned during this quake to advise future employees of things like: how long to expect your building to sway after the shaking stops, what they might expect to hear (creaks, rumbles), how elevators might behave, what it might be like getting home, etc.
- **TELEPHONE SYSTEM QUICKLY BECAME OVERLOADED:** We need to save this resource for emergency calls only for the first 90 minutes after any major event. This means:
 - a) don't use the phone unless you have an emergency,
 - b) don't call 911 to ask "was that an earthquake we just had?", and
 - c) hang up any phones that may have shaken off the hook.
- **FAMILY NOTIFICATION:** Your employees need to let their families know they are OK... but ask them to wait 90 minutes before calling (to accommodate emergency calls). Encourage them to arrange an out-of-state contact for family to call to say they're OK.
- **PLACEMENT OF BUSINESS CONTINUITY RESPONSIBILITY:** *Some businesses shared that they've moved their Business Continuity function to report very high up in the management chain.* This is where it belongs, because it needs senior management clout, and it supports the survival of the entire business. Any Contingency Planner or Business Continuity professional who reports several management layers down will confirm their efforts to be "futile". Their existence may satisfy a regulation of having a contingency plan, but it's unlikely the plan will be understood, tested or effective.

OFFICE SPACE

- **FILE CABINETS:** Some tall file cabinets tipped over. *Push drawers in until you hear the latch click. Be sure cabinets are secured to a strong wall to prevent tipping onto people or walkways. Secured means screwed into studs... hollow wall anchors pulled out cleanly!*
- **OVERHEAD CABINETS** (such as above desks in cubicles): Keep these closed. Secure hutches to desk tops. Also, don't allow storing heavy items, flower pots or vases atop high cabinets. They can become dangerous missiles during a quake. *Employees emerged from under their desks to find the cabinets emptied onto their desks and floors. In addition to the cleanup effort, the noise of falling items added to their fright during the shaking!*
- **CABINET DOOR LATCHES:** Inexpensive pull-knob latches, or hidden friction locks can keep cabinet doors closed during a quake. *This not only prevents loss, but also makes passage by employees and customers much safer. Just remember to open the doors slowly the first time after a quake!*
- **BOTTLED WATER:** Bottled water is a great asset after an earthquake. A great plan is to have, at minimum, a three day supply on hand in case of a major quake. The emergency community continues to caution us to prepare for 72 hours before help may get to us.
- **EARTHQUAKE KITS:** Those kits you bought several years ago containing water and food for your employees... *have any contents gone past their expiration date?* Personal kits should be stored beneath employees desks or their most used workstation. Large "floor kits" should be placed where they won't be damaged by falling equipment or debris.
- **CEILING GRIDS AND LIGHT FIXTURES:** Many suspended ceilings and light fixtures that weren't seismically restrained dropped. *Are you or your employees or customers in danger of being struck by falling objects? One company thought their light fixtures were properly restrained, but discovered they were restrained with only one wire, and became dangerous pendulums! Another business had a swinging light fixture clip off a sprinkler head.*
- **SEISMIC RESTRAINTS ON PC's, MONITORS AND CRITICAL OFFICE EQUIPMENT:** Inexpensive earthquake straps and quake mats proved to be a very good value. *Some thought \$10-\$15 was too much to protect a \$200 - \$300 monitor. Those who lost production while waiting for replacement monitors wished they'd spent those few dollars! Some thought a CPU on the floor didn't need restraining, but some CPUs were lost simply because the cables and cords jerked the circuit boards and mouse ports hard enough to destroy them. If you have restraints already, check them semi-annually to see if anything got moved or overlooked. A hospital reported one TV set fell from its bracket because its restraint wasn't latched. Luckily, no one was beneath it at the time!*
- **PUBLIC ADDRESS SYSTEMS:** PA systems need to be tested for adequate volume, the ability to reach all areas, predetermined announcements, training in how to use and how to speak to be understood, etc. *Many employees reported unacceptable delays in making the announcements, volume too low to be heard over the general noise in certain areas, announcements heard but not understood (garbled, excited), etc. One employer now recommends using a whistle to get people's attention before announcements. Some announcers directed people to evacuate the building. This can be a dangerous option if evacuation would put employees and customers in the path of falling debris, glass, etc. Consider, plan and drill whatever is best for your situation!*

