## 1. Introduction

You're about ready to start a course that most seasoned mechanics wish they had before they started in the industry.

"Oh my aching back" and "my shoulder is stiff" are so common that they are clichés. For the Aviation Maintenance Technician or aircraft builders working on a project, these common complaints are liabilities. Jobs are not being completed or just as bad, short cuts are being taken, all due to a medical condition. Beyond these clichés lurk more serious medical conditions. Chronic Kidney disease, occupational asthma, and contact dermatitis are examples of health condition that can arise from work on aircraft. These conditions usually occur slowly and do not disappear because of a job change or retirement.

Welcome to **Working Healthy – 8 Steps for Protecting Your Health**; a course for Aviation Maintenance Technicians and Builders. My name is Doc Allen, I'm a retired navy physician who spent his career in the Navy's shipyards and air rework facilities. My medical practices included workers whose jobs were in aviation maintenance, repair and overhaul. I'm going to use my medical background to give you a better understanding of the health effects from work on aircraft.

I'll cover a lot of material but the emphasis is always on prevention. Feel free to take this course more than once. I guarantee you'll pick up useful points each time you work through the course. References for this course are my books: *Working Healthy* (ISBN: 978-0-9822719-0-2) and *Working Healthy, Solvents* (ISBN: 978-0-9822719-2-6). In the course you'll find page number references to both of these books annotated as WH or WH,S. Also included in reference section are web addresses to specific documentation that presents additional information.

**Helping me** narrate this leaning course will be my daughter, Mary, who I taught to fly. She is now an airline pilot but we both work on the family's Cherokee.

## 2. Did my job make me sick?

Did my job make me sick? Anyone who has experienced an unexplained illness has asked that question.

So what do you mean by sick? In 2007 5,488 US workers died from occupational injuries. Fortunately the aviation maintenance, repair, and overhaul (MRO) industry is not one of those industries with a high death rate.

Instead of death, let's ask about the frequency of non fatal occupational injuries and illness. These are the types of sickness that are most familiar to workers such as back pain and rotator cuff tears. In 2007 4 million workers experienced these non fatal occupational injuries and illnesses. A study by the National Health Interview Service ranked ordered occupations by the frequency of these injuries

and illness. Aviation maintenance was one of the top 25% of occupations that experience high non fatal occupational injuries and illnesses.

Perhaps these statistics are not a surprise to the seasoned mechanic. But these statistics do indicate that we have much opportunity to improve.

3. **Teaching by industry**

I have to point out one other statistic that indicates that our MRO industry lags behind other occupations in understanding health effects. That statistic deals with teaching our workers in the industry.

The table lists three industries, health care, firefighters, and construction. These are large industries with construction alone accounting for 4 to 5 million workers. Each of these industries has an accreditation body that trains their workers in health topics. For example: The Joint Commission on Accreditation of health Care Organizations requires all health care providers to learn about blood borne pathogens and the handling of sharp instruments. Fire fighters have training in similar topics. The Center for Construction Research and Training teaches their workers about health effects from dry wall, asbestos, asphalt, use of tools to name a few topics.

I show this table because aviation is missing. In other words, mechanics in the MRO industry have skills that permit completion of a variety of tasks. Unfortunately these same mechanics who learn so many skills, do not have a consistent training to learn about the health effects that might arise from completing these tasks.

4. **Aviation Training Topics**

Federal Aviation Regulations, advisor circulars, and private recommendations present training topics for Aviation Maintenance Technicians (AMT). In these documents you'll find phrases such as maintenance human factors, general Occupational Safety and Health Administration (OSHA) laws, and safety culture. These phrases suggest to mechanics the importance of protecting their health when working on aircraft.

In addition to written documents, training aids also suggest the importance of maintaining your health when working on aircraft. Examples include:

o. Dirty Dozen which focuses on those human factors that can lead to maintenance errors.

o. Risk Matrix which provides a relation between the likelihood of an event and the severity of consequences

o. Risk/hazard Identifier which recognizes immediate personal risk factors that an AMT might be experiencing.

