Introduction

Shenandoah Valley Project Impact is a disaster preparedness and mitigation education program that began through a grant from the Federal Emergency Management Agency. We serve the twenty-one jurisdictions of the Central Shenandoah Planning District. The goal of Shenandoah Valley Project Impact is to change the way people deal with natural and man-made disasters through mitigation and preparedness education programs. Our programs help communities become “disaster resistant” by teaching people ways to protect their families, homes, and businesses.

This guide is designed to help businesses in the Shenandoah Valley in three ways. First, business continuity information is provided to help business owners think about simple actions they can take to protect their businesses and reduce the amount of downtime that may result from a disaster. Second, preparedness information for employees is included. By helping employees know what to expect during and how to prepare for disasters, a business owner is protecting its greatest asset - its employees. Third, this guide contains information on a variety of floodproofing methods that can be implemented to protect a business’ site and structures. Implementing floodproofing measures to protect a business’ vulnerable areas may reduce or even eliminate damages that may result from a flood event.

There are many simple steps that you can take to keep your business, employees, and property out of harm’s way. Business continuity, preparedness, and mitigation practices are proactive rather than reactive and help a business thrive no matter what arises. We hope the information provided in this guide will help your business on the road to “disaster resistance”.

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Of all businesses that close down following a disaster, more than 43 percent never reopen and an additional 29 percent close for good within two years. Unless you protect your business from natural disasters, you risk losing it all together.”

- Open For Business by the Institute for Business and Home Safety
Business Continuity
The information contained in this section of the guide was obtained from a series of safety bulletins provided by the Holmes Murphy Insurance Company.

Safety Bulletin

Are You Prepared For An Emergency

In light of the events of September 11, 2001 businesses are placing more emphasis on emergency planning. The best way to deal with an emergency is to be prepared in advance. Here are some prevention tips for business and industry to be ready in case a disaster or catastrophe strikes:

- Investigate your locality. Find out which natural and technological hazards can potentially happen in your area. Get information about how to prepare your employees to respond to possible hazards.
- Have a disaster plan. Disaster recovery begins before a disaster. When developing your plan, consider three subjects: human resources, physical resources and business continuity. Designate one employee from each work shift to be the safety coordinator. Think about what you would need to serve your customers even if your facility is closed.
- Start building your plan now. Make phone lists of your key employees and customers available to all staff.
- Designate one remote voice mail number on which you can record messages for employees.
- Arrange for programmable call-forwarding for your main business line. Then, if you can’t get to the office, you can call in and reprogram the phones to ring elsewhere.
- If you might not be able to get to your building quickly after an emergency, leave keys and alarm codes with a trusted employee who is closer.
- Install emergency lights that turn on when the power goes out.
- Back up computer data frequently each day. Keep a backup tape off site.
- Use UL-listed surge protectors and battery backup systems.
- Purchase a NOAA Weather Radio with a tone alert feature. Keep it on and when the signal sounds, listen for information about severe weather and protective actions to take.
- Consult with your Holmes Murphy insurance agent about precautions to take for disasters.

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Contingency Planning - Don't Get Caught With Your Plants Down

How will you respond in the event of an emergency at your plant, when a key piece of equipment fails? What will be your first reaction? Don't wait for disaster to strike. Many of these questions can be answered ahead of time with a formal contingency plan. You can reduce expensive down-time and repair costs by having a contingency plan in place. It will cost you much more to answer questions and concerns during the panic of an outage than it will if you answer them during the relative calm of normal production and maintenance planning. Contingency plans should include the following steps.

KEY EQUIPMENT

Plans should cover all key equipment. This list may include your boilers, electrical equipment such as power transformers, switchgear, cable, and buswork, pressure vessels, mechanical equipment such as gear sets, plant services, and critical production machinery. The first step is to identify the key equipment in your plant. Key equipment is the equipment that would shut you down or severely curtail production if it failed.

SPARES

The next step is to determine what can go wrong with the equipment and what spares are needed. Compare this list with what is presently available at the plant. Many vendors are more than willing to sit down with you and review your present spare parts program. Once you develop a spare parts program it is important to maintain documentation of inventory to keep the program effective. A complete spare parts list is mandatory and should be referenced in your plan.

If it is cost prohibitive to purchase the spares, explore alternatives. Are quick delivery parts available from the manufacturer or a local vendor? The same vendors who assisted in your review of your spares program should be able to provide assistance. Ask the vendors specific questions regarding delivery times and their normal stocking quantities. Request written estimates of delivery times. Contact other local production facilities to obtain vendor references or to confirm references supplied by the vendor. If practical, visit the vendor's warehouse or production facility to verify they can back up their claims.

RENTAL EQUIPMENT

Determine if rental units are available to maintain production while the
machinery is being repaired. Rental companies' names and telephone numbers should be part of this plan. Request written estimates of rental, set-up, and shipping costs, and delivery times. Check references to confirm that the rental company has come through when needed. Update the plan annually. The rental company may also be able suggest modifications to your plant that will allow faster connection and start-up of the rental unit.

You can reduce critical downtime by determining where you will locate the unit and then running power connections, air, chilled water, steam, gas lines, etc., to the location ahead of time.

**PRODUCTION ALTERNATIVES**

Your plan of action should also include alternate production schedules, plant service duplications, and any other manufacturing procedures that would reduce or avert a production loss. For a one or two shift parallel line operations, can you put undamaged equipment into 24 hour a day operation or can you extend shift production to make up for the loss of one line? Changes in plant personnel schedules may require pre-negotiation with shift workers or their representatives. Do you produce in-house, an intermediate product that you can purchase on the open market? You may have to pay more for this product than your normal in-house production costs. However, this expense may cost you less than leaving your downstream production unit idle. Pre-planning can minimize the time between the accident and the receipt of the intermediate product and resumption of final production.

Contact suppliers beforehand and request estimates of delivery time and costs. What are the minimum economical delivery loads? You may produce this product just in time to serve the downstream process, requiring very little storage. However, you may have to accept bulk delivery from outside vendors requiring larger temporary storage. Is there available warehouse space or storage vessels on-site, or will you need rental trailers or tank trucks? Will you need to rent material handling equipment? Again, preplanning for these contingencies can save production downtime. Document contact names, phone numbers, and purchase terms.

**RIGGING**

Other considerations should include the requirement for any special rigging or crane service. Determine if you can easily remove key equipment for replacement or repair. Plan this out ahead of time so that you can keep down-time and expense to a minimum. Find out if your primary rigging contractor has the equipment necessary to handle your largest piece of equipment. If they can't, locate and document contacts with other rigging companies who can accommodate the lifts required. Note these contact names and the lift equipment required in the action files for each piece of
equipment that is larger than can be normally handled in-house or by your normal rigger.