- OVERHEAD PIPES, AIR CONDITIONING AND HEATING UNITS: Some hanger brackets that used a “beam clamp” to hang them from beams let go, causing these heavy items to drop. Consider adding some sort of safety restraint to these.
- SPRINKLER SYSTEMS, OVERHEAD WATER PIPES, ETC: Most of the damage to the contents of a Renton building was caused by water from overhead pipes that broke. *Flexible pipe and/or connections may have prevented or minimized this damage*
- ELEVATORS: Most people know to not use the elevators during an evacuation, but you could be in an elevator when the quake starts. *One business reported an elevator stopping at a floor, then literally throwing its occupants out! An occupant of a high-rise said the building sway caused elevators to swing and repeatedly hit the sides of the elevator shafts. As designed, the elevator cars slowed down and slowly descended to a lower floor before opening, but the occupants were very frightened..*

RETAIL SPACE

- ANNOUNCEMENTS: Some employees yelled out or used the PA system to tell customers this is an earthquake and what to do. *These customers will come back, because they were thankful they were looked after. Retailers and other businesses with inside customers would do well to pre-plan and practice what to tell their customers.*
- MERCHANDISE ON SHELVES: Many dumped their contents into aisles. *Put heavy items down low to reduce chance of injury to customers.*
- SHELVING: Make sure yours is designed for the weight you’re asking it to carry, and is secured or braced to protect your customers as well as your merchandise. *See more detail on shelving in the WAREHOUSE category following.*
- CEILING GRIDS AND LIGHT FIXTURES: Many suspended ceilings and light fixtures that weren’t seismically restrained dropped. *Are your customers in danger of being struck by falling objects? One company thought their light fixtures were properly restrained, but discovered they were restrained with only one wire, and became dangerous pendulums! Another business had a swinging light fixture clip off a sprinkler head.*

WAREHOUSE, FACTORY, GARAGE SPACE / LOADING DOCKS

- **SHELVING:** Some shelving wasn't rated for the weight it was carrying. *When a load is subject to the G forces of a quake, its effective weight is increased. Make sure your shelving is adequate to protect people and goods.*
- **SHELVING SECURING & BRACING:** Freestanding shelving should be secured to the wall and/or floor. Tall shelving, like in warehouses and warehouse clubs, should be secured to the floor, and from the top, and/or be diagonally braced. *A business that warehouses nails and screws had an interesting experience. Their shelving is 16' to 20' high, with 3-5 levels of shelves, has strong reinforced uprights bolted into the cement floor. Each shelf section is designed to house 2 pallets containing forty-eight 50 lb. cartons (2400 pounds). The shelving racks run north/south, as did the seismic waves in this area. The racks shook violently from south to north. Warehousemen shouted warnings to get out of the aisles. Pallets having vacant spots next to them flipped over, to either the north or south, depending upon where the vacancy was. Only one pallet tipped into the aisle. The warehouse manager believes the shelves would have emptied into the aisles, and/or the shelving collapsed, had the seismic waves run east/west.*
Another business who had seismically retrofitted virtually everything had a few tall shelving units and cabinets tear loose from their restraints. This failure was later determined to have been caused by improper loading... the heavy stuff on the top!
- **OVERHEAD HEATING/AIR CONDITIONING UNITS AND PIPING:** Beam clamps can shake loose! *Some hanger brackets, supporting overhead pipes and HVAC units, which were attached to beams by "beam clamps" let go, causing these heavy units to drop.*
- **HEAVY PARTS** should be placed on lower shelves. *Transmission parts on mezzanine shelving in a transmission shop fell onto a car on a service hoist and totaled the car. These parts have been moved down and farther back.*
- **SERVICE RACKS:** *A BMW on a two post lube hoist (one post on each side of vehicle) danced over to the driver's side, jumped off the passenger side hoist arms, then crashed to the floor on its side. There was no failure of safety mechanisms, all subsequent actions considered create routine hardships and the vehicle could still sustain damage. Their recommendation... immediately get out from beneath the vehicle!*
- **DON'T GET RED TAGGED NEEDLESSLY!** Simple nonstructural hazards could red tag a building, even if no significant structural damage occurred. An example is chemicals spilled under a sink and spreading out onto the floor.