The conclusion from both the documentation and training aids is that the mechanics' health is important to safe completion of a job. Workers in all industries, not just aviation, have similar concerns about protecting their health when on the job.

**5. Teaching Health Effects**

The medical literature contains studies of the medical consequences that AMTs have experienced from their work on aircraft. This table shows a link between the training topics referenced in FAA writings and important concepts highlighted by the medical studies.

o. The left column uses phrases found in FAA documents which are suggestive of important medical issues

o. The right column is the important concepts taken from medical studies involving maintainers.

Let's review

General OSHA – The OSH ACT of 1970 does have a general duty clause which states that all employers must provide a workplace free of recognized hazards which are likely to cause death or serious physical harm.

Safety Culture – This implies protecting specific organs from the harmful effects of exposures

Organizational Factors - Prevent accident and ILLNESS, using aids such as the safety hierarchy

Maintenance Human Factors - The discipline of human factors addresses how people interact with technology. Maintenance human factors addresses how mechanics interact with noise, solvents, vapors, and ergonomic challenges.

Terminology used in regulations, Advisory Circulars and other writings may not specifically match the findings from medical studies. Nevertheless, three important messages are clear:

1. Protecting your health, not just preventing an accident, is worthy of discussion in the aviation workshops.
2. The health of the aviation workforce is critical in accident prevention.
3. Medical factors including exposures and ergonomics, influence each mechanic's performance just as fatigue, personal stress and human factors

Exposures can result from work on aircraft and these exposures do have medical consequences. What medical subjects do you teach to addresses these real world exposures?

**6. WH-8 stairways**

To identify and teach subject matter relevant to the Aviation Maintenance Technician (AMT) I use a teaching tool called the **Working Healthy -8** (WH-8).

Aviation maintenance instructors and AMTs in the hangar can use the WH-8 to recognize health risks and implement preventive measures.

I'd like to introduce the Working Health – 8, Let me give a general review of this training aid before going through specific steps.

First: The logo is a stairway composed of eight steps.
The first step is planning your work, in other words, start at the bottom of the stairway.

Second: The terms use technical concepts but no medical terms.

Third: The presentation is either an OJT that focuses on only one step or a stand alone presentation that covers the entire WH-8.

Fourth: Instructor qualifications requires an interest in creating a culture of safety and protecting health.

Review of the eight steps of the stairway highlights findings in medical studies that present subject matter relevant to the AMT's health.

7. **Step 1**
*Health effects arise from a combination of duration and concentration*

In most cases one contact with a chemical, such as a solvent or a physical hazard, such as noise, or ergonomic hazard does not cause problems. The exception will be diseases caused by allergies, such as occupational asthma from contact with paint or an allergic contact dermatitis from contact with additives in oil or fuels.

8. **Health effects cumulative exposures**
The general rule is that health effects arise from the Summation of all your exposures
Examples of exposures, also called stressors, are noise, MEK, ergonomic stress

Emphasis for exposure monitoring is on an 8 hours work period, ASSUMES no exposure for time outside work.

This step is planning your work associated with assessing the amount of exposure you'll receive. Chances are you receive multiple exposures over the workday. For simplicity let's look at just one

9. **How you hear**

Noise is present in nearly all industrial operations. Noise produces a condition called noise induced hearing lose (NIHL). This most frequent compensable injury among federal workers, and probably among private workers too.

Ever since Charles Taylor built the first aviation engine and placed it in the Wright's Flyer, noise has been part of aviation. Let's examine hearing and determine the effects on hearing from industrial noise; then apply this information as outlined in Step 1 of the WH-8, Planning your work

The diagram above shows the right ear and ear canal. Both of these structures serve to capture sound pressures waves from the environment and apply it to the ear drum. The purpose of the ear drum is to convert the pressure waves of sound into a physical movement. Three small bones transfer the physical movement of the ear drum to the Cochlea, the organ of hearing. Lining the Cochlea are hair cells, each of which vibrate at a specific frequency. Electrochemical signals from the hair cells travel along the auditory nerve to the brain where we interpret the original sound waves.

