

### 3.3.3 Environmental Control Facts

This lesson covers the following topics:

- Environmental considerations
- Environmental monitoring

#### Environmental Considerations

Computer systems are sensitive to environmental conditions. Environmental controls to protect computer systems include:

- Cool temperatures to protect hardware from being damaged by overheating.
- Humidity control to keep humidity above 50% to avoid electric shock.
- Moisture detectors to identify the presence of water and provide early alerts to prevent water/flood damage from water pipes and sprinklers.
- Fire suppression controls to prevent damage from heat and smoke.

Infrastructure refers to the systems that support the site. Infrastructure components include electrical power, heating, ventilation, and air conditioning systems (HVAC), gas, and water.

#### Environmental Monitoring

Environmental conditions have a substantial impact on the reliability and life span of IT equipment. Environmental monitoring should be implemented in server rooms and data centers to ensure the proper function of environmental controls. The goal of environmental monitoring is to maintain environmental conditions and keep them as stable as possible.

The following table addresses various environmental concerns along with a description and possible management solutions.

Environmental Concern	Description
Electro-magnetic interference (EMI)	<p>Electro-magnetic interference is caused by noise between the hot wire and the ground or neutral wires in a circuit. This burst of energy is known as an electromagnetic pulse (EMP.) It can disrupt the signal in a data cable. Common causes of EMI are:</p> <ul style="list-style-type: none"><li>■ Motors</li><li>■ Heavy machinery</li><li>■ Lights</li><li>■ Electrical systems (for example, a computer system)</li></ul> <p>EMI shielding is the process of protecting computer components from interference to prevent transmission problems and security concerns, such as eavesdropping. A Faraday cage or a Faraday bag can be used to protect a device from EMP. The Faraday cage or bag is made of special metallic materials that can shield devices such as cell phones, tablets, computers, and servers.</p>
Temperature	<p>Heat reduces the life span and reliability of computer equipment.Keep in mind the following about temperature:</p>

- Fans and cooling systems on users' desktop, laptop, and notebook computers are usually adequate to keep those types of equipment sufficiently cool.
- Server rooms require special cooling systems due to the high concentration of equipment.
- The optimum temperature for computer equipment is 68 degrees Fahrenheit (20 Celsius).
- There is a variety of environment sensors and software available to monitor the temperature in server rooms and data centers.
- Environmental sensors and software can also help you identify hot spots.
- Temperature sensors are generally located one-half to two feet above the floor and five to six feet above the floor throughout the room. A variation of more than 12 degrees between low-mounted and high-mounted sensors indicates a problem.

A well-maintained HVAC system is important for employee comfort and the protection of equipment.

- HVAC controls the temperature and humidity of a building.
- HVAC keeps temperatures cool for computer systems.
- Computer systems and server rooms should be centrally located and have separate ducting for better controls.
- Computer rooms/server rooms require full-time environmental controls.

Recommendations for HVAC systems include:

- Use positive pressure systems. Positive pressure systems protect the air quality in the facility by causing air to be forced out through doors, windows, and other openings. Negative pressure systems draw air in, potentially bringing in airborne particles such as dust, smoke from a fire, or contamination from a chemical leak. Positive pressure systems are more energy effective.
- Protect filtered air intakes. The air intakes are the source of air for the positive pressure system. Air intakes can be a target of sabotage or contaminated by toxic chemicals if an incident occurs in the surrounding area.
- For electronic components, keep the temperature between 70 and 74 degrees and humidity between 40% and 65%.
- Ensure that appropriate personnel has access to shut-off valves for the HVAC system in the event of an emergency.