EMPLOYEES

- EARTHQUAKE TRAINING: Trained employees immediately dropped under desks or tables and hung on (“Drop, Cover & Hold”). They emerged uninjured and ready to help after the quaking stopped. *Conversely, some answered that employee actions were frantic and varied. Some scrambled out of buildings, right into the path of falling glass and bricks. Many companies reported employees standing in doorways.*
Safest: under a sturdy desk, table or workbench!
Next best: alongside an interior wall (when a ceiling collapses, it generally hangs onto the top of the wall and hits the floor in the center, forming a “tent” next to the wall).
Don’t run for doorways. Doors will swing back and forth, hitting occupants and smashing fingers. *People were injured while running for doorways. Others reported being shoved out of doorways by people who felt they had more right to be there!*
- BEWARE OF “FLYING DRAWERS”: *A Seattle business in a downtown high-rise said some employees suffered minor injuries while diving under their desks, as their center desk drawers slammed open and shut with amazing force! One advised “the center drawer of desks has the power to knock you out – don’t stick your head up from under a desk until you’re sure the shaking has stopped.”*
- EMERGENCY DRILLS: Whether fire drills, evacuation drills or disaster testing... practice, **practice, practice:** *Heard from companies many times... “you can not practice too often!” To be effective, drills must be a mandate of management... and management must participate. Their effectiveness is seriously diminished if the manager closes his door and “hides out” during drills.*
- EXPECTATIONS: Fright and panic are reduced when employees know what to expect. Document what you learned during this quake to advise future employees of things like:
 - a) how long to expect your building to sway after the shaking stops,
 - b) what they might expect to hear (creaks, rumbles),
 - c) how elevators might behave,
 - d) that it might take as much as 72 hours before help may get to you,
 - e) what it might be like getting home, etc.*A high-rise business occupant said the seismic motion and building sway caused many elevators to swing and repeatedly hit the sides of the elevator shafts. As designed, the elevator cars slowed down and slowly descended to a lower floor before opening, but the occupants were very frightened. Getting home may be tough. Landslides will block roads, bridges and overpasses may be damaged (or closed for inspection), and walking home may be the best method. Emergency kits with nutrition bars, medications, emergency water pouches, sturdy shoes and gloves will be very welcome!*
- EMPLOYEE LOYALTY: *Repeatedly I heard employees expressing thanks that their employer had provided earthquake awareness training. Another company, whose senior management walked through each area after the quake, said employees were very impressed that management personally checked on their well-being.*

- **EMERGENCY KITS:** These kits include at least three days of any required medications, sturdy shoes and work gloves, and food and water to survive 72 hours. *One company, whose employees each had emergency kits, observed many of their people going through their kits immediately after the quake. Commonly used items were heavy shoes, work gloves, and a few dust masks. Had the quake been stronger, the emergency water, protein bars, flashlights and medications would have been tapped. Another company whose employees had, at one time, mostly all had emergency kits under their desk, found that turnover had reduced the number of employees ready to "survive 72 hours without help". They took an action item to make emergency kits part of the new employee checklist.*
- **FAMILY NOTIFICATION:** Your employees need to let their families know they are OK... but ask them to wait 90 minutes before calling (to accommodate emergency calls). Encourage your employees to have an out-of-state contact that everyone can call to say they're OK. Out-of-state is important, because in-state calls may be blocked. *One major long distance carrier blocked 7.9 million calls so that state and local emergency workers could conduct the business of emergency management. Puget Sound Energy recommended in ENERGYwise, May 2001: "Select one out-of-state and one local friend or relative for family members to call if separated by disaster."*
- **HOME & FAMILY PREPAREDNESS:** Your employees will be much less worried if their family, and pets at home are prepared. Home preparations for disasters, like seismic restraints, emergency water supplies, clear exit pathways, a predetermined gathering place, first aid kits and training, all add to safety and comfort. *Caution... if you encourage this you may be viewed as a caring employer, a good company to work for, and... your employees will stick around longer to help with your recovery. One hospital decided "We need to revisit our family arrangements. A few years ago we focused on having our family plans set up so we could be free to concentrate on the hospital; we need to do this again!."*
- **DON'T PUT YOURSELF INTO HARMS WAY!** We witnessed objects falling (bricks, facades, shingles, etc.) for several days after this quake. Not from aftershocks -- they just finally let go! *I received several observations of people standing outside buildings, looking up, smoking, using cell phones... all the while in harms way!*

EVACUATION ISSUES:

- “ESCAPE HOLE”: Encourage your employees to maintain an “escape hole” to dive into during a quake. This might be under their desk, a counter or a table. *Requires protecting this space so it doesn’t get filled with other items (one hospital reported treating some people for injuries incurred when trying to climb under something for cover).*
- EVACUATION: Evacuate? Don’t evacuate? This question is often asked. People feel the need to get out of the building that has just frightened them with its shaking. *Don’t even consider going outside until the shaking has stopped! DROP, COVER AND HOLD without exception, then consider the advisability of evacuation. It is generally advised to stay inside a stable building. High rises, and even two story buildings, can shower debris on people while they evacuate. Occupants of single story buildings can generally evacuate safely. If someone feels they must evacuate, encourage them to peek out and look up and around before leaving. Look for falling objects, power wires, piles of debris, broken glass, etc.*
- EVACUATION DRILLS: Posting an evacuation map, or telling employees isn’t enough. People need to do it to remember what to do. When a disaster hits, many people go into “shock,” so knowing where to go/what to do has to be automatic. Pre-assigning search teams or floor wardens to do a sweep of the area after a disaster will ensure no one is left behind. *Frequently reported was that people were confused as to what to do, where to go. Many of them had never been told where to meet or gather after evacuation. One company promised (in their post event recap) to do evacuation drills following their drop, cover and hold drills.*
- EVACUATION TIMING: One “hard hit” employer said they probably evacuated too soon, through stairwells filled with bricks. This respondent, even after waiting “a long time” found a crunch of people upon reaching the first floor.
- POST EVACUATION ACCOUNTING: One employer had difficulty knowing everyone was accounted for (and this employer had conducted multiple evacuation drills). They spent a lot of energy searching for someone who’d gone home. *They’ve now put HIGH emphasis on nose counts, and assigning individual responsibility to report in before you leave.*
- GATHERING PLACES: A predetermined place for employees to gather after a disaster is very important for determining if everyone got out. Key to making this work is ensuring all employees know where to meet, ending your fire/evacuation drills at that meeting place, and ensuring the place you pick will be a safe place to gather (and large enough to accommodate your staff and anyone else’s who might pick the same place).
- SIMULATION EXERCISES: Forward thinking companies have done disaster simulation exercises, designed to train management and staff how to react to an actual disaster. These exercises often become so intense that participants forget it’s just an exercise. Participants, both management and staff, believe these exercises to be extremely valuable, *and reflecting back on this earthquake, their behavior proved the value of simulation exercises. The actual earthquake and post earthquake behavior of those that didn’t participate was less effective.* Key to maximum effectiveness of an exercise is management putting a higher priority on the exercise than travel and offsite meetings, so the entire management and key employee team can participate.

COMPUTERS / NETWORKS / SERVERS

- **RAISED FLOORING:** Raised flooring support pedestals that aren't set up for "earthquake country" can tip over or buckle, letting the floor collapse and dumping expensive computer and network hardware. *Have yours been seismically braced?*
- **SERVER CABINETS:** These should be restrained to the wall or floor to keep them from walking. *Many server cabinets tipped over... a few servers survived, many others were destroyed. One company reported a notebook shook off a cabinet, then the cabinet walked up onto the notebook and tilted over!*
- **SERVER RACKS:** There are seismically designed server racks that are made to allow the servers to "roll with a quake". Something to consider when you are adding or replacing server racks.
- **MONITORS & TERMINALS:** These should be strapped or otherwise restrained to keep them in place. *Many companies lost monitors and computer terminal screens during the shaking. Many monitors that weren't strapped down were thrown off the desk. Some survived, but many didn't. A few employees were hit by "flying" monitors, and a lot of productivity was lost while waiting for replacements. Those companies who had spent a very few dollars per monitor got a very good return on their investment.*

COMMUNICATIONS

- **TELEPHONE SYSTEM QUICKLY BECAME OVERLOADED:** Many phone calls made were unnecessary. AT&T alone blocked 7.9 million incoming calls for 17 hours. We need to save this resource for emergency calls only for the first 90 minutes after any major event. This means:
 - a) don't use the phone unless you have an emergency,
 - b) don't call 911 to ask "was that an earthquake we just had?", and
 - c) hang up any phones that may have shaken off the hook.*The woman who died of a heart attack was my neighbor. Her husband succeeded in getting a dial tone, but the 911 system was jammed, and much of its load was due to b) above. While the husband applied CPR, a neighbor drove to the fire station and got the medics, but too much time had passed.*
- **CELLULAR PHONE SYSTEM WAS ALSO JAMMED:** The cellular system suffered the same problems, and for the same reasons, as the wired system.
- **NEXTEL PHONES WORKED WELL** within 15-20 minutes after the quake. *One company is considering Nextel as their new standard.*
- **TWO WAY PAGING SYSTEMS WORKED WELL**, and don't require a dial tone to answer or acknowledge. *A large Tacoma business reported that their ARCH two way text pagers were their only portable communications devices working.*