WORKSHEET / ACTION FILE

On the following page is an example of a blank worksheet that you can fill out to document action plans for a small plant. Larger plants will have to develop more detailed plans with possibly a folder or equivalent computer file for each piece of equipment or contingency. Keep the contingency action file for a particular piece of equipment with the maintenance record for that equipment, or keep all action files grouped together. The exact format is not critical. The key is to include all the information outlined above at a central point to facilitate rapid access when needed and to allow orderly periodic updates to the plans. Review plans annually or when changes in production or plant configuration affect the utilization of key equipment.

SUMMARY

It is easy to dismiss contingency planning as unnecessary paperwork. In part, this is true since hopefully, much of what you document you will never have to implement. However, insurance industry experience shows that formal documentation greatly increases the likelihood that contingency plans will work smoothly when needed. Committing the plans to paper and review by your coworkers can point out flaws in the plan and trigger ideas to make the plans more effective. Too often, plans that exist only in the minds of one or two people in the plant fall apart when most needed.

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## Plan of Action Worksheet

<table>
<thead>
<tr>
<th>Key Equipment List</th>
<th>Backup/Spares</th>
<th>Repair/Rental Comp.</th>
<th>Action/Comments/Phone</th>
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<td>BOILERS</td>
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<td>PRODUCTION EQUIPMENT</td>
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</tbody>
</table>
Safety Bulletin

Business Continuation Planning Guide

Scope

Each year, thousands of businesses and organizations are affected by man-made and natural disasters. Fires, tornadoes, hurricanes, terrorism, storms and earthquakes cause extensive damage and disrupt an organization’s operating ability. It has been estimated that over 40% of businesses closed by a catastrophe or disaster never reopen. Without a pre-defined plan, most organizations find it very difficult to survive a major business outage.

Purpose

This bulletin is intended as a brief introduction to the concept of business continuity planning and provides suggestions and guidelines on how to go about preparing a business continuity plan tailored to the needs of virtually any business or organization. In the context of this bulletin, the term "business" applies to virtually all economic activities in the private and public sector and the information on business continuity planning is intended as an overview of the concept rather than providing a detailed methodology.

Business Continuity Planning - Defined

Business continuity planning can be defined as "planning to ensure the continued availability of essential services, programs and operations, including all the resources involved." Business continuity planning prepares an organization to respond to an interruption of essential business functions and provides the guidelines to fully recover operations, services and programs.

Why Have A Business Continuity Plan?

Every organization is at risk to some extent. A fire, tornado, earthquake or explosion could seriously damage your building. Floods originating inside or outside your building could affect your operations. A prolonged power outage, sabotaged computer system or damaged equipment can also shut your organization down. Your facilities, inventory and essential information could be inaccessible for a prolonged period. If any of these dramatic events occur, or any others of a less drastic nature, your organization may be unable to continue operating. If the interruption continues, the ability of your business to survive may be threatened. Before that happens, you should arm yourself with a business continuity plan.
How Can A Business Continuity Plan Help An Organization Stay In Business Following An Unplanned Interruption?

A good business continuity plan:

- Identifies the pre-set arrangements you need to have on "stand-by" in order to get vital functions operating again with as little delay as possible.
- Ensures the availability of necessary resources including personnel, information, equipment, financial arrangements, services and accommodations.
- Helps an operation survive the unplanned interruption by making sure essential clients’ needs are met until normal operations are resumed.

Steps Toward Producing A Good Business Continuity Plan

- Clearly define the essential aspects of the business you are in.
- Determine the essential activities that must continue in order for your organization to continue functioning. List them in order of urgency and importance.
- Conduct a business impact analysis to determine the impact on your organization of the loss of those essential functions in dollars and cents.
- Involve your operations managers and key employees in the development of the plan. It's their plan as well as yours. Implementation of the plan will be easier if they have helped develop the plan and feel responsible for its success.
- Develop a recovery strategy by determining what resources are needed, where they can be acquired, and the costs involved.
- Address the requirement for alternative resources (e.g. alternate accommodations, furniture, computers and other office equipment, phone service, essential records, and inventory items necessary to continue essential business functions.) Remember that alternate resources in the same geographical location may be knocked out by the same disaster affecting you.
- Write a business continuity plan that is simple, straightforward, and easy to understand. A business continuity plan is no good unless it is realistic, up-to-date, tested and is well known by those who must implement it, possibly in the midst of post-emergency chaos.
Some Prerequisites For Successful Business Continuity Planning

Senior management must be actively involved in the development of the business continuity plan. They must:

1. Agree to the need for such a plan.
2. Assign the necessary resources for plan development.
3. Concur in the selection of essential activities and priority for recovery.
4. Agree to back-up arrangements and the costs involved.
5. Be prepared to authorize activation of the plan, should the need arise.

A large organization should have a project coordinator to develop the plan. The plan should be developed with input from managers and employees at all levels. Someone must be assigned to keep the plan up-to-date and to implement it, if necessary.

Don’t be intimidated or overwhelmed by the prospect of developing a business continuity plan. Develop a planning schedule and work on the plan step-by-step and in stages, if necessary. Remember that preparing a business continuity plan is not a "one-shot" project or a one-time activity but rather an integral part of an effective business strategy. A completed plan needs to be reviewed, tested and updated regularly if it is to be effective when put into action.

A STEP-BY-STEP GUIDE TO PREPARING A BUSINESS CONTINUITY PLAN

1. List the major functions or activities of your business or organization.
2. Determine which activities are "time-critical" business functions.
3. Assign a priority to each of the time critical activities you have identified.
4. Develop a planning objective for each activity.
5. Determine the minimum needs for initial response.
6. Obtain senior management approval of the essential functions, priorities, and planning objectives that you have identified.
7. Delegate planning assignments to the staff who carry out the essential activities on a daily basis.
8. Write the detailed portions of the plan.
9. Consolidate all sections of the plan into a business continuity plan for your entire organization.
10. Communicate the plan to all employees.

11. Test the plan.

12. Update the plan regularly based on test results and organizational changes.

References

Additional Resources
2. Contingency Planning and Management magazine, www.cpm.com

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Disaster Recovery and Restoration

After a significant property event, whether a catastrophic fire, natural disaster, bomb threat, act of terrorism or other similar events, it is important for companies to undertake certain precautions to help re-establish the business environment in terms of restoration of operations, protecting employees and safeguarding property. Without intervention, the initial property event may severely impact the building structure, fire protection, machinery & equipment, operations or health and welfare of a company’s staff.