**10. How we loose our hearing**

Most AMTs have had a hearing test. You sit in a lead lined booth wearing head phone and holding a trigger. When you hear a pure tone you press the trigger. The result is an audiogram shown on this slide. Any readings above 20 dB is good hearing. Notice that with mild hearing loss the first and most severe loss is to sounds at a frequency of 4,000 Hz.

The frequency range for normal speech is 500 to 3,000 Hz so a hearing loss at 4,000Hz will note be noticeable. As nose exposure continues hearing loss of more than 20 dB begins to enter the speech frequencies. With moderate hearing loss, the lower frequencies of human speech are preserved. With severe Noise-induced hearing loss (NIHL), understanding speech at all frequencies is impaired.

The important factor of NIHL is that the first loss of hearing occur at 4,000Hz which is above the frequency used in human speech. In other words, you'll loose hearing and not know it unless you have an audiogram.

**11. Symptoms of NIHL**

This slide shows the symptoms of NIHL. The first symptom is the need for higher volume to hear TV or radio. With progression of noise exposure, hearing further deteriorates so the individuals can not discriminate speech or localize sound. These symptoms prevent listeners from identifying who is speaking to them in a crowded room or at a diner party. The final symptom of NIHL is not an absence of sound but rather a constant ringing in the ears.

No, hearing aids that amplify sound will not help. With NIHL the hair cells in the cochlea are destroyed. This means that the cochlea is not reliably transmitting signals along the auditory nerve to the brain.

**12. Preventive message**

So what is the preventive message from step 1 of the WH-8? Health effects arise from the interaction of concentration and duration of an exposure. This step encourage planning your work so you are aware of likely exposures. Noise exposure offers a good example of understanding the relation between time and concentration in order to plan your work.

If your work requires you to be out on the ramp or around noisy equipment for the work day; then after work give your ears a rest. Don't go home and use the lawn mower or chain saw. More importantly, do not drive away in a car with the radio blasting. These activities are not resting their ear. Exposure to noise is continuing well beyond the 8 hours work period.

Since noise is ever present in aviation, we'll again look at noise exposure in another step of the WH-8.

Resources:
WH: pages 78 – 98
NIOSH, search on NIHL

**13. Step 2**

Second step in the WH-8:
find out about the product you are using; then, implement steps to substitute or control exposures, lastly use Personal Protective Equipment (PPE).

**14. Safety Hierarchy**

This second step of the WH-8 speaks directly to the culture of safety that should exist in all organizations. To illustrate both the culture of safety and the importance of asking for information I use the Safety Hierarchy. The safety hierarch shows three levels for obtaining information about protection for exposures. To implement protections in the workplace, start at the bottom of the hierarchy.

first level: **eliminate or substitute** – The basic principle is to remove from the workplace any product that has adverse medical effects. Substitution of a toxic product for one that is non-toxic illustrates this basic step. As an example, consider clearing agents. Perhaps you can use a product that will have less effect on the skin or produces less vapor. In aviation much of maintenance activity is required. Consider coatings on an aircraft which AMTs can not decide to substitute or eliminate.

second level: **Administrate and Engineering Controls**. Mechanics typically have more latitude in the second level of the hierarch. limiting the time spent working in a hot or cold environments is an examples of administrative controls . Engineering controls would include routine maintenance of power tool to limit vibration. Asking for information about an exposure will highlight administrative and engineering controls that AMTs can use to limit their exposures.

third level: **Personal Protective Equipment**: PPE includes items worn by the worker. Examples of PPE include gloves, hearing protections, respirators, aprons, and eye protection. Note PPE is the LAST item to use when trying to protect from overexposures. When learning of a workplace hazard many workshop issue PPE to workers as their FIRST response.

**15. Importance of Fit**

The reason PPE is the last level of protection in the safety hierarchy is because of the importance of fit. To provide effective protection the ear plug or a respirator must *fit* into the individual wearer.

In this slide the individual is demonstrating the correct way to roll, then insert a foam ear plug. Without proper fit the wearer will not receive the noise reduction ratio that the PPE offers. The same is true of any type of PPE such as gloves, respirators, and aprons. Wearing any PPE is no assurance that you are receiving appropriate protection. The PPE must fit the wearer to offer protection.