- **REGULAR PAGING SYSTEMS WERE INTERMITTENT:** Digital paging systems require a phone call to initiate, transmission air time to send the signal, then often require the recipient to make a call, so while the phone system was overloaded they didn't all get through. Alpha pages have the advantage of passing along a useful message using minimal airtime, such as to meet somewhere, or similar. Blast pages (a single computer generated message is sent to a group of pagers) generally got through, but usually not everyone got the page, and some pages were significantly delayed. *One company reported that Out-Of-State pages took 20 minutes to more than an hour to be received in the NW, and have since cautioned their people Do Not Send Repeated Pages!*
- **EMERGENCY RADIOS:** *One very well prepared company reported they were unable to communicate via radio to their home office communications center and other downtown offices. Several other companies mentioned similar difficulties with radios, especially with newer employees. Remedy: more frequent usage training and radio testing! A hospital said their 800mhz radios were temporarily useless due to lack of air space, and said they were going to look at another frequency, or alternative radios.*
- **ALTERNATE PROVIDER FOR 1-800 AND FAX SERVICE:** A business that relies on an 800 number to receive orders can suffer a severe loss of business when their service is out for any length of time. *A Spokane company experienced 2-1/2 days downtime because their provider was down. They have since arranged for alternate emergency providers, and have split their daily traffic to protect their business.* You should also find out where your provider's central office is located. If your provider's facility is in your locality, you should consider at least splitting the traffic.
- **EMAIL AND WEB BASED STATUS COMMUNICATION:** *Several businesses and agencies found this to be an effective means of communicating status of things like availability of hospital beds, status of utilities, and lots more.* While it's hard to disagree with the usefulness of something that proved to work, you need to recognize that this means of communication could be severed in a stronger quake than this one... so don't make this your only means of conducting your recovery.
- **SATELLITE PHONES:** An expensive solution, but if immediate communication is a must, these can provide it. Frequent training and testing is critical though, otherwise your investment could be useless. *One company reported exactly such a problem... they couldn't figure out how to make theirs work!*

RECOVERY

- **DISASTER/CONTINGENCY PLANS:** Simple is better! *A hospital supervisor said it best... “Our disaster script needs to be rewritten with the highlights on ONE page at the beginning of the plan – we missed the highlights and got lost in the huge volume of words in the plan!”*
- **COMMUNICATIONS PLANS LACKING!** *Several companies admitted their employee call lists and vendor contact lists were out of date. This caused a lot of delays in recovery.*
- **PLANS SHOULD BE KNOWN TO EMPLOYEES,** and accessible when the manager is away. *A utility company reported “Our unit should have remained at work ready to respond to emergencies, but without a written plan or a manager on site, this did not happen.*
- **EMPLOYEE HOT LINES** (aka. SNOW LINES, EMERGENCY LINES, etc.): Many companies have these systems for dispensing emergency information to employees, and they generally work very well. But... to be effective, the hardware must not be located on your company’s premises. Best is to have it located out of your area, like in a phone company central office across the mountains. *One company reported their hotline out of commission because it was in their disabled site. This really crippled their ability to communicate information to their employees in a timely fashion. Another company stated they have since established a remote 800 number to communicate with their staff.*
- **TRAVEL ARRANGEMENTS FOR RECOVERY STAFF:** Many companies prearrange, or at least predetermine, travel arrangements for staff to get to hotsites or other company sites. *One large company found those arrangements to be much less clear than expected. They have since rewritten them to be clearly understandable in an emergency. Alternate arrangements should also be considered, in case the airport is shut down or a bridge closed.*
- **RECOVERY MEDIA MANAGEMENT:** *One business admitted discovering problems locating all their backup data. Several others nodded in acknowledgment! They found knowing what is on which backup tape was not easy!*
- **WORK SHIFTS:** Early in the recovery you should send part of your recovery staff away to get some rest. Some companies were fortunate enough to learn this during disaster testing, and planned their “real recovery” accordingly. *One company who successfully recovered, but much later than they planned, lamented “Shifts were long and sleep was short. This led to bad mistakes and major set backs in system restore.”*
- **CANCEL UNNECESSARY FUNCTIONS DURING YOUR RECOVERY:** *One hospital modified their disaster plan to automatically cancel non-emergency surgical cases during a disaster because the patients want to go home, and the operating rooms might be needed for people injured during the quake.*
- **CHILD CARE FOR RECOVERY STAFF** can make the difference between having the staff you need, and being understaffed. One company said “we needed to set up a baby sitting area for staff who had to bring children in... we are refining our plan to include who should be the sitters.”