The following considerations are provided in the interest of helping companies reduce employee injuries or loss by fire, explosion and allied perils as they work to return their operations to normal. These considerations do not take into account compliance with any or all codes or standards. Companies should consult with federal, state and local authorities, including, but not limited to, local fire marshal, local building officials, and/or other government agencies, including area Environmental Protection (EPA) and Federal Emergency Management (FEMA) agencies.

GENERAL PRECAUTIONS

Before beginning any cleaning activity, a number of safety precautions should be considered. Safety precautions should include, but not be limited to:

- Careful review of safety precautions in the equipment “owner’s manual”.
- De-energizing of the equipment.
- Lock-out and tag-out of all energy sources.
- The proper use of appropriate personal protective equipment (such as goggles, dust masks, and/or respirators).
- Proper ventilation considerations.

RESTORING THE WORKING ENVIRONMENT

Fire Life Safety

A number of considerations are important to fire life safety when restoring a safe work environment, including exits, lights, alarms, fire escapes, trash and other debris. These items should be addressed before re-opening the building, as well as during restoration, to help provide safeguards to those involved in the restoration.
Fire exits and exitways should be inspected regularly to ensure that they are not blocked by debris or construction equipment or other materials. There should be at least two unobstructed ways out of each area of the building.

Emergency lights, exit signs, evacuation alarms should be inspected and tested to ensure operability, especially where they may have run on battery power for an extended period of time.

Outside fire escapes should be inspected to ensure structural integrity, removal of debris and adequate means of egress.

Outside debris and trash should be cleaned up and moved/removed to ensure it does not in any way block or impede exiting the building in an emergency.

**Indoor Air Quality and HVAC System Start Up**

A number of considerations are important to the operation of the Heating, Ventilation, and Air Conditioning (HVAC) system with respect to providing good indoor air quality to workers and other people who come into facilities. Before HVAC system startup (for companies who may have had downtime as the result of a property event), or before continuing to operate HVAC systems (for companies who did not have down time but who may be in the vicinity of affected properties), the following are a number of Indoor Air Quality/ HVAC system considerations. In some instances, testing may be required. [See also smoke and dust-covered cleaning considerations for HVAC systems provided under the “Cleaning Smoke & Dust Covered Energy Equipment” section of this article.]

Outside air intakes and their components should be clean, in good condition and unobstructed. There should be no debris or other sources of potential contamination, including standing water, within 20-30 feet of intakes. Intake structures should not be damaged or constricted. Intake grills/screens should be intact and clean. Exterior (roof top air handlers) and interior HVAC Units (air handlers inside mechanical rooms of larger buildings) and their components should be clean, unobstructed, intact, properly fitted and/or sealed and show no structural damage. There should be no debris, dust or other sources of potential contamination, including standing water, within 20-30 feet of units. Tests may need to be conducted to confirm proper functioning. The following components should be inspected for the above considerations before system startup:

- Intake grills/screens.
- Filters (pre-filters and primary filters).
- Unit interiors.
- Unit condensate drain openings.
- Air-handlers.
- Fans and fan blade surfaces.
- Ductwork, ductwork connections, and any insulation lining the ducts.
☐ Return Air System (plenums, ducts) and their components should be clean, intact, and unobstructed.
☐ Return air grills, return air ductwork, and/or ceiling plenum areas should be clean and free of debris and visible contamination.
☐ All sensors and control instrumentation should be checked and/or tested to make sure these also are in working order.
☐ The HVAC system and its components have been cleaned and verified that they are in proper order, indoor air quality parameters (temperature, relative humidity, and carbon monoxide [CO] should be monitored.

**RESTORING BUILDING & EQUIPMENT**

**Building / Structure**

If there are any questions regarding the integrity of the structure as a result of an incident in or near the building, the structure should be inspected by qualified personnel. Any hazardous areas should be prominently placarded and barricaded to prevent unauthorized entry.

Roofs and Roof Drains should be cleaned of any significant dust accumulation or debris that may lead to clogged roof drains and subsequent potential for roof collapse or water intrusion. Roofs should also be inspected for damage due to impact by debris to help prevent subsequent water intrusion or wind damage. Chimneys should be inspected for structural damage, cracks in the flue or obstruction from debris.

Power interruption, including potential for surges, should be addressed to avoid problems with computers, automatic controls on boilers, timers, etc. Trash should not be stored nor allowed to accumulate within the building or in the immediate vicinity, but should be removed from the premises as soon as practical. If the trash is collected but cannot be removed from the premises immediately, it should be temporarily moved to a location that would not impair fire department access.

**Fire Protection**

Fire protection equipment, including sprinkler control valves, fire pumps and similar fire fighting and fire protection equipment should be inspected to ensure that they are operational and in their normal position (control valves open, fire pumps energized, etc.). Fire alarm systems, particularly smoke detectors, should be inspected to ensure that they are clean, clear of dust/debris and in a normal or ready status. Dust may have triggered alarms that resulted in alarm panels being silenced or alarms disconnected. Fire detectors, smoke detectors and their photoelectric components or ionization chambers should be inspected and cleaned as necessary. Alarm panels should be temporarily
disarmed when cleaning to prevent false alarms, making sure to restore them promptly after testing. Particular care should be given to HVAC duct detectors and consideration to probable dusty conditions within the HVAC system.

Alarm panel connections to central stations, emergency dispatchers, etc. may have been compromised and should be tested. Alarm panel batteries should be tested to ensure operability, especially where they may have run on battery power for an extended period of time. Roof-top water storage tanks should be inspected for leaks, structural integrity, including potential for water contamination. Fire protection city water supply may be inadequate for sprinkler systems if fire water demand remains high, city water mains ruptured or water main control valves were closed resulting in reduced street pressure.

Impaired fire protection – If fixed fire protection or detection equipment cannot be restored promptly, arrangements should be made for security personnel/watchman service during idle periods.

Control of Ignition Sources

No Smoking should be allowed within the buildings or in the vicinity of combustible trash or debris accumulations outside the facility. This is particularly important if gas lines in / around the facility may have been compromised. Candles or other open flames should not be used for temporary lighting.

Welding, cutting or hotwork should be carefully controlled, including use of a fire watch equipped with portable fire extinguisher. Hotwork should not take place within 30’ of combustible materials and should not be conducted if sprinkler protection is out of service. Fire watch should remain no less than 30 minutes after completion of hotwork operations.

Fuel lines and fuel-fired equipment. If there are any questions regarding gas line integrity or fuel-fired equipment, the fuel lines and equipment should be shut down until inspected by qualified personnel. If a gas leak is suspected, electrical equipment, including telephones, should not be used. Intermittent fuel supply service and/or pressure fluctuations may cause heating equipment to unexpectedly shutdown.

Temporary electrical wiring and equipment for light, heat, or power purposes should be installed in accordance with the requirements of the NFPA #70 National Electrical Code.