When you ask for information about the protection you need from an exposure, use all three levels of the safety hierarchy. Do not make the assumption that simply wearing PPE protects your health.

**16. Preventive message**

The message for step 2 focuses on asking for information about appropriate preventive measure. Obtain information about the protection that controls or limits the exposure you are about to encounter.

A hierarchy of protections exists as illustrated in the three levels of the safety hierarch. For AMTs, engineering and administrative controls are the most effective way to reduce and control exposures in the workplace .

Do not make the assumption that placing workers in PPE is the only way to limit exposures. Use PPE as the last level of protection after attempting to reduce the exposure with engineering and administrative controls. Also remember that to be effective in reducing exposures, respirators, hearing protection, gloves and other PPE must fit the user.

Reference: WH
hearing protection: WH 93-94, 13 – 15, 17-18
respiratory protection: WH 47 - 56

Reference: The EARLog series of technical monographs on hearing and hearing protection
http://209.200.67.149/e-a-r.com/hearingconservation/earlog_main.cfm

**17. Step 3:Think Ventilation**

Your lungs are filtering several liters of air per minute. Contaminants in the air will enter your lungs.

**18. How to "Think" Ventilation**

How do you think ventilation? The key factor is to keep contaminants out of the air. Typical examples of airborne contaminants are vapor from use of solvents, dusts from sanding or grinding operations and fumes from welding.

Once a contaminant is in the air, it can enter your lungs. If small enough in size, the contaminant can pass through the lungs into the blood. Once in the blood the contaminant reaches the liver, brain, or any organ.

The preventive message when thinking ventilation is to capture the contaminant at its source. Local exhaust ventilation mounted over a grinder or as part of a sander are examples. The picture above shows a builder in his home workshop deciding on the type of vent to install with a fan to create a home made LEV system. The design of the vent is an important parameter in the capture of contaminant before they enter room air.

Reference:
WH,S – pages 31- 33
ACGIH® Industrial Ventilation: A Manual

**19. Consequences**

The story of the Designated Examiner or DE illustrates the consequences when Step 3 of the WH-8 is overlooked. A DE told me this story and the consequences that follow. Unfortunately, numerous other AMTs have told me similar versions of the same story and have experienced similar health effects.

The three drawings illustrate the DE's story:

The work process, **top left**, involved cleaning the cabin with a solvent, in this case, methyl ethyl ketone (MEK). The cabin was enclosed, had little ventilation, and was dark. The DE, who had just received his A&P was working with his

partner who was also a newly certificated A&P. They decided to add lights to the cabin and brought in a fan

Although their supervisor told them to clean using a rag soaked with MEK, the DE and his partner decided to modify the work process (**bottom left**). The poured out the contents of the MEK on the work area, turned on the lights and fan and started to clean the cabin.

The end result, **pictured on the right slide**, is that the both DE and his partner became dazed from the fumes. The partner also developed a significant nose bleed that required hospital care, a non fatal occupational illness.

While much can be said about this experience, the results are an example of consequences when step 3, Think Ventilation, are neglected.

Reference:
WH,S story and analysis of DE - pages vi – x, 37 – 41
WH,S MEK and Stoddard solvent, 7-11

**20. Step 4**

In this step we'll start with normal anatomy. Then we'll learn that the skin is not an impermeable barrier.

**21. Don't forget the skin**

The picture on the right shows important anatomy of skin –

The epidermis is the outer covering. The dermis contains all the elastic properties of skin, as well as blood vessels, fat, and skin appendages such as hair follicles and sweat glands. Occupational exposure alters the normal anatomy in numerous ways. For example, solvents can dissolves the fats in the skin, abrasions remove the epidermis, and sensitizing agents can pass through the epidermis perhaps by the skin appendages.

Insults to the skin cause a condition called contact dermatitis. Ninety percent of skin diseases originating from the workplace are contact dermatitis. Initially the skin becomes red and raised with vesicles that ooze fluid. Eventually crust forms but repeated exposures results in thickening of the skin and scaling.