MISCELLANEOUS

- **EARTHQUAKE INSURANCE:** Few of the companies responding had earthquake insurance. *Some had declined earthquake coverage due to premium cost. Others didn't realize they didn't have it. Many reported taking another look at their insurance program.*
- **TRANSPORTATION PLAN:** Businesses whose revenue stream depends upon getting vehicles, packages and/or employees to/from their location are advised to devise an alternate plan(s). These plans should include alternate routes and airports, if appropriate to your business. *Companies who had this planned out were able to "hit the ground running," and suffered less than those who had not planned. The financial community was severely disrupted by the closure of Boeing Field, as many couriers that move checks fly out of this convenient field.*
- **DEPENDENCIES:** Consider what your business is dependent upon. If your survival depends upon daily flights from Boeing field, a ferry between Fauntleroy and Vashon, a bridge, whatever... what are your plans if these facilities are not available for a day, a week, or a year.
- **CENTRALIZE vs. DECENTRALIZE:** An earthquake (or other disaster) tips the scales in favor of decentralizing (as an effective disaster backup). *Companies that were able to switch production to an unaffected facility may have been tight on capacity, but they kept on running. One of those companies reported capturing a chunk more market share in the area, when their main competition was unable to deliver. Another large local company switched their call center traffic to another call center, and their customers never felt them miss a beat!*
- **POST RECOVERY RETURN HOME:** A well thought out return process should be part of your recovery plan. You have the opportunity to create another disaster if your return home is not carefully scripted. *This is embarrassing (at least) if you've successfully recovered off site, and then fall on your face when making the move to your home site.*
- **STRUCTURAL REVIEW OF OLDER BUILDINGS ADVISED:** Buildings designed and built over twenty years ago need to be reviewed. Recent earthquakes suggest that building damage in minor earthquakes is related to lack of upkeep and maintenance practices, in addition to possible inadequate lateral structural systems. Older buildings should be reviewed using ATC-21 or other FEMA Hazard reduction program documents. Volunteer building reviews may be available for businesses that cannot afford to hire consultants for such activities. Contact Behrooz (Ben) Emam at (206)783-1909, or emam@amazon.com.
- **NEWER BUILDING STRUCTURE PROBABLY O.K.:** The experience in recent earthquakes suggests buildings less than twenty years of age perform well in seismic events, and damage in these buildings tends to be minor, and related to non-structural components (piping, equipment, furnishings, etc.). Attaching this equipment to building structural systems reduces the likelihood of damage and post earthquake business interruption.

POSITIVE ASPECTS

- Many more now understand that DROP, COVER & HOLD drills are useful exercises.
- Many businesses have strengthened their emergency procedures to help save lives and prevent injuries, and to help them maintain a competent image during a future event.
- Some small to medium businesses don't maintain a full-time Business Continuity staff, but add contingency planning duties an existing position or positions. Some of those have now recognized the need for a dedicated business continuity function, realizing that splitting a function this critical can compromise the survivability of the business.
- *Some businesses shared that they've moved their Business Continuity function to report very high up in the management chain.* This is where it belongs, because it needs senior management clout, and it supports the survival of the entire business. Any Contingency Planner or Business Continuity professional who reports several management layers down will confirm their efforts to be “futile”. Their existence may satisfy a regulation of having a contingency plan, but it's unlikely the plan will be understood, tested or effective.
- Seismic retrofits were proven in several companies. *Even though I heard some reports of strapping and bracing failures, those who had retrofitted (or built to seismic specifications) couldn't stop talking about how well it paid off.*
- Masonry and drywall contractors have enjoyed a major surge in business!

LESSONS LEARNED FROM THE SBA (U. S. Small Business Administration)

By October 22, 2001, the SBA had approved \$81.3 million in low interest disaster loans to 6,181 homeowners, renters, and businesses that sustained damage from the Nisqually earthquake. This includes 615 disaster loans to businesses totaling \$26.1 million for repairs, and 121 loans to businesses totaling \$2.3 million for economic injury assistance. To date, SBA disaster loans have protected more than 3,996 jobs for businesses damaged by the Nisqually earthquake. Here are some lessons they learned from the businesses they assisted:

- Buildings constructed of un-reinforced masonry will often sustain a significant amount of damage during an earthquake.
- When upgrading your facility or machinery and equipment, consider mitigation efforts that you can take to protect your investment. Consider the long-term benefits of safety measures versus achieving a trendy look for your building.
- Have a contingency plan in place that will allow you to continue operations, even in a limited capacity, until you can make repairs.
- Protect important data and business records by storing copies of this information off-site. Disasters can destroy valuable information and your business may not be accessible after a disaster.
- Be aware of potential hazards that surround your business, such as walls of adjacent buildings, which could cause damage or threaten the safety of your employees and customers.
- Owners of commercial and residential rental property must consider the potential impact of lost rents, or the loss of a valuable tenant because of disaster damages. If landlords and tenants work together to prepare for a disaster, losses can be significantly minimized for both parties.
- Business owners must consider the value of maintaining adequate insurance coverage on their property, including the cost vs. benefit of earthquake insurance.
- If you lease your business facility, carefully review your lease to ensure it addresses who is responsible for damages to the building, leasehold improvements, mechanical systems, parking areas, etc. Also, determine if your landlord carries earthquake insurance.