Temporary engine-powered equipment such as generators should be located so that the exhausts are well away from combustible materials. Exhausts should be piped to outside the building, away from building air intakes, and with a clearance of at least 6” maintained around such piping and combustible material. Exhaust fumes should be
discharged into a well ventilated area. Re-fueling should be conducted safely using approved containers. Fuel storage should be safely stored, preferably in secured storage areas outside the building. Approved transfer switches should be installed or the building electrical system should be properly disconnected from the power grid by a licensed electrician to avoid potential problems when regular power is restored.

CLEANING SMOKE & DUST-COVERED ENERGY EQUIPMENT

To help maintain the safe operation and normal life use of energy equipment, proper care, maintenance, and safety precautions are critical. This criticality becomes especially key in catastrophic events, such as the collapse of building structures, including nearby buildings, that can cause immense amounts of air-borne dust and smoke. Smoke and dust-covered equipment, among other things, can overheat and result in equipment failure and damage.

Heating, Ventilation, and Air Conditioning Equipment

Evaporative cooling towers should be cleaned with water spray of the air passages and fan blades and then draining the sump and flushing with clean water. Clean outdoor air-cooled condensers with water spray but make sure any motors with frame openings are protected from the spray. Direct evaporators, chilled water and steam heat exchangers, and fan blades should first be cleaned by vacuum methods. The residual dirt in crevices can be blown out with compressed air limited to 30 psig or less, but any motors with frame openings and any exposed electrical devices must be protected by temporary coverings. Air ducts should be vacuum cleaned. After cleaning, new air filters should be installed before restarting fans. For greased bearings, especially those that have operated in dusty or smoky conditions, fresh grease should be applied, enough to flush out the contaminated grease. Solvent cleaning can be used to clean smoke residue from HVAC equipment if caution is taken to avoid contact with electrical insulation and ductwork. Only petroleum distillates should be used as solvents, and solvents should be used only when necessary. Standard solvents should never be used on silicone treated windings. Solvents, petroleum distillates or other flammable or combustible solvents should never be used to clean ducts.

Note: Cleaning with solvents can be hazardous from a fire and health standpoint and should only be performed by qualified personnel and/or companies.

Electrical Equipment

Electrical maintenance and cleaning can be hazardous and should only be performed by an electrical contractor, a licensed electrician, or a qualified staff electrician with access to the manufacturer's maintenance and operation documents. Computers, electronic data processing equipment and peripheral components should
be cleaned prior to turning this equipment on. Only qualified personnel should be used to inspect, clean and test this equipment, especially where the importance or criticality is high or visible accumulations of dust are noted. It is critical that equipment be verified as functioning properly before the system is used with back-up data, or before creating new back-ups.

Switchgear, including switchboards, panelboards, motor starters, and electronic controllers should be de-energized, locked-out and cleaned using vacuum methods. After vacuuming the residual dirt in crevices, electrical equipment can be blown out with compressed air at 30 psig or less, but the air used must be dry. Metal and plastic surfaces with smoke residue may be cleaned by hand wiping with water and detergent mixtures if care is taken to avoid getting moisture on electrical insulation and conductor joints. Use only lint free wiping cloths. Lint on components can attract moisture and dirt. Change out the air filters on the metal enclosures and blow off the cooling fan blades.

Motors: Totally enclosed motors should be cleaned by blowing off with dry compressed air at no more than 30 psig. Open frame, drip proof and splash proof motors should be cleaned by vacuuming only. Do not use compressed air on these devices as it can drive the material farther into the windings and blown abrasive material can damage the insulation. Fresh grease should be applied to all electric motor bearings.

Transformers: Cast coil dry transformers should be cleaned by blowing off with dry compressed air at no more than 30 psig. Open-coil dry transformers should be cleaned by vacuuming only. As with motors, do not use compressed air on these devices as it can drive the material farther into the windings and blown abrasive material can damage the insulation. Internal components of oil filled transformers should not be affected by soot or dust. However, the transformer bushings should be cleaned in an appropriate manner by specialists and external components such as cooling fans should be cleaned as outlined above.

Electromechanical relays require specialized expertise to clean and inspect. A qualified contractor with proper test and calibration equipment should be used to clean, inspect, and calibrate the instrumentation. It takes only a small amount of dust or dirt to disturb delicate mechanisms used in these relays. Before re-energizing, use a megohmmeter operating at 500 or 1000 VDC to determine condition of electrical insulation after apparatus has been cleaned.

A thermographic survey is advisable once the equipment has been cleaned and returned to normal duty. This will help identify any localized overheating in conductors and terminal connections.
Internal Combustion Engine Generators

Clean the generator air passages and cooling ducts with vacuum methods. Clean out control panels with vacuum methods and change out enclosure cooling air filters. Clean out the engine air intakes using vacuum methods and change air filters before running engine. Change out the crankcase breather filters. Blowout the air passages in the engine radiators with compressed air. Check and remove any obstructions in the exhaust passages.

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Emergency Contact List

Local Police Department: ______________________________________

Local Fire Department: _________________________________________

Ambulance Service: __________________________________________

Hospital: ___________________________________________________

Insurance Company: __________________________________________

Agent: ______________________________________________________

Policy Number: ______________________________________________

Telephone Company: _________________________________________

Gas/Heat Company: __________________________________________

Electric Company: ____________________________________________

Building Manager: ____________________________________________

Building Security: ____________________________________________

Local Newspaper: ____________________________________________

Local Radio Stations: _________________________________________

Local Television Stations: ____________________________________

Attach A List Of Employee Emergency Contact Numbers To This List
Employee Preparedness
Disaster Preparedness Checklist

' Pick Two Places For Your Family To Meet In The Event Of An Emergency Or Disaster: 1. Right Outside Your Home In Case Of A Sudden Emergency, 2. Outside Your Neighborhood In The Event That You Can’t Return Home.

' Designate A “Long Distance” Family Contact That Family Members Can Use To Relay Messages.

' Assemble A Disaster Supply Kit That Is Portable So It Can Be Used In Your Home Or Taken With You. Include Medications, Etc., Important Papers And Any Special Things You May Need.

' Assemble A Disaster Supply Kit For Your Pets And Create An Evacuation Plan For Them.

' Install Smoke Alarms Near Every Bedroom In Your Home, Check Their Batteries Regularly, And Have Your Family Practice An Evacuation Plan.

' Keep Your Gas Tank At Least Half Full At All Times.

What To Put In Your Disaster Supply Kit

Store your kit in an easy to carry container such as a plastic bin with handles, a camping backpack or a duffle bag, in case you need to evacuate. Store enough supplies to last for three days.

♦ Water: Store one gallon per person in your household, per day.