Examples of exposures that can cause contact dermatitis include mechanical pressures from a poorly fitted tool, chemical agents such as paints, additives and solvents, and physical extremes such as hot or cold exposure. Remember that bacteria can also invade the skin forming a puss filled infection.

**22. Petroleum derivatives**

AMTs have multiple opportunities to contact petroleum products. A common question revolves around identifying which ones are most likely to cause contact dermatitis. Answering this question requires an understanding of the two types of contact dermatitis.

Irritant contact dermatitis arises from direct tissue damage following the exposure
Allergic contact dermatitis arises from first sensitization then subsequent exposure that triggers the allergic reaction

Exposure to gasoline and jet fuel usually causes an irritant contact dermatitis. The condition continues after repeated exposures to ever higher concentrations. Time to develop the skin condition also distinguishes allergic from irritant contact dermatitis. Irritants produce skin disease within minutes to hours of the exposure

Additives in hydraulic fluids and lubricating oils can cause an allergic contact dermatitis. Allergic skin disease arises after exposure to small amounts of the contaminant and takes days or months to manifest symptoms.

Note that greases rarely cause irritation to the skin.

**23. Preventive message**

The preventive message is that skin is a major route of absorption into the body. Don't forget the skin

Some important preventive measures include:

remove soiled clothes to reduce skin contact with a solvent, dust or other contaminant

Gloves which serve as PPE, can also trap moisture resulting in a Contact Dermatitis. Like all PPE gloves musts be fitted to the individual. Two considerations are important when using gloves:

*first.* Confirm that the gloves used actually protect against the exposure encountered. If the exposure is a solvent, use a glove that is resistant to that solvent. Do not use gloves designed for thermal protection under the assumption that they will also protect against solvents or fuels.

*second*, Gloves wear out. Make sure you have a change out schedule for replacing gloves on a regular basis

After thoroughly cleaning the skin consider the use of barrier creams and moisturizers.

Barrier creams provide a protective layer for the skin.

Moisturizers replace oils lost or dissolved by solvents. These products keep the dermis supple so it will not crack

Don't forget the skin as a major route of entry of fuels, paints, adhesives and other solvent exposures in the workplace.

Reference:
WH pages 139 -12 (skin wellness program) and 143 – 148 (Contact dermatitis)
web search under "work gloves" to identify the variety of sizes and construction available

**24. Step 5**

Emphasis is on the work environment. For example:

- o. Is it hot or cold?
- o. Are engines running nearby and producing Carbon Monoxide?
- o. Will your work require positioning of arms, shoulders, or hands out of neutral position?

As an example of the importance of step 5, let's review a case from the OSHA files.

**25. Environmental Factors**

In an open hangar or on a ramp…… who would consider Carbon Monoxide (CO) accumulation a problem?

Let me tell you the true story of "the fueler who did not return his call". I've taken it from the OSHA files.

The winter day at a major airport in northeast is cold with a north wind blowing. In spite of the cold weather the fueler has a busy morning driving his fuel truck to aircraft that are requesting fuel. He has his lunch with co-workers who note nothing wrong with his behavior. He starts his afternoon fueling service but by mid afternoon the dispatcher notes that aircraft requests for fuel are building up. He calls the fuel truck on the radio. No response. The dispatcher then put on his heavy coat, walks outside and sees the fuel truck. He is convinced that the fueler is not paying attention to his radio calls. As the dispatcher approaches the truck he notes the windows are rolled up but sees the fueler is inside. He opens the door to the truck, and the fueler falls out on the ground, dead.

OSHA's analysis of this work site fatality showed:

- o. Measures of CO inside the cab are very high
- o. All trucks in the fuel fleet had high levels of CO
- o. All tucks including the one driven by the fueler had leaks into the cab.
- o. The fueler's truck was pointed into the wind. Its exhaust pipe, located in front, caused fumes to accumulate under the truck

The point of this story is that carbon monoxide is in the environment of the airport and can cause fatalities.

Other studies have confirmed high levels of carbon monoxide in mechanics who work on the ramp.