GENERAL SOURCES OF ADDITIONAL INFORMATION

EARTHQUAKE PREPAREDNESS INFORMATION:

- Cascadia Region Earthquake Workgroup (CREW)
www.CREW.org
- Nisqually Earthquake Clearing House:
http://maximus.ce.washington.edu/~nisqually/
- Washington Military Department, Emergency Management Division:
www.wa.gov/wsem (800) 562-6108
- City of Seattle Emergency Management:
www.cityofseattle.net/emergency_mgt/ (206) 233-5076
- King County Emergency Management:
www.metrokc.gov/prepare
- American Red Cross... and Seattle Chapter of American Red Cross:
www.redcross.org www.seattleredcross.org (supplies available from Chapter Store)
- Institute for Business & Home Safety
www.ibhs.org (866) 657-IBHS Toll Free
- Phinney Neighborhood Association's Earthquake Home Retrofit program
http://www.phinneycenter.org/wh_classes.shtml
- BOMA (Building Owners and Managers Association). Earthquake and disaster preparedness information for both business and home. *www.bomaseattle.org*
- Oregon Showcase (Oregon's Partners for Disaster Resistance)
www.OregonShowcase.org
- Emergency Preparedness for Industry and Commerce Council
www.EPICC.org

EARTHQUAKE TIPS, DISASTER LOANS:

- Federal Emergency Management Agency (FEMA)
www.fema.gov (800) 462-9029
- U. S. Small Business Administration (SBA)
Loans for homeowners, renters, and businesses of all sizes: (800) 488-5323
www.sba.gov/disaster

INSURANCE INFORMATION:

- Washington State Office of the Insurance Commissioner
www.insurance.wa.gov (800) 562-6900

CHIMNEY and MASONRY INFORMATION:

- *www.masonryinstitute.com*

EARTHQUAKE PREPAREDNESS FOR ARTISTS and ARTWORK:

- Tip sheet for storing artwork and preparing work spaces. Case studies of quake damage. Artist Trust organization: *www.artisttrust.org* (206) 467-8734, ext. 9

EARTHQUAKE PREPAREDNESS TIP SHEET

Earthquake preparedness combines common sense with a few actions based on simple physics.

BASIC CONSIDERATIONS

1 – Address Human Safety

The primary concern should be the protection of life and limb. No matter how valuable objects may be, hazards to human safety must be addressed first.

- Identify large or heavy objects that could fall on people, or could block access to the exit from your work area, or the building.
- Look for large objects on upper shelves, stacks of lumber, or sets of shelving that are not secured to walls.

Damage in earthquakes is caused in three basic ways – almost all damage can be attributed to one of these basic causes:

- Objects tipping over
- Objects colliding into other objects or surfaces
- Objects falling from shelves, tables, pedestals, etc.

2 – Don't Procrastinate

Measures taken to reduce risk need not be complex or expensive; small measures can make a huge difference. Securing a set of shelves with a couple of screws fastened to a wall is a great example. This will secure the shelves from tipping, and thus make objects less likely to fall off the shelves and cause harm to a person, other objects, or itself.

3 – Be Practical

Measures must be easy to use, and appropriate to the function of the item being prepared. Any prevention method that is awkward or inconvenient will soon be abandoned, and thus become a waste of energy and money.

RISK REDUCTION

Tipping Hazards:

In order to reduce tipping hazards:

- Secure unstable items to more stable ones such as walls, pillars, or mounts, thus limiting motion.

EARTHQUAKE PREPAREDNESS TIP SHEET, continued.