♦ Food: store non-perishable, ready-to-eat foods that require no refrigeration or cooking, and little or no water. Include canned foods and fruit juices, high energy foods, and comfort/stress foods.

♦ Non-electric can opener.

♦ Battery operated lanterns and flashlights.

♦ Portable, battery operated radio or television.

♦ Extra clothes including sturdy shoes, rain gear, hats and gloves.

♦ Blankets or sleeping bags.

♦ First aid kit including daily medications.

♦ Personal hygiene items.

♦ Sanitation items such as soap, detergent, disinfectant, bleach, paper towels, garbage bags.

♦ Personal identification, copies of important documents such as birth certificates and social security cards, and cash, in small bills and change.
What Do I Do In ....

A Tornado:
If you are in a building, go to the lowest level. Once at the lowest level, go to the middle of the building away from windows, into a bathroom or closet if possible. Get under something sturdy and hold on with one hand. With the other hand and arm, protect your head and neck from falling or flying objects.

If you are in a car or mobile home go immediately to the lowest level or a nearby sturdy building.

If you are outside with no shelter nearby, lie flat in a low spot so that the wind and debris can blow over you. Protect your head with your hands and arms.

A Flood Or A Hurricane:
If you come upon flood waters, stop, turn around, go another way, and climb to higher ground. Stay away from flooded areas - water may still rise.

Never try to walk, swim, drive, or play in flood water. You cannot see on the surface how fast water is moving, or holes and submerged debris. Water only 6 inches deep can knock a person off his or her feet. Vehicles can be swept away by only 2 feet of water.

Watch out for snakes - floodwaters flush them from their homes.

Stay away from creek and stream banks in flooded areas. Soaked banks often become unstable due to heavy rainfall.

A Winter Storm:
Before: Make sure your automobile’s gas tank is full in case of an emergency and to prevent fuel line freeze. Move animals to a sheltered area and have a water supply available. Wrap pipes in insulation or newspapers to keep them from freezing. Store sufficient heating fuel.

During: Stay indoors and dress warmly. Eat regularly and drink plenty of fluids. Conserve fuel. Wear layered clothing, gloves, and a hat if you must go outside.

After: Avoid overexertion such as shoveling or walking in heavy snow. Walk carefully on snowy, icy sidewalks. Use public transportation if possible. About 70% of deaths related to ice and snow occur in automobiles.

Thunderstorms:
If you are outside during a thunderstorm, go to a low, open space, crouch on the balls of your feet, place your hands on your knees and lower your head. Minimize your contact with the ground.

Lightning strikes outside of heavy rain and may occur as far as 10 miles away from any rainfall. You are in danger from lightning if you can hear thunder. Severe thunderstorms can produce winds 100 to 150 miles per hour.
**What You Should Know About Terrorism**

Terrorists look for visible targets where they can avoid detection before or after an attack. Be alert and aware of the surrounding area. The very nature of terrorism suggests that there may be little or no warning. Learn where emergency exits are located. Think ahead about how to evacuate a building, subway or congested public area in a hurry. Learn where staircases are located.

**Building Explosions:**
The use of explosives by terrorists can result in collapsed buildings and fires. People who live or work in a multi-level building can do the following: Review emergency evacuation procedures. Know where fire exits are located. Keep fire extinguishers in working order. Know where they are located, and how to use them. In a building explosion, get out of the building as quickly and calmly as possible. If items are falling off of bookshelves or from the ceiling, get under a sturdy table or desk. If there is a fire: Stay low to the floor and exit the building as quickly as possible. Cover nose and mouth with a wet cloth. When approaching a closed door, use the palm of your hand and forearm to feel the lower, middle and upper parts of the door. If it is not hot, brace yourself against the door and open it slowly. If it is hot to the touch, do not open the door—seek an alternate escape route. Heavy smoke and poisonous gases collect first along the ceiling. Stay below the smoke at all times.

**If You Are Trapped In Debris:**
Use a flashlight. Stay in your area so that you don't kick up dust. Cover your mouth with a handkerchief or clothing. Tap on a pipe or wall so that rescuers can hear where you are. Use a whistle if one is available. Shout only as a last resort—shouting can cause a person to inhale dangerous amounts of dust. Untrained persons should not attempt to rescue people who are inside a collapsed building. Wait for emergency personnel to arrive.

**Chemical Agents:**
Chemical agents are poisonous gases, liquids or solids that have toxic effects on people, animals or plants. Most chemical agents cause serious injuries or death. Severity of injuries depends on the type and amount of the chemical agent used, and the duration of exposure. Were a chemical agent attack to occur, authorities would instruct citizens to either seek shelter where they are and seal the premises or evacuate immediately. Leaving the shelter to rescue or assist victims can be a deadly decision. There is no assistance that the untrained can offer that would likely be of any value to the victims of chemical agents.

**Biological Agents:**
Biological agents are organisms or toxins that have illness-producing effects on people, livestock and crops. Because biological agents cannot necessarily be detected and may take time to grow and cause a disease, it is almost impossible to know that a biological attack has occurred. If government officials become aware of a biological attack through an informant or warning by terrorists, they would most likely instruct citizens to either seek shelter where they are and seal the premises or evacuate immediately. A person affected by a biological agent requires the immediate attention of professional medical personnel.

- Information From The Federal Emergency Management Agency’s Website—www.fema.gov

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**Pets and Disasters**

People who have pets need to do some special planning before a disaster. Here are some tips:
- Always keep a collar and tag on animals that should normally wear them.
- Identify several possible locations you can take your animals should you have to evacuate.
- Have a week’s supply of emergency food and water on hand for your pets.
- Have several pictures of your animals available for identification purposes.
- If your animal takes medication, keep an emergency supply on hand.
- Have a cat carrier ready to evacuate each cat in your household.
- Have a harness and a leash for each dog in your household.
What Are Mitigation and Floodproofing?

**Mitigation** is any sustained action that reduces or eliminates long-term risk to people and property from natural and man-made hazards and their effects. If your business is in an area vulnerable to flooding, the type of mitigation you want to consider is floodproofing. **Floodproofing** is a combination of adjustments and/or additions of features to individual buildings that are designed to eliminate or reduce the potential for flood damage.

There are three types of floodproofing: **permanent measures, contingent measures, and emergency measures**. **Permanent Measures** are always in place, and require no action if flooding occurs. **Contingent Measures** require installation prior to the occurrence of a flood. **Emergency Measures** are improvised at the site when flooding occurs.

**Permanent and Contingent Floodproofing Measures**

Once installed Permanent Floodproofing Measures require no other action when flooding occurs. They are most effective when used in areas that are subject to repetitive flooding, high floodwater depths, or in areas where flooding occurs without much warning or preparation time. Permanent measures can be the preferred floodproofing method over contingency or emergency measures because they do not rely on adequate warning time or experienced installation staff to be effective. Permanent measures also may be less costly over time than the other two types of methods because there is no need to train manpower or maintain and store parts. On the other hand, when considering permanent measures, be aware that initial costs may be higher than the other two measures and they may restrict certain parts of your business structure.