This true story should make my message clear. Contaminants in the work environment, not just those at your worksite, can result in significant exposures.

**26. Shoulder**

Aircraft have many oddly shaped compartments producing cramped work areas. AMTs work is often in these difficult to access spaces. Ergonomics becomes an important concern.

Ergonomics is the field of study that focuses on the biomechanics of the human body interacting with the work process

To illustrate preventive measures when considering biomechanics, let's turn our attention to the two cliché's I used to introduce this lesson. One was "My shoulder is stiff".

This slide shows some basic anatomy that can account for shoulder problems. The purpose of the shoulder is to position and stabilize the arm. Four muscles, called the rotator cuff, provide movement. Unfortunately the shoulder can not place the arm in all positions. The illustration color codes arm positions based on the strain placed on the rotator cuff muscles. Over-head ( called Abduction) and extreme back-reaches, (called external rotation) colored in red, place the most biomechanical strains on the rotator cuff. In these dangerous positions, the bones of the shoulder pinch nerves and restrict blood flow to the rotator cuff muscles. The result is weakening of these muscles and their tendons. Tears of the rotator cuff occur and increase in frequency after age 40.

By contrast note the positions of the arm colored in green. The muscles of the rotator cuff experience reduced biomechanical forces when the arms are in these positions.

**27. Shoulder, correct vs. incorrect**

Once you understand the ergonomics of the shoulder, the correct and incorrect positions of the arm are obvious.

The two figures show a mechanic replacing the oil filter on the accessory case. To reach this area the mechanic extends his arm. The figure on the left shows over extension of the arm with the shoulder in the forbidden area (colored red). The figure on the right shows the mechanic working from a ladder. Using this slightly elevated position the mechanic performs the repair while keeping his shoulder in the safe zone (colored green).

The position from which you work is important . Prolonged outstretching of the arms to reach inaccessible area is frequent in aviation maintenance activities. This

position makes the muscles and tendons of the rotator cuff susceptible to microscopic degenerations and tears. The body can not repair these small degenerations. With time large tears occur and the mechanic must visit the surgeon for rotator cuff surgery.

The preventive message encourages correct ergonomic position when performing maintenance activities.

**28. Back forces on low back**

The second cliché that I referenced, "Oh my aching back" is also understandable in terms of body ergonomics.

The picture above shows that the oil only weighs 20 pounds. Unfortunately, the AMT is trying to lift this weight with an outstretched arm. The result is that the low back is experiencing a 300 pound force. Strain of the lumbar muscles and discs occurs with that amount of force. A back ache will be the result.

These two examples of ergonomics-in-action illustrates how body mechanics can lead to the common complaints of back and shoulder pain. The preventive message is to use proper lifting and lowering techniques and to position your arms to keep your shoulders in the safe zone. Ignoring the preventive message from these two examples will definitely cause you to experience the two clichés.

Reference:

WH: pages 99 – 106

Department of Defense Ergonomics Working Group:

www.ergoworkinggroup.org

This entire site is an excellent source of information about lifting and lower tasks and ergonomics in general

**29. Step 6**

Step 6: *A spill is inevitable.* The question is: How do you clean it up?

**30. anticipate clean up**

Emphasis of this step is access to information about cleaning up a spill

Under the Hazardous Communications Standard, chemical manufactures must provide for each chemical a Material Safety Data Sheet (MSDS) that shows the product's ingredients and some medical and environmental protection information. Federal regulation require posting of MSDS. Making information available to employee is mandatory and a frequent source of deficiencies found

during OSHA inspections of worksites. Electronic access is the preferred method of providing MSDS to workers.

An important section on the MSDS is the information on accidental release of the product. This section gives information on cleaning up a spill.

An effort is well underway to harmonize safety sheets from manufacturers around the world. Global Harmonization is becoming a reality so AMTs can expect to see Safety Data Sheets or International Chemical Safety Cards (ICSC). A section of these cards also has information on Spillage disposal.

**31. Sources of info**

Three sources other than the MSDS provide medical and health information and guidance on spill disposal.

