Chapter 1

Protecting Yourself and Your PC

In This Chapter

- Preventing ESD damage
- Cleaning a PC
- Disposing of hazardous components
- Identifying good ergonomic practices

In this chapter, you practice procedures for ensuring that your PC doesn't hurt you — or your environment — and vice versa.

Preventing ESD Damage

Electrostatic discharge (ESD), also known as *static electricity,* is an insidious destroyer of computer and electronic components. Even the smallest, most harmless-seeming jolt of ESD can ruin a circuit board or chip. The damage can be immediately apparent, or it can weaken the component in such a way that it fails days, weeks, or even months later.

ESD is caused by electrical potential equalizing itself between a higher and a lower source. Think about what would happen, for example, if two sides of a gate had different water levels. When the gate is opened, the water from the higher-level side rushes into the lower-level side to equalize the level. Well, when electrical potential rushes from the higher-potential side to the lower-potential one, it zaps the component on the lower side, and that's what causes the damage.

Humans don't even notice ESD unless it's thousands of volts in strength (because the amperage is so low), but much lower levels can damage equipment. Therefore you can't use "Can I feel it?" as a reliable indicator of whether ESD damage is taking place. Instead, you must take precautions to ensure that ESD doesn't happen in the first place.

As a PC technician, you need to know how to set up a work environment so that the risk of ESD damage is minimized as much as possible. This includes wearing certain clothing/fabrics, using antistatic equipment and mats, and controlling environmental conditions, such as humidity in the room.

1. What is the optimal humidity level in a work area, as a percentage?

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2. Describe the characteristics of the optimal clothing you should wear while working on a PC in order to avoid ESD.

   A. What material should your clothing be made of?

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   B. What material should you especially avoid?

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   C. What type of shoes should you wear?

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   D. Should you work in socks (no shoes)? Why or why not?

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3. Describe the characteristics of the optimal flooring for avoiding ESD.

   A. What types of floor covering generate the least ESD risk?

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   B. What type of floor covering should you especially avoid?

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4. What is the purpose of an antistatic wrist strap?

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5. Where does an antistatic wrist strap attach at each end?

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6. What is the purpose of an antistatic grounding mat?

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7. If a cable is leading from the grounding mat, what should it plug into, and why?

8. When working inside a PC without an antistatic wrist strap, experts recommend that you frequently touch the metal frame of the PC case or the power supply box. What does that do?

Cleaning a PC

Keeping a PC clean takes only a little time and pays off by extending the life of the equipment and making it more pleasant to use on a daily basis. If you've ever tried to use a PC with a sticky mouse, a grimy keyboard, or a dusty screen, you know firsthand about that! Even though in most organizations, end-users are responsible for cleaning their own PCs, in practice a technician may find that PC cleaning is sometimes a part of his or her job.

To clean a PC, you need the following equipment and supplies:

- Compressed air
- Lint-free cleaning cloths (paper towels are acceptable for cleaning keyboards)
- Ammonia-free monitor cleaner
- Mild general-purpose cleaner for external plastic parts, or mild soapy water
- Cotton swabs and alcohol (if you have a ball-style mouse)

9. How do dust and dirt inside a PC make the PC more prone to failure?

10. Why is it important to use ammonia-free products on a monitor screen?

11. Why should you avoid using alcohol to clean the rubber ball of a ball-style mouse?

12. Why is it preferable that cleaning cloths be made of natural materials (such as cotton) rather than synthetic materials?

13. Describe the qualities of an appropriate general-purpose cleaner for use on the external parts of a PC.

14. Most PC technicians would not take the time to disassemble a keyboard for cleaning (that is, to pull off the keys and clean underneath them). Why is that?

Exercise 1-1: Cleaning a Desktop PC

Follow these steps to practice cleaning a desktop PC:

1. Shut down the computer and unplug it.
2. If you have a ball-style mouse, disassemble it and clean out the inside of the mouse casing with alcohol and a cotton swab. Clean the mouse ball itself with mild soapy water.
3. Using general-purpose cleaner or mild soapy water and either a paper towel or a lint-free cloth, clean the keyboard as thoroughly as possible without disassembling it.

   It isn't worth disassembling most keyboards because putting them back together again is extremely difficult.
4. Using monitor cleaner and a lint-free cloth, clean the monitor glass.
5. Using general-purpose cleaner and a lint-free cloth, clean the plastic surfaces of the monitor.
6. Using general-purpose cleaner and a lint-free cloth, clean the plastic surfaces of the outside of the PC.
7. Open the PC case and, using your fingers, fish out any clumps of dust or hair that you can reach.
8. Using compressed air, blow out any remaining clumps of dust or hair from inside the PC case.

9. Using compressed air, blow out any dust from the fans inside the PC, including the fan on the power supply.
10. Close the PC case.

