MONITORING PROCEDURES AND EQUIPMENT

COURSE OUTLINE

- **You'd better watch out... because you have an enemy.**
  - It has a thousand different names and no mercy.

- **Your nemesis doesn't know fear.**
  - It never sleeps.
  - It is literally inhuman.

- **It can injure or kill you with no remorse.**
  - Worst of all, you might not even know that you are under attack.

- **Contamination from hazardous materials is one of the most significant dangers that you face while on the job.**
  - You know that contamination could make you severely ill... even kill you.
  - But the danger doesn't stop there.
  - Once you are contaminated, you can expose others as well.

- **Without meaning to, you can unknowingly spread hazardous materials to your:**
  - Coworkers.
  - Family.
  - Friends.
  - Even pets.

- **Contamination doesn't always end with you, and if you don't protect yourself... it won't.**

- **To combat the dangers of contamination, the Occupational Health and Safety Administration (OSHA) has developed a broad range of regulations.**
  - Foremost among these is the "Hazardous Waste Operations And Emergency Response" standard... commonly known as HAZWOPER.

- **HAZWOPER sets the guidelines for all hazardous materials activities, including:**
  - Storage.
  - Handling.
  - Disposal.

- **One of the most important areas that it addresses is "monitoring", which covers two broad activities:**
  - Detection.
  - Surveillance.

- **"Detection" determines what hazardous materials are present at a site. This includes:**
  - Airborne contaminants such as dust, gases and vapors.
  - Pollutants in water or soil.

- **Detecting airborne hazards is especially important, because the contaminants that you inhale are among the most dangerous.**
  - Many chemicals pass easily from the lungs into the bloodstream.

- **The "surveillance" part of monitoring deals with keeping tabs on hazardous chemicals over time.**
  - The object is to ensure that your work site won't have any unpleasant surprises in store for you later on down the line.

- **As you can see, monitoring is crucial when you are dealing with hazardous materials. Without it:**
  - No one would be able to evaluate dangers to your health.
  - You couldn't determine when and where protection is necessary.
  - The proper selection of PPE would be impossible.

- **Some of the most hazardous materials can not be seen, smelled or felt.**
  - Monitoring for these chemicals requires the use of highly specialized tools.

- **Exposure monitoring instruments come in two varieties:**
  - "Direct-reading instruments", which provide instant information.
  - "Sampling collection devices", which store airborne contaminants in collection media for later analysis at a laboratory.

- **Each type of equipment has its own strengths and weaknesses.**
  - Used together, they often complement one another.

- **The main strength of direct-reading instruments is that they provide <u>immediate</u> feedback.**
  - That's why they're used to detect conditions that OSHA designates as IDLH (immediately dangerous to life and health).

- **Direct-reading instruments do have weaknesses, though.**
  - Each one is sensitive to only a limited range of chemicals.
  - There is no single direct-reading device that picks up every contaminant.

- **Even highly sensitive direct-reading instruments cannot detect concentrations below one-half of one part-per-million.**
  - Certain chemicals are hazardous in quantities below this level.
  - A direct-reading device will not be able to measure them.
  - Direct-reading Instruments also may not be able to distinguish between multiple chemicals when they are present.

- **Sampling collection devices are different from direct-reading Instruments in a number of ways. With a sampling tool, you collect material which will be analyzed later in a laboratory.**
  - A lab can detect concentrations of hazardous materials in parts-per-billion, rather than the parts-per-million possible of direct-reading instruments.
  - As a result, laboratory analysis produces findings that are usually more reliable than information collected with direct-reading instruments.

- **The biggest drawback to using sampling collection devices is that you have to wait for the results… immediate feedback isn't possible.**
  - So you can't use sampling collection instruments to detect IDLH conditions.

- **Together, direct-reading and sampling collection devices make up for each other's shortcomings.**
  - This is why you need both… to give you an accurate picture of all the hazardous conditions you may face.