**One source** is called Haz Map and is sponsored by the National Library of Medicine. This resource places emphasis on the biological effects of a chemical.

**A second source** is NIOSHTIC sponsored by the National Institutes of Occupational Safety and Health (NIOSH). NIOSHTIC-2 is a searchable bibliographic database of occupational safety and health publications and is updated continually.

**The third source** of information on chemicals, including their cleanup is the NIOSH Pocket Guide to Chemical Hazards referred to as the NPG. In the NPG you'll find chemical properties, medical information and recommended PPE. At the bottom of the chemical information displayed on the NPG is a link to the International Chemical Safety Card.

The preventive message is that clean up information is readily available.

References:
WH: pages 126 – 133
WH,S: pages 49 – 50
search Haz-Map and NPG for stoddard solvent (CAS No. 8052-41-3) and MEK (CAS No. 78-93-3) to determine medical effects and spill disposal

Find Haz-Map at: http://hazmap.nlm.nih.gov/

Find NIOSHTIC-2 at: http://www2a.cdc.gov/nioshtic-2/n2info.asp

Find NIOSH Pocket Guide at: http://www.cdc.gov/niosh/npg/

**32. Step 7**

Step 7: Degreasing stations are good but their misuse can have medical consequences.

**33. use of degreasing station**

Degreasing is a frequent, repetitive task and one where contact with the degreasing agent is probable. Degreasing station prevent direct contact with the clearing agent and its vapor. The illustration on the **left** shows the AMTs unprotected hand degreasing a part with the cleaning solution. Avoid this direct contact with the cleaning agent.

The alternatives are shown on the illustrated on the right. Use gloves as in the **top right**… OR… use a basket to dip material into the cleaning solution, **bottom right**. Use of a degreasing station reinforces the concept of engineering controls discussed in step 2 and avoiding skin contact, step

**34. Maintainer who can't walk**

Medical studies indicate that the degreasing step often generates adverse health effects.

Let me illustrate with a true story that occurred at an engine assembly facility.

- Three mechanics were involved with cleaning and grinding using a solution containing the solvent n-hexane.
- During October 1983 to January 1984 the men gradually developed weakness, numbness and tingling in the lower and upper extremities.
- They started having difficulty walking and holding tools
- By January 1984 all three left work due to disabilities.
- An investigation of their worksite began. Nothing apparently had changed until someone noticed that the n-hexane they were issued in the Fall 1983 was 95%. This concentration was significantly more that the 2% to 5% they had previously used.
- needless to say their worksite had poor ventilation and certainly no Local Exhaust Ventilation.

The medical studies focused on the nerves. The picture on the **top right** is a normal nerve cell with the cell body and an extension called an Axon which transmit the nerve impulse to the muscle causing contractions. The axon is wrapped in a myelin sheath.

The picture on the **lower right** shows what the medical researchers found when they looked at the Axon under the microscope. The myelin sheath was stripped away, causing the biological equivalent of a short circuit. The men couldn't walk because the short circuit prevented nerve impulses from reaching the leg muscles.

**35. Preventive message**

Another example of exposure from a degreasing operation involved the avionics and sheet metal workers at a Navy Air Rework Facility. Five years after that operation, these workers developed testicular cancer. This case, plus the previous one about the mechanics who couldn't walk, illustrates that degreasing and cleaning operations are common sources of exposure.

Preventive message for step 7 recognizes that degreasing is a necessary part of maintenance but highlights concepts presented in previous steps

- First – know how to use the degreasing station and actually use it. In other words, don't simply drop a part into bucket of MEK.
- Second - Keep the degreasing operation contained in one area of the hanger. Don't let cleaning chemical splash outside the work area and onto your skin, see step 4. An important corollary is not to wash your hands in gasoline
- Third – be aware of the chemicals used in the degreasing process. Obtain information about the cleaning solvents using references from step 6, as well as appropriate protections, as outlined in the safety hierarchy from step 2
- Fourth – work in a ventilated area which we discussed in step 3.

To repeat a point previously mentioned - avoid skin contact with the cleaning solvents. Solvent resistant gloves may be appropriate PPE to have available at the degreasing station. A respiratory may be appropriate PPE for cleaning operations producing solvent vapors.

