



**WEAPON SYSTEM POLLUTION PREVENTION**

# MONITOR



Volume 4, Number 5 - Public Release Number 0797

July, 1997

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To be added to our mailing list, please write or call:

Human Systems Center (AFMC)  
**HSC-ESOH Service Center**  
 2402 E. Drive  
 Brooks AFB, TX 78235-5114  
 Commercial: (210) 536-5452  
 DSN 240-5452  
 FAX (210) 536-3228 DSN 240-3228  
 E-Mail:

[JOHN.BIGGS@GUARDIAN.BROOKS.AF.MIL](mailto:JOHN.BIGGS@GUARDIAN.BROOKS.AF.MIL)

## ESOH

### THE THREE PRINCIPLES OF THE AIR FORCE ENVIRONMENT, SAFETY, AND OCCUPATIONAL HEALTH (ESOH) PROGRAM

*SAF/MIQ in concert with partners in the Secretariat and the Air Staff is developing a White Paper which explains how the execution of ESOH programs supports and enhances the Air Force mission. This issue's feature story contains key concepts which will become part of that paper.*

The Air Force's core values of, "integrity, service above self, and excellence in all we do", are the foundation to meeting our operational requirements for the 21<sup>st</sup> century. ESOH programs support these core values through the three principles, outlined in the March 13, 1995 memorandum by the Secretary and the Chief of Staff, of "leveraging resources, sustaining readiness, and being a good neighbor". These principles outline how we intend to interact with a diverse group of stakeholders with integrity, to serve the long range needs of our environment and of our personnel, and to strive for excellence by improving productivity and reducing costs. We believe enhanced execution of the ESOH program can lead the Air Force to substantial productivity improvements by 2005, and we are working with the Air Force Financial and Planning Offices to quantify an appropriate goal. This article provides an overview of the key aspects in meeting the ESOH principles, as summarized in **Figure 1**.

Air Force ESOH Principles	Key Aspects of Meeting Principles
<b>Leverage Resources</b>	<ul style="list-style-type: none"> <li>➔ Meet the objectives of the AF Pollution Prevention Strategy dated 24 July 95</li> <li>➔ Develop a systematic, quality based management system</li> </ul>
<b>Sustain Readiness</b>	<ul style="list-style-type: none"> <li>➔ Maintain access to training ranges and installations</li> <li>➔ Ensure workplace health and safety</li> <li>➔ Maintain medical readiness</li> </ul>
<b>Be A Good Neighbor</b>	<ul style="list-style-type: none"> <li>➔ Develop community-based environmental programs on sound science and informed stakeholders</li> </ul>

**Figure 1. Key Aspects for Meeting the AF ESOH Principles**

**PRINCIPLE I: LEVERAGING RESOURCES**

The four objectives of the Air Force Pollution Prevention (P2) Strategy, signed out by the Secretary and Chief of Staff on July 24, 1995 are the cornerstone for leveraging resources. These objectives include the following:

- Institutionalize P2 into all phases of the weapon system life cycle.
- Incorporate P2 into all aspects of installation operations.
- Permeate all mission areas with the P2 ethic through comprehensive education, training, and awareness.
- Develop and transition innovative technologies to the field.

The key to leveraging resources lies in developing a smart investment strategy (see article on page 6 for current efforts at Tinker AFB). This strategy would create a process for making business decisions that provides a maximum return on investment while supporting the mission. AF business decisions (i.e., using our Planning, Programming, and Budgeting System) should adequately consider the true cost of pollution and the true cost of hazards borne by our workers and communities. Clearly, to develop a smart investment strategy we need a supporting cost accounting system and tools to analyze costs. Cost accounting systems and analysis tools however, are not enough; we need to re-look at our overall management system to ensure it is world class and incorporates a cycle of “plan-act-check” to ensure the highest levels of quality. Figure 2 summarizes some of the Air Force’s initiatives supporting this principle.