- **Now that we have talked about the major categories of monitoring equipment, let's take a closer look at when and how they should be used.**

- **It is important to monitor for IDLH if:**
  - You are going onto a new site.
  - Chemical concentrations have changed at your current site.

- **Since IDLH conditions are by their very nature life threatening, you need to use direct-reading instruments for instant feedback about the on-site environment.**

- **Direct-reading Instruments come in a variety of shapes, sizes and sensitivities.**
  - Most of this equipment needs to be calibrated before it is used.
  - Calibration involves testing an instrument with a known quantity of a substance to see if the device gives a proper reading.

- **Let's take a look at some direct-reading instruments that you might use. "Oxygen indicators" use electrochemical sensors to determine the oxygen level of the air around you.**
  - If the oxygen level falls below 19.5%, there will not be enough oxygen for you to breathe.
  - If the level rises above 25%, the atmosphere will become combustible (and there will be a significantly greater chance for a spark or other ignition source to cause a fire or explosion).

- **Oxygen Indicators are crucial in confined spaces, where often the air:**
  - Is not refreshed regularly.
  - Could be very different than what we are used to breathing.

- **"Combustible gas indicators" (CGIs) detect gases which have the potential to ignite.**
  - A CGI burns a small quantity of gas by exposing it to a heated filament.
  - The hotter the filament gets, the greater the concentration of the gas in the air.
  - Because CGIs contain a potential ignition source, they should <u>never</u> be used in any area where the oxygen content is unknown.

- **The "gas chromatograph" (GC) is another direct-reading instrument.**
  - It forces air through a substance that absorbs contaminants.
  - Various chemicals will evaporate from the absorbing medium in different periods of time.
  - The duration that chemical traces remain in the medium indicates what chemicals they are.
  - This allows a gas chromatograph to separate a complex mixture into its component parts.

- **"Photo-ionization detectors" (PIDs) take samples of airborne contaminants and strip them of their electrons.**
  - The PID does this by bombarding the contaminants with ultraviolet light (this process is called ionization).
  - Because different gases ionize at different frequencies of UV light, the PID can accurately tell you what contaminants have been detected.

- **"Radiation detectors" are another type of direct-reading Instrument.**
  - They are sensitive to a range of emissions, from the moderately hazardous alpha and beta particles to the extremely dangerous "gamma rays."

- **"Energetic" gamma rays can often penetrate several centimeters of lead.**
  - If you suspect radioactivity at your site, the first thing you need to do is monitor for gamma rays.

- **"Colorimetric indicator tubes" are perhaps the most widely used direct-reading devices.**
  - They are accurate, inexpensive and easy to use.
  - You do not need to calibrate them.

- **The procedure for using colorimetric tubes is uncomplicated.**
  - Just break off both ends of a tube, then insert it into a specially-designed hand-pump.
  - When you squeeze the pump, air is drawn through the tube, which changes color according to how much of the contaminant is present in the air.
  - Once you've taken a reading, you simply throw the used tube away.

- **There are many more kinds of direct-reading instruments than we have time to review here.**
  - Talk to your supervisor about any other direct-reading tools that you may need to use.

- **Once you have chosen your direct-reading tools, you need to "characterize" the site.**
  - In addition to monitoring for IDLH, you will need to look for general hazards… ranging from open pits to things that might fall on you.

- **Wear appropriate PPE, and remember that unsafe conditions can develop quickly. Be especially aware of places where:**
  - You could trip or fall.
  - Something could fall on you.

- **When you begin to monitor for IDLH, pay particular attention to places where the air might be still. These are high risk areas, and include:**
  - Gullies.
  - Enclosures.
  - Spaces between hills.

- **"Confined spaces," should also be examined closely. Proper precautions should be in place for any hazards that are discovered in places like:**
  - Storage tanks.
  - Boxcars.
  - Silos.
  - Mine shafts.