Reference:
WH,S: 16 – 17, 43-44, and 53 - 55

**36. Step 8**

You are not the only person in the work environment. The last step of the WH-8, urges you to consider others when you are in the workplace.

**37. Consider others**

This collection of three scenes illustrates the influence of the work process on others who we call innocent bystanders

**The spray operation**, (Left): Spraying paint or a solvent onto the work results in an overspray that remains airborne as droplets called an aerosol. The operator is using a respirator so we can assume he is protecting his lungs from the overspray. Look at the wind sock. Now look at the innocent bystander, perhaps the hangar's secretary, who is walking downwind from the operation. Judging from the cloud of overspray, the wind will blow this aerosol to the innocent bystander. If the spray contains diisocyantes, then the secretary is becoming sensitized to this

chemical. Upon a subsequent exposure to diisocyantes, she may experience the symptoms of an asthma attack. Diisocyantes are chemicals often present in paints and are a well known cause for asthma. In recent years, adult onset asthma has become increasingly common with an estimated 15% of newly diagnosed cases due to occupational exposures. This scene shows how adult onset asthma can originate from the workplace because of a careless AMT how does not consider others.

**The static engine run-up** (top right): The blades of a helicopter generate a low frequency sound. Unlike sound of high frequency, those of low frequency can easily penetrate the walls of most hangars. In this scene a mechanic and a computer operator who are in nearby hangars are now obtaining their dosage of unwanted noise. A more thoughtful method of conducting the static engine run-up is to taxi the aircraft away from occupied buildings. The ideal location is behind Jersey barriers or earthen mounds that have sufficient mass to stop low frequency sound.

**Keep solvents covered** (lower right): The AMT in this third scene is covering a can of solvents prior to placing it into the solvent locker. By covering the solvent he is limiting the diffusion into the air of Volatile Organic Compounds (VOC) which deplete ozone in the atmosphere. This AMT is considering others.

**38. Follow the stairways**

The Working Healthy - 8 permits mechanics to identify health risks in the aviation workplace and implement preventive measures. We have reviewed all eight steps and shown examples of each. The basis for the subject matter presented in each step originates from medical studies some of which I have documented in this presentation. My point is that the cases I quote are not an abstraction. They are real world situations which I do not want you to repeat.

AMTs working in the hangar can use the WH-8 as soon as their next job. Before starting that job, look at the work process and the work environment. Consider the steps of the WH-8. Ask yourself:

"Could this job result in an exposure that may influence my health?
How do I protect myself?
Could the job influence the health of others?

The steps of the WH-8 allow identification of potential health risks and appropriate preventive measures.

May I suggest a first step? Print out the **WORKING HEALTHY- 8** and paste it to the top of your tool box.

Ref: Allow for reduced sized printed version of WH-8 (size 7.5x7.5)

## 39. Working Healthy, Always

Working healthy *always* means more than just completing this course and printing the WH-8. As a mechanic either A&P certificated or not, you work in an industry with a higher morbidity than other mechanical trades. Morbidity is the medical term that refers to the high non-fatal occupational injuries and illnesses. Your job covers internal combustion engines, refrigeration, sheet metal work, electricity, composite construction, high and low pressure systems to name a few of the multiple exposures. Aviation is also a test site for new technologies so the aviation technician will be the first to maintain any new systems, materials and technology.

Working Healthy *always* means to educate yourself about your health risks; then assume personal responsibly for protecting your health. The three mechanics in the picture didn't protect their health when working on aircraft. They now suffer from respiratory disease, ergonomic injury and hearing loss. By completing this course you should be aware of work processes that lead to these conditions. More importantly, you should know how to prevent these illnesses and injuries.

My goal is to reduce the number of non-fatal occupational injuries and illnesses among AMTs. I hope this course provided you with some insights that will allow us to make progress towards that goal.

Thank you for taking this course. And by all means, go through this course a second and even a third time. I know you'll gain more insights into protecting you heath each time around.

This is DOC Allen asking you to **… Work Healthy *always,***