**A. Elevation on Fill, Posts, Piles, Piers, or Walls**

Elevating the structure(s) that house your business out of the floodplain may be one way you can minimize damage from flooding. The cost of elevation will depend on the size of the structure and how high it would need to be elevated to put it out of the floodplain. For elevation to be an effective mitigation option, most structures are typically elevated one foot above the base flood elevation. The **base flood elevation** is the elevation for which there is a one percent chance in any given year that flood levels will equal or exceed it. Your local community development office or building official should be able to tell you the base flood elevation of your site.

There are several ways to elevate a structure. The construction method and
design of your structure will most likely be the determining factor on how you will be able to elevate it.

1. Elevation on Fill

Structures may be placed on elevated fill to protect them from flood damage. You must be careful about putting fill in the floodplain because it can increase the height and spread of floodwaters. If it can be shown that the addition of fill will not cause additional flooding problems, it can be an effective elevation method.

Standard construction materials and procedures can be used to elevate on fill. Soil saturation does have to be considered though, especially in areas with permeable soil or where extended periods of flooding are experienced. In cases where flooding for extended periods occurs, the structure needs to be designed to withstand all hydrostatic pressures.

FEMA Illustration #1
Elevated Structure

2. Elevation on Posts, Piles, Piers, or Walls

Buildings can also be elevated out of the floodplain using support systems made of wood, steel, masonry, or concrete. The most important characteristic of the support system is that it is designed to reduce effects from floodwaters without compromising the stability of the structure. Floodwater forces can include moving water and the impact and accumulation of debris. Adding a bracing system to the elevated foundation above expected flood levels can help provide needed support.

Posts: Lighter structures may be elevated on posts made of wood, concrete, or steel. Posts are fit into pre-dug holes. The holes are then back-filled with loose material such as soil, or gravel. To add necessary stability and bearing capacity, use concrete as partial or total backfill. With poor soil conditions, posts can be attached to a concrete pier that is above ground. The number of
posts you will need is determined by the size of the posts and the amount of load the posts will need to carry.

**Piles:** Piles are slender shafts driven to a predetermined depth or to a stable, load-bearing layer of bedrock. Posts are into pre-dug holes while piles are driven into the ground. Pile elevation can create a greater degree of strength and stability and the ability to withstand scour than posts. **Scour** is the process by which floodwaters remove soil around objects that obstruct flow. Timber piles such as southern yellow pine, douglas fir, and birch can be used. Piles can also be used to provide a foundation for posts and piers.

**Piers and Walls:** Structures may also be elevated on a system of piers and/or walls. Piers, which are heavy columns and walls, can be constructed out of brick, masonry block, or concrete. Brick and masonry block need to be anchored, filled with concrete and reinforced to withstand anticipated loads. Cast in-place concrete can be either reinforced or non-reinforced.

Elevated foundation walls can consist of either cast in-place concrete or reinforced masonry. Walls should be placed parallel to the direction of flood flow. Walls should also be placed to allow for flow to prevent trapping of flood debris. Walls may be attached to posts or piles to increase their stability.

Maintenance will be needed for structures elevated on posts, piles, piers, or walls. Steel columns for piers will need to be painted every 3-5 years. Timber piers will need to be treated for insects and deterioration every 3-5 years. Scoured areas around piers need to be repaired after any flooding. Maintenance of concrete piers may not be necessary.

**B. Waterproof Construction: Closures, Flood Shields, Sealants, and Membranes**

Waterproof Construction is floodproofing of a structure to prevent floodwaters from reaching the structure’s interior.

1. **Wall Construction**

Three basic types of walls can be used in waterproof construction. They are brick veneer, unreinforced masonry and concrete, and reinforced masonry and concrete.

**Brick Veneer** can be used to protect against very low flooding depths. Brick veneer leaks excessively so a waterproofing barrier needs to be installed.
between two layers of brick.

**Unreinforced Masonry and Concrete** can also be used in waterproof construction. These types of walls generally range in thickness from eight to twelve inches and are usually no more than 24 feet high. Regardless of their height or thickness, unreinforced masonry and concrete walls can only protect against non-moving floodwaters six feet or lower in depth. Floodwater velocity and debris also have to be taken into account and may reduce the amount of protection to an even lower amount.

**Reinforced Masonry and Concrete** walls can be built in a wide variety of configurations to withstand the pressure of floodwaters. This type of masonry and concrete wall contains inserted reinforcing bars that add to their strength. Reinforcing a masonry wall is always the better alternative than a plain masonry wall.

2. **Floor Construction**

Cast-in-place concrete is the only construction material that has the design capability to resist full hydrostatic uplift pressure. Both Unreinforced and Reinforced concrete floors can resist uplift pressures. An Unreinforced slab floor if it is thick enough may have sufficient strength and dead load to resist up-lift pressures. Using Reinforced concrete slab is the most desirable method because it is tied to the structure’s walls, columns, and footings allowing for the total weight of the structure to be used to counteract uplift pressures. This construction method where a reinforced concrete slab is tied into the other elements of the structure is known as a mat or raft foundation.

3. **Counteraction of Hydrostatic Forces**

Reducing hydrostatic force is an important aspect of floodproofing. Hydrostatic force is force exerted by water at rest and causes lateral pressure on walls and uplift (buoyancy) on floors. Using techniques such as impervious blankets and cutoffs, subsurface drainage systems, and/or anchorage may counteract hydrostatic forces.

**Impervious Cutoffs:** Cutoffs are constructed of materials such as steel sheet piling, cement grout curtains, or impervious compacted soil to reduce the amount of seepage under a floodproofed structure. They may be placed either away from the structure footings or directly beneath the foundation footing. If floodwaters are expected to rise above the ground level, the cutoff must either be designed as an integral part of the structure or tied to the structure with
impervious blankets or membranes. Cutoffs, blankets, and membranes must be installed carefully in order to be effective. A minor defection of the system can eliminate any reduction of hydrostatic force at all.

Subsurface Drainage:
Drainage systems can be used to significantly reduce uplift pressure on floor slabs. Drainage systems may be ineffective when infinite sources of water exist. The most effective drainage system is a blanket drain that extends under the total structure foundation. Perforated drainpipes leading to a sump pump above flood level may be part of the drain system. Drain cleaning provisions should be included in the system’s design.

Pressure Relief: Installation of sump pumps or construction of valves in the floor slab may also help to relieve uplift pressures. Sump pumps pump water out of the foundation area, while pressure relief valves allow water to flow in to the structure at a lower level of pressure.