- Lower the center of gravity:
 1. Place heavier items on lower shelves.
 2. Lay tall things on their sides.
 3. Fasten items to a base that has a larger footprint and is thus harder to tip.
 4. Enclose items so they are contained in a box or other structure with a wider footprint, and thus a lower center of gravity.
 5. Allow items to slide on the surface where they are setting, as long as they aren't able to slide and fall off.
 6. Anchor small objects and artwork, such as glass and glazed ceramics, with dental wax, "quake" putty or silicone (these items can be purchased at art supply stores, hardware stores, etc.) This is a very effective technique, especially when coupled with the addition of weight – this will lower the center of gravity. Use three to four small balls of wax on the bottom of object. Place object on shelf or pedestal with a slight twist. Remove in same fashion to shear wax layer. Do not use on low fire ceramics, as wax can pull pieces from poorly vitrified ceramics as well as pull gold leaf decoration from porcelain. Wax can also migrate into unfinished surfaces.

Tripping Hazard:

Tripping is basically a complication of tipping, and occurs when an object slides across a surface until it encounters a point of resistance, and then trips over that obstruction. Tripping can also occur when an object has a high friction bottom that won't slide, and a center of gravity high enough to topple it. To avoid tripping of objects, follow the same steps for securing or lowering the center of gravity, as detailed in Tipping Hazards, above.

Collision Hazards:

Collision damage occurs when an object slides and strikes another object or surface without tipping over.

- Increase bottom friction and lower center of gravity.
- Place padding or separators between objects. On a set of shelving that has been secured against tipping, a grouping of objects such as ceramics or glass are best placed close together with foam, cardboard, or even folded newspaper between them to allow minimum movement.

EARTHQUAKE PREPAREDNESS TIP SHEET, continued

Falling Hazards:

Objects may be damaged by falling from a shelf, workbench, or display stand.

Pictures and art work may be damaged, or even destroyed, by falling off a wall.

To reduce falling hazards:

Limit the availability of edges by applying a lip to a surface, or stretching a light rope or bungee across the opening of a set of shelves to limit the ability of objects to fall off the shelves.

- With pictures and art work hung on walls:
 1. Secure the lower edge so that the panel cannot flap, and stress the hanging attachments. (“Secure-T” security fasteners will retain the lower edge best, but rubberized poster adhesive putty will secure bottoms fairly well. Poster putty is not an archival product, so keep off actual art surfaces.)
 2. Upper hanging hardware must be well secured.
- For Pedestals:
 1. Anchor objects with wax or a mount (see last bullet in “Tipping Hazards” section.)

OTHER HAZARDS IN THE WORK PLACE

Hazardous Materials:

- Flammables: Ideally, all flammables should be in a steel flammables cabinet approved by the National Fire Protection Association (NFPA) that is secured to a wall. That said, the greatest concern is with breakage and spillage, especially of those materials in use at any given time.
 1. Equip all storage cabinets with doors that latch.
 2. Use boxes, or plastic tubs or containers to sequester and contain any contents which could spill.
 3. Use a wheeled cart with tray type shelves to help contain any spillage, as well as allow limited movement.
 4. Buy materials in plastic containers, when possible.
 5. If you’ve transferred hazardous materials out of their original package, make sure the new package is labeled with its hazardous contents.

EARTHQUAKE PREPAREDNESS TIP SHEET, continued

- Gases: Gas cylinders for welding or other purposes must be secured to a wall to keep from tipping over. Even sets on two wheeled welding carts must be secured. Cylinders should be secured at two points: 1/3 of the way up from the bottom, and 1/3 of the way down from the top. Caution: Gas cylinders are under high pressure – if damaged they can explode or become a flying projectile. When purchasing a gas cylinder, please consult with sales staff regarding tank safety precautions.

Equipment and Tools:

- Large tools:
 1. Secure to walls or pillars.
 2. Lower the center of gravity, with weight at the bottom.
 3. Fasten base to larger footprint of plywood.
 4. Fasten base to floor, or place tool on mobile base that allows limited movement.
- Small tools:
 1. Store in cabinets with latching doors.
 2. Put neoprene or rubber compounds on underside of toolboxes to increase friction.
 3. Use racking system to organize and secure tools in convenient locations.

Lumber and awkward sized materials:

- Secure items with eye screws into wall studs at strategic intervals, and ¼” nylon rope to snug up stacks.
- Build storage racks to enclose and store materials. These racks must be well built and secured to a wall or pillar.

Glass, Ceramics and Fragile Items:

- Place on foam lined shelves with separators or foam cavities to isolate objects from one another.
- “Chock” rounded objects with foam to keep them from rolling.
- Store objects in boxes with padding and separators.

I wish to express thanks to James Hascall of Hascall Museum Services, 3052 15th Ave West, Seattle, WA 98119, 206-352-0728, jhascall@accessone.com, for contributing the majority of the information in the EARTHQUAKE PREPAREDNESS TIP SHEET.