Use hot and cold aisles to ensure proper cooling. A cold aisle is created by having the front of the equipment face toward the center of the aisle. Hot aisles have the back of the equipment face the aisle. Air from the cooling system is forced into the cool aisles from underneath and exhausted through the hot aisles overhead. Typically, cold aisles face air conditioner output ducts and hot aisles face air conditioner return ducts. Best practices for hot aisle/cold aisle containment include:

- Install internal fans to bring air into, or exhaust air out of, individual units to act with the overall pattern of airflow in the center.
- Locate devices with side or top exhausts in their own part of the datacenter.
- Raise the floor 1.5 feet so that air being pushed by air conditioning equipment can pass through.
- Install automatic doors in the data center.

#### Humidity

Humidity is an important consideration for server rooms.

- Humidity should be kept within a range of 40 to 65 percent. Too much humidity results in condensation. Too little humidity results in electrostatic discharge (ESD). Depending on the naturally occurring humidity level of your area and the season, you may have to add or decrease humidity.

	<ul style="list-style-type: none"> <li>▪ Avoid large, rapid changes in humidity. Keeping a narrow range of temperature in the computer room will help to avoid condensation.</li> </ul>
Airflow	<p>Airflow is an important factor in controlling temperature. Be aware that:</p> <ul style="list-style-type: none"> <li>▪ Fans are a critical component in preventing hot spots in a computer room. There are two types of fans, fans inside the computer equipment and room fans, which circulate air in the room.</li> <li>▪ The air exchange rate for a computer room is much higher than for an office area. An office area needs approximately two air changes per hour. A server room needs between 20 and 30 air changes per hour.</li> </ul>
Power Conditions	<p>Here is a list of power conditions that you should be aware of:</p> <ul style="list-style-type: none"> <li>▪ A surge or spike in power is a sudden rise in voltage. It can be caused by a lightning strike; a power plant coming online or going off-line; or even equipment inside the facility.</li> <li>▪ A sag or dip in power is a reduction in voltage for a short period of time (up to as long as a few seconds). Sources of sags or dips include chained power strips, faulty wiring, sudden power draws (such as when equipment is first turned on), and large inductive sources, such as an electric motor.</li> <li>▪ A brownout is a reduction in voltage that lasts longer than a few seconds. A brownout is generally caused at the utility company during times of high-power usage. The ANSI standard defines a brownout as an 8% drop between the power source and the voltage meter or a 3.5% drop between the voltage meter and the wall outlet.</li> <li>▪ A blackout is a complete power failure. A blackout can have a variety of sources, such as downed power lines or failed transformers.</li> <li>▪ A fault is a momentary power outage that can have a variety of sources.</li> <li>▪ A transient is a fluctuation caused by line noise or disturbance.</li> </ul> <p>Power systems can help keep electrical service constant. The following types of protection are available to improve and protect your equipment against AC power issues:</p> <ul style="list-style-type: none"> <li>▪ Surge protectors protect against spikes that damage components. Many power strips have a built-in surge protector.</li> <li>▪ Uninterruptible Power Supplies (UPS) protect against under-voltage conditions of short duration (depending on battery life, 30 minutes or more). Most UPS systems include a line conditioner and a surge protector.</li> <li>▪ A redundant power source can ensure constant power. An example of a redundant power source is a backup generator or power from a secondary source in case the primary source fails. Backup generators require fuel to operate and can provide power to critical systems until the fuel is consumed.</li> <li>▪ Line conditioners, also known as power conditioners, can improve the quality of the power by providing filters to remove noise, temporary voltage regulators, and surge protectors.</li> </ul>
Water or Gas	<p>Recommendations for water and gas focus on the ability to turn them off in the event of a broken pipe, fire, or another type of emergency. These recommendations are:</p> <ul style="list-style-type: none"> <li>▪ Identify the location of a master shut-off valve.</li> <li>▪ Identify the location of any secondary shut-off valves. Using secondary shutoff valves minimizes the impact of the service loss.</li> </ul>

- Ensure that the shut-off valves work.
- Mark shut-off valves to increase visibility.
- Ensure that appropriate personnel has access to shut-off valves for water and gas systems.
- Secure shut-off valves from general access.

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