Anchorage: Stabilizing a structure against the force of floodwaters by tying structural elements together is known as anchorage. Anchoring foundation walls to footings with hooked rods or using anchor bolts to anchor sill plates to foundation walls can increase the structure’s resilience to floodwaters.
4. Waterproofing

Because concrete and masonry is somewhat permeable, waterproofing can only be accomplished by using high quality concrete, sealant materials and/or impermeable membranes.

In existing structures, the use of sealants must be accompanied by alternative drainage systems or they will only increase hydrostatic pressure and force.

**High Quality Concrete:** By using a richer cement mix that contains a well-graded fine aggregate, concrete can be made impervious. Fine aggregates that can be used include hydrated lime, chloride of lime, oil emulsions, lime soaps, or finely ground clay or sand.

**Sealants:** By adding sealants to the exterior or interior surfaces, masonry and concrete structures may be waterproofed. Sealants may also be used to waterproof by using them between structural elements (for example, between a masonry wall and a layer of brick veneer).

**Membranes:** Another method of waterproofing involves surrounding the floodprone surfaces of a structure with an impermeable membrane. To create a membrane, materials such as canvas, felt, or PVC sheets are given a bituminous coating of coal tar, pitch, or asphalt. Membranes work well with all types of masonry and concrete construction. In order to work properly, the membrane must be continuous and a layer of brick, concrete, or sand should be added to protect it from damage.
5. **Watertight Cores**

For either physical or economic reasons, it may not be feasible to waterproof the exterior of a structure. It may be possible for you to create a watertight core around an interior area that may house costly items such as equipment or utilities. Watertight cores use similar construction methods as exterior waterproof construction. Watertight cores must be capable of withstanding uplift and lateral floodwater forces. They must also contain walls that exceed the height of expected flood levels in order to be effective. Access openings and steps or ramps need to be provided for use in non-flood conditions so flood shields for these openings will need to be created.

6. **Closures and Flood Shields**

If a building is constructed or modified using waterproofing techniques, permanent or temporary closure systems may need to be used. If an opening is unused, it may be permanently sealed using concrete, masonry blocks, or metal assemblies that are reinforced and anchored to the framing, floor, or walls. Flood shields are used to protect openings that are in use. The design of the flood shield must take into consideration hydrostatic forces. Steel and aluminum are most commonly used in flood shield construction. Shields should be attached to the wet
side of the opening so that the pressure of the water helps seal the shield. Shields may be attached to their frames with a variety of latching devices. When deciding on a latching system, consider those that are simplest, most effective, and require the least amount of skill to activate. New flood shields should be tested before they are installed to ensure their effectiveness. When storing shields, try to store them as close to the opening where they will be used. Tools or equipment needed to attach the shields should be convenient to either the storage or installation site as well.

C. Floodwalls and Levees

**Floodwall** - Flood barrier constructed of manmade materials, such as concrete or masonry.

**Levee** - Flood barrier constructed of compacted soil.

Floodwalls and levees can be used to protect individual structures as well as adjacent land. They may be used to protect one or all sides of a structure. Floodwalls and levees can protect structures effectively from flooding depths of seven feet or lower. For flooding depths above seven feet, construction and design costs may make a floodwall or levee cost prohibitive. Each floodwall or levee will need to be designed around requirements that will be specific to that site and use. The following information describes the factors involved in determining the feasibility of using a floodwall or levee.

**Site survey**: Information on depth of flooding will be needed to determine how high the floodwall or levee will need to be. Topographic maps are also a helpful tool to help not only to decide the location of the floodwall/levee but also highlight potential problems such as surface drainage and foundation soils which will be below the foundation wall or levee.

**Interior drainage**: Floodwalls/Levees must be designed so that there is minimal seepage on the “dry side” of the floodwall or levee. Seepage is the passage of water through a porous medium, such as the passage of water through an earth embankment or masonry wall. There must be a system for draining surface storm water away.

**Seepage**: If the soils under the floodwall or levee are impervious, floodwater will not seep through. If the floodwall/levee is made up of pervious materials, it can cause underseepage and a build-up of hydrostatic pressure at the base of a floodwall or toe of a levee, which can cause the adjacent soil to rupture. There are several techniques you can use to prevent this including landside berms, impervious cut-offs, pervious trenches, or pressure relief wells.
1. **Floodwall Design**

Floodwalls can be constructed of a variety of materials and with several configurations. The two elements that must be addressed by any floodwall are the stability of the wall to handle both external and internal stress loads. Three concerns that can cause the failure of any wall are overturning, sliding, and soil failure. Three styles of wall that deal with these concerns are gravity walls, cantilever walls, and moveable walls. Gravity walls are designed to use the dead weight of the concrete for stability. Cantilever walls use not only the dead weight of the concrete but the weight of the soil and floodwaters as well. Moveable walls are supported at both the top and the bottom and may be constructed of lighter materials.

![FEMA Illustration #7 Floodwall Concerns](image)

2. **Levee Design**

A levee forms a stable barrier to floodwaters by placing suitable fill material, compacted into layers. Besides the components of seepage and drainage control mentioned previously, slope stability, borrow area design, and erosion protection are also important components. Slope stability is the resistance of a given embankment to soil slippage. The borrow area is land used to displace the water prevented from movement on to land behind the levee. Erosion protection prevents scouring on the riverside of the levee through the addition of grass cover, gravel, asphalt paving, concrete mats, or riprap.

3. **Maintenance**

The structural integrity of floodwalls and levees should be inspected annually. Inspections for erosion and scour damage should be conducted after a flood event.

D. **Floodproofing Utilities**

Buildings are not the only part of the business site that should be protected from floodwaters. Floodproofing of utilities also needs to be considered as well. The following methods can be used to floodproof utilities:
• Elevate incoming power lines, transformers, and panels one foot above the design flood elevation.
• Fuel tanks should also be elevated one foot above the design flood elevation, and anchored to prevent flotation.
• Fuel lines should be equipped with automatic shut-off valves in case lines are broken.
• Exhaust fans and louver outlets not elevated should be protected by floodshields or enclosures.
• Backflow prevention valves should be placed on sewer lines to prevent back-up of lines.
• On-site wells should be equipped with watertight casting.
• Backflow prevention valves should be placed on primary waterlines.
• Heating or air conditioning units should be elevated above expected flood levels, if this cannot be done, a watertight closure system should be provided.
• All openings, pipes, conduits, vents, or other fixtures below the design flood elevation should be sealed during the flood event to prevent leakage.