Disposing of Hazardous Components

The United States Environmental Protection Agency (EPA) publishes standards dealing with the proper disposal of electronics components (such as computer hardware) and of cleaning supplies and consumables (such as toner cartridges). It's important to follow these standards, not only because it's the right thing to do for the environment, but also because in many cases, it's the law. These guidelines are published at `www.epa.gov/epaoswer/osw/hazwaste.htm`.

Many cleaning supplies also have their own specific disposal guidelines contained in a Material Safety Data Sheet (MSDS). You can obtain the MSDS for a chemical from the manufacturer, usually from its Web site. In some cases, the proper disposal procedure for a chemical is also printed on its container.

To effectively deal with equipment and consumables that are potential environmental hazards, you should not only be able to enumerate what items require special disposal, but you should also understand *why* they do. When you know why things are hazardous, you can make judgment calls when you encounter new equipment in the future that isn't on the specific list to which you normally refer.

PRACTICE

15. For each of the following items, specify how they should be handled and explain what the hazard is for each one.

Component/Material	Proper Disposal	Reason
Notebook PC battery		
Standard alkaline battery, such as in a flashlight		
Coin-style battery, such as on a motherboard		
CRT-style monitor		
Toner cartridge		

Exercise 1-2: Determining Disposal and Recycling Options

When the time comes to get rid of cleaning products and electronics, take these steps:

1. Look on the packaging of the cleaning products you used to clean your PC earlier in this chapter and find the Web sites for the manufacturers.
2. Visit those Web sites and attempt to locate Material Safety Data Sheets for each of the cleaning products. (Not all products have them.)
3. Visit `www.epa.gov/epr/products/ele-resources.htm` and review the information about electronics disposal and recycling.

Identifying Good Ergonomic Practices

Ergonomics is the science of designing equipment and setting up work areas in a way that reduces or prevents discomfort and injury in workers. The most common type of injury caused by poor ergonomics is *repetitive strain injury* (RSI), which is an injury to the muscles and tendons caused by repeatedly performing the same movement in a way that stresses them.

Here are the three components to good ergonomic practices:

- Purchase ergonomically sound equipment that's appropriate for the user.
- Set up workstations so that the user is positioned in a way that avoids stress.
- Use equipment in a way that avoids stress.

16. Describe the features that differentiate an ergonomic keyboard from a standard one.

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17. Where should a monitor be positioned in relation to the user's eyes?

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18. Describe the appropriate body posture a computer user should maintain when using a PC in order to avoid body stress and strain, including the angles at which arms and legs should be positioned in relation to the floor.

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19. Describe how a user can avoid eyestrain when working at a computer for a long stretch of time.

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Exercise 1-3: Making a Workstation Ergonomically Correct

Follow these steps to help prevent RSI:

1. Go to `www.osha.gov/SLTC/etools/computerworkstations` and read the information about creating an ergonomically sound computer work area.
2. Evaluate and correct your current workstation for ergonomic problems:
   - Reposition the monitor if needed.
   - Check the keyboard and mouse positioning. Adjust them if needed so that your arms are positioned correctly when using them.
   - Check the chair height. Adjust the chair if needed so that your feet and legs are positioned correctly.
   - Evaluate the design of the keyboard to determine whether it could potentially cause RSI. If it could cause RSI, consider replacing it, or reassign it to a workstation that is used less frequently than others.

Answers to Questions in This Chapter

The following are the answers to the practice questions presented earlier in this chapter:

1. **What is the optimal humidity level in a work area, as a percentage?**

   The optimal humidity level is between 50 and 80 percent. If the humidity is less than that, static electricity is more prevalent; more than that, and moisture tends to collect on parts, possibly causing short-circuiting.

2. **Describe the characteristics of the optimal clothing you should wear while working on a PC in order to avoid ESD.**

   A. What material should your clothing be made of?

   Clothing should be made of natural fibers.

   B. What material should you especially avoid?

   Avoid polyester and other synthetic fibers because they generate ESD.

   C. What type of shoes should you wear?

   Wear rubber- or leather-soled shoes.

   D. Should you work in socks (no shoes)? Why or why not?

   No, you should not go shoeless, because socks, especially those made with synthetic fibers, can rub against a carpet, rug, or other surface to create static electricity.

3. **Describe the characteristics of the optimal flooring for avoiding ESD.**

   A. What types of floor covering generate the least ESD risk?

   A rubber floor mat is best; a tile floor is also acceptable.

   B. What type of floor covering should you especially avoid?

   Avoid synthetic-fiber carpeting.

   Remember back when you were a kid and you used to scuff your stocking feet on the carpet and then zap your little brother with static electricity? That's what you want to avoid doing to your PC. Avoid working in your socks, especially on carpet.