- **When IDLH conditions are under control, the next step is usually to conduct "general on-site monitoring."**
  - "General on-site monitoring" means monitoring for all contaminants, whether they pose an IDLH threat or not.
  - You need to evaluate all the environmental conditions at the site.

- **Use direct-reading instruments to identify areas that you suspect are contaminated.**
  - Then use a sampling pump to collect air directly from the area itself, as well as from locations that are downwind.

- **Remember, the contaminants that you gather will need to be sent out to a laboratory for analysis after being stored in "collection media" such as:**
  - Impingers.
  - Sorbent tubes.
  - Filter cassettes.

- **Another way to detect contaminants involves going outside the site. This is called "perimeter monitoring."**
  - Perimeter monitoring detects contaminants that might escape from the site.
  - It helps you to evaluate how effective your containment procedures really are.

- **Often, perimeter monitoring makes use of "fixed-location sampling equipment" placed at the edges of the property.**
  - Because it takes place outside of known contaminated areas, perimeter monitoring does not usually require you to wear PPE.

- **"Periodic monitoring" keeps tabs on environmental changes that occur over time. It is used to determine if:**
  - The concentration of a contaminant has changed as time has passed.
  - A new contaminant has appeared.

- **Changes in contaminant levels can occur when:**
  - You are handling a number of contaminants at the same time.
  - Work has switched to another area.
  - A different type of work begins within the site.

- **All of these activities can cause the release of gases or vapors… which makes contaminant levels rise.**

- **As we discussed, IDLH and periodic monitoring look at entire sites or work areas. But you need to be monitored, too.**
  - This is called "personal monitoring."

- **By keeping an eye on how much of a chemical you come in contact with during every work day:**
  - Your company can determine when you are in danger of over exposure.
  - You can be assigned to a different job or work area to protect you, if necessary.

- **Personal monitoring is done by collecting samples of airborne gases, vapors and particles from your "breathing zone"… the area near your nose and mouth.**
  - The instruments used for personal monitoring are attached to the clothing in your breathing zone.
  - They range from passive devices, such as organic vapor monitor badges… to personal pumps, which gather airborne contaminants through a flexible tube and store them in a collection medium.

- **Some personal monitoring devices, such as organic vapor monitor badges, are sensitive to a wide range of substances.**
  - Others will register only the presence of a single chemical.
  - A few will warn you if you are nearing a dangerous level of exposure, usually by changing color.

- **Normally, personal monitoring devices are used to record exposure data over the course of a full shift.**
  - Then at the end of the work day each device or collection medium is retrieved.
  - Its collection medium is then sent to a laboratory for analysis.

- **Before collection medium from a personal monitoring device can be analyzed, the lab technicians need to know the times you started and stopped work on the day that you used it.**
  - Without this information, the technicians can't determine if the exposure occurred over an hour, or ten hours.
  - These start and stop times will be usually be recorded by your supervisor, or an Industrial Hygienist, prior to sending your monitor to the lab.

- **As varied as they are, the different kinds of monitoring all have one thing in common… your safety.**
  - Used together, these monitoring techniques are the best way to tell if your worksite contains dangerous levels of contaminants.
  - If you have any questions about monitoring, ask your supervisor.

*** * * SUMMARY * * ***

- **There is a saying that "knowledge is power."**
  - To have the power to prevent contamination, you need the knowledge that only monitoring can provide.

- **Learn all that you can about all of the monitoring techniques and the substances they detect.**

- **Find out what direct-reading and lab analysis equipment you will be using.**

- **Make sure that you are thoroughly trained on how to use various kinds of monitoring tools, including calibrating them if necessary.**

- **Talk to your supervisor, and other experts, about the conditions at your work site.**

- **Knowledge <u>is</u> power.**

- **When you learn how to monitor for hazardous materials, that knowledge gives you:**
  - The power to detect hazards that would otherwise remain invisible.
  - The power to eliminate problems before they get out of hand.
  - And the power to stay safe!