Emergency Floodproofing Measures

Emergency floodproofing techniques can be implemented in a short time. The important thing to remember when using emergency methods is that while they may be put into place fairly quickly, advance planning must take place. Planning should consider questions such as labor, storage of materials, maintenance, and training. The advantage of emergency measures includes low implementation costs and the use of easily available natural materials, such as sand and timber. Emergency measures work best in areas with low water velocity, with shallow flooding depths, and slow rising floodwaters. The disadvantages of emergency measures include the necessity for advanced warning, the ability to gather an extensive labor force on short notice, the possibility of failure if floodwaters rise beyond expected levels, and long term storage of construction materials.

Three types of emergency floodproofing measures, sandbag dikes, earthfill crib
retaining walls, and stop log barriers, are described on the following page:

A. Sandbag Dikes

Sandbags are one of the most common emergency floodproofing measures used. Soil can be used in place of sand when sand is not readily available. Sandbags will conform to the irregularities of the area where they are placed. Bags need to be strong enough to hold approximately 1/3 cubic yard of material and withstand prolonged contact with water. Bags specifically designed for floodproofing can be made of either plastic or burlap. Because of their strength and resistance to wear, webbed polypropylene bags are a preference for some. Bags and sand must be stored close to the site they are to protect so they are not isolated by floodwaters. In order to utilize sandbags, a large workforce should be able to be assembled with short notice during a flood event. A trench of at least one bag deep and two bags wide should be dug to prevent water seepage under the sandbag dike. Bags should only be filled half full so that they will lie flatter. The trench layer and first layer of bags should be placed parallel to the water channel. The second layer of bags is placed perpendicular to the first layer. The third layer of bags is placed parallel to the first layer and so forth. For stability, the dike should be about two or three times as wide at the base as it is high. Polyethylene plastic sheeting may be added to provide greater seepage protection.

B. Earthfill Crib Retaining Wall

The use of retaining walls and earthfill cribs may also provide protection. Setting two lines of posts parallel to the water channel, nailing boards to the inside of each row, and using a plank or wire to brace the posts is how to construct a crib. Then the crib is filled with soil. Plastic sheeting can also be added for increased protection. Emergency retaining wall structures do not usually create a barrier that is watertight. Pumps should be available to remove leakage and stormwater behind the wall. Remember electrical service may be interrupted during the flood events, so electrical pumps should not be used.

C. Stop Log Barriers

To construct a stop log barrier, small beams or planks are stacked on top of each other to create a temporary wall that prevents the passage of water through it. To create the walls, the planks may be dropped either into concrete walls containing slots or freestanding metal channels. Stop logs are usually made from treated lumber that is at least two inches thick. Tongue and groove lumber may be used to provide a
better fit between planks. Polyethylene sheeting will add strength to the wall. A double layer of sandbags placed at the bottom of the wall will help reduce seepage. This type of barrier does not generally leave a watertight seal, so a pump should be on hand to pump out any leakage.

FEMA Illustration #9
Stop Log Barrier

The information contained in “Floodproofing Methods” section of this guide is intended for informational purposes only. Please contact a professional before attempting any type of floodproofing. Shenandoah Valley Project Impact makes no warranty, express or implied, and assumes no responsibility for the accuracy or completeness of the information herein.

The Source for the information is the “Floodproofing Methods” section is from the Federal Emergency Management Agency’s publication, Floodproofing For Non-Residential Structures. Illustrations are taken directly from the same publication and are cited below:

- FEMA Illustration #1: Page 8, Figure I-9
- FEMA Illustration #2: Page 53, Figure III-18
- FEMA Illustration #3: Page 54, Figure III-19
- FEMA Illustration #4: Page 59, Figure III-24
- FEMA Illustration #5: Page 3, Figure I-2
- FEMA Illustration #6: Page 10, Figure I-10
- FEMA Illustration #7: Page 81, Figure III-48
- FEMA Illustration #8: Page 102, Figure IV-9
- FEMA Illustration #9: Page 99, Figure IV-5
Glossary

**Backflow Preventer (Check Valve)** - A device that allows liquids to flow in only one direction in a pipe. Backflow Preventers are used on sewer pipes to prevent a reverse flow during flooding situations.

**Base Flood Elevation (BFE)** - The elevation for which there is a one-percent chance in any given year that flood levels will equal or exceed it.

**Flash Flood** - A flood that reaches its peak flow in a short length of time (hours or minutes) after the storm or other event causing it. Often characterized by high velocity flows.

**Flood or Flooding** - Temporary inundation of normally dry land areas from the overflow of inland or tidal waters, or from the unusual and rapid accumulation or runoff of surface waters from any source.

**Flood Crest** - The maximum stage or elevation reached or expected to be reached by the waters of a specific flood at a given location.

**Floodplain** - Any normally dry land area that is susceptible to being inundated by water from any natural source. This area is usually low land adjacent to a river, stream, watercourse, ocean or lake.

**Hydrodynamic Loads** - Forces imposed on structures by floodwaters due to the impact of moving water on the upstream side of the structure, drag along its sides, and eddies or negative pressures on its downstream side.

**Hydrostatic Loads** - Those loads or pressures resulting from the static mass of water at any point of floodwater contact with a structure. They are equal in all directions and always act perpendicular to the surface which they are applied.

**One-Hundred Year Flood** - A flood having a one-percent chance of being equaled or exceeded in any given year.

**Permeability** - The property of soil or rock that allows passage of water through it.

**Runoff** - That portion of precipitation which is not intercepted by vegetation, absorbed by the land surface, or evaporated.

**Seepage** - The passage of water or other fluid through a porous medium.

**Subsidence** - Sinking of the land surface, usually due to withdrawals of underground water, oil, or minerals.
Resources
Books and Brochures

The following materials can be obtained from the Federal Emergency Agency (FEMA)’s Publication Center by calling 1-800-480-2520. For additional information about obtaining publications, check FEMA's website at www.fema.gov:

♦ Disaster Mitigation Guide For Business and Industry (FEMA 190)
♦ Emergency Management Guide For Business and Industry (FEMA 141)
♦ Emergency Preparedness Checklist (FEMA L154)
♦ Floodproofing Non-residential Structures (FEMA 102)
♦ Protecting Building Utilities From Flood Damage (FEMA 348)
♦ Reduce Your Risk For Natural Disaster (FEMA L231)
♦ Your Family Disaster Plan (FEMA L191)
♦ Your Family Disaster Supplies Kit (FEMA L189)

Websites

♦ American Red Cross: www.redcross.org
♦ Association Of Contingency Planners International: www.acp-international.com
♦ Business Continuity Institute: www.thebci.org
♦ Contingency Planning And Disaster Recovery: www.contingencyplanning.com
♦ Disaster Survival Planning Network: www.disaster-survival.com
♦ Institute For Business And Home Safety: www.ibhs.org