4. **What is the purpose of an antistatic wrist strap?**

   An antistatic wrist strap equalizes the electrical potential between you and the PC. It doesn't "ground" you per se, unless you use it in conjunction with a grounding mat; it simply keeps the potential the same between you and the parts that you don't want to accidentally zap.

5. **Where does an antistatic wrist strap attach at each end?**

   The wrist strap attaches to your wrist, of course. The alligator clip at the other end attaches to the PC's frame or to its power supply — anything that's metal and not a circuit board.

6. **What is the purpose of an antistatic grounding mat?**

   A grounding mat dissipates any excess electrical potential that builds up in your body, channeling it out to a ground source.

7. **If a cable is leading from the grounding mat, what should it plug into, and why?**

   A grounding mat typically plugs into a three-prong electrical outlet; the third prong (the grounding prong) channels ESD away from your body — and from anything else placed on the mat.

8. **When working inside a PC without an antistatic wrist strap, experts recommend that you frequently touch the metal frame of the PC case or the power supply box. What does that do?**

   Touching the metal frame equalizes the charge between you and the PC's frame, keeping excess charge from building up. If you touch the metal frame, the electrical potential in your body flows harmlessly into that nonelectronic source. If you touched a sensitive circuit board instead with excess charge built up in your body, it would get zapped.

9. **How do dust and dirt inside a PC make the PC more prone to failure?**

   Dust is an insulator, so heat builds up to a greater degree on a dusty chip than on a clean one. This causes the chips to run hotter and to fail more quickly. Dusty fan blades circulate air less efficiently than clean ones, and clumps of dirt or hair inside a component can impede the free flow of air within it.

10. **Why is it important to use ammonia-free products on a monitor screen?**

    Ammonia can destroy the antiglare coating on monitor glass and can damage LCD screens.

11. **Why should you avoid using alcohol to clean the rubber ball of a ball-style mouse?**

    Alcohol can dry out the rubber in the ball.

12. **Why is it preferable that cleaning cloths be made of natural materials (such as cotton) rather than synthetic materials?**

    There are two reasons. One is that some synthetic materials react with chemicals to cause color bleeds or to break down the fibers in the fabric. Another is that synthetic fibers are more prone to generating ESD.

13. **Describe the qualities of an appropriate general-purpose cleaner for use on the external parts of a PC.**

    A cleaner should be nonabrasive and should not contain harsh chemicals such as benzene or ammonia. Mild soapy water (made with dishwashing detergent) is inexpensive and works well for external parts; for internal areas, where water is a no-no, consider an alcohol-based product.

14. **Most PC technicians would not take the time to disassemble a keyboard for cleaning (that is, to pull off the keys and clean underneath them). Why is that?**

    Keyboards are inexpensive, so it doesn't make financial sense for a skilled technician to spend a lot of time cleaning one meticulously. In addition, the keycaps can be difficult to remove and replace, and some keyboards have a spring under the spacebar that's hard to reinstall.

15. **For each of the following items, specify how they should be handled and explain what the hazard is for each one.**

Component/Material	*Proper Disposal*	*Reason*
Notebook PC battery	Take to recycling center or hazardous waste center	Batteries can contain heavy metals such as nickel and cadmium.
Standard alkaline battery, such as in a flashlight	Okay to throw in regular trash	This type of battery doesn't require special handling.
Coin-style battery, such as on a motherboard	Okay to throw in regular trash	This type of battery doesn't require special handling.
CRT-style monitor	Donate to charity or take to recycling center or hazardous waste center	Phosphors and lead are used in the monitor; in addition, the large, boxy nature of such a monitor means it takes up lots of space in a landfill.
Toner cartridge	Return to manufacturer for recycling or disposal, or take to recycling center or hazardous waste center	The fine powder in toner can present a breathing hazard if it's dispersed in the air, and the plastic cartridge can take up space in a landfill.

16. **Describe the features that differentiate an ergonomic keyboard from a standard one.**

An ergonomic keyboard typically has a built-in wrist rest and might also have a split design that enables your wrists to point at more natural angles than with a standard keyboard.

17. **Where should a monitor be positioned in relation to the user's eyes?**

The monitor should be at eye level so that the user doesn't have to bend or stretch his or her neck to look at it. Also, the monitor should be about two feet away from the eyes.

18. **Describe the appropriate body posture a computer user should maintain when using a PC in order to avoid body stress and strain, including the angles at which arms and legs should be positioned in relation to the floor.**

Forearms and thighs should be parallel to the ground. Calves and upper arms should be perpendicular to it. The shoulders should be relaxed, and the lower back should be supported.

19. **Describe how a user can avoid eyestrain when working at a computer for a long stretch of time.**

Users should blink their eyes frequently as they work. They should focus on a distant object for a few seconds every 15 to 20 minutes. Users should keep eyedrops handy if dryness is a problem because they forget to blink.