AF Strategic Objectives	Goal	AF Initiatives
Institutionalize P2 into all phases of the weapon system life cycle.	Every weapon system program manager should <b>consider the cost of pollution</b> as part of his normal decision making.	ESOH issues need to be considered in the development and sustainment of weapon systems. Partnering with other services both to benchmark and to share lessons learned; the <b>Joint Group on Acquisition P2 (JG-APP)</b> and the <b>Tri-Service Technology Needs Survey (TNS)</b> are two such examples.
	<b>Enhance the Linkage</b> between <b>Civil Engineering (CE)</b> offices at installations who pay for waste disposal, <b>technical offices</b> who design and change the processes, and <b>the operators</b> who develop the performance requirements.	<b>Hazardous Materials Prioritization Process (HMPP)</b> was developed to link the installation user who must pay for compliance requirements and waste disposal with the Weapon System Program Office that has the authority to bring about a change. HMPP has identified 127 priority requirements that Single Managers and major commands are now considering.
Incorporate P2 into all aspects of installation operations.	<b>Refocus AF programs with compliance to pollution prevention.</b>	<b>Environmental investment (ENVVEST)</b> project at Vandenberg AFB, CA will soon become the first installation to develop a Final Project Agreement that will move administrative compliance costs to P2 projects.
Permeate all mission areas with the P2 ethic through comprehensive education, training, and awareness.	Empower and educate workers to take <b>ownership of the processes</b> where they work.	The <b>Shop Level P2 Training Manual</b> developed by AETC is one such example.
Develop and transition innovative technologies to the field.	Facilitate <b>improved communication</b> between those <b>organizations requiring off-the-shelf technology</b> and <b>those who develop</b> and understand <b>technology</b> .	<b>ESOH TPIPT</b> enhancements are improving the process of identifying and fielding near-term solutions. In concert with other federal agencies, we are compiling a directory of our requirements and a secondary directory of available technologies.

**Figure 2. AF Initiatives to Support ESOH Principle I of Leveraging Resources**

**PRINCIPLE II: SUSTAINING READINESS**

The principle of sustaining readiness focuses on the following three areas:

- Maintaining access to training ranges and installations;
- Ensuring worker health and safety; and
- Enhancing force readiness.

We have a covenant with the American people. They have entrusted us with over nine million acres of land, a half million acres of forests and 1100 miles of streams and rivers for our training ranges and installations. These lands provide a habitat for endangered and threatened species of great value, for example, in the Pacific north-west, the Yew tree was considered of no value. Scientists now know that the bark of the Yew tree is an irreplaceable source for taxol, a very powerful anti-tumor compound used to treat ovarian cancer. We are beginning to understand that every species and supporting ecosystem holds the potential for significant benefit to humanity. **Figure 3** summarizes the major elements in our plan to be good stewards.

Key Elements to Maintaining Access to AF Training Ranges and Installations	Summary of AF Initiatives
Conservation through enhancement of biodiversity and sound ecosystem management.	In support of conservation, the AF has completed the biological and wetland inventory of its installations and the cultural resource inventories are more than 80% completed. Additionally, plans to support the natural and cultural resource conservation at AF installations are more than 70% complete. The AF is implementing conservation principles in <u>Conserving Biodiversity on Military Lands</u> , developed by the Nature Conservancy. AF was the DoD Executive Agent for developing this handbook. The keystone dialogue on ranges is being conducted to develop procedures for implementing the handbook.
Full compliance with environmental regulations.	Two thirds of the land entrusted to the AF is encompassed in Goldwater and Nellis Training Ranges. Currently, the AF is conducting an extensive environmental analysis in preparation for renewing the withdrawal action which expires in 2001. Concurrently, we are working with interested parties to build sound conservation management programs. These programs are being built in the model presented in <u>Conserving Biodiversity on Military Lands</u> . A case is being made that the cost of environmental analysis conducted every 15 years could be better used for accomplishing significant conservation and management projects on the ranges.

**Figure 3. Summary of Key Elements of Maintaining Access to AF Training Ranges and Installations**

The Air Force’s Occupational Safety and Health Program sustains readiness by protecting every worker’s health and safety in peacetime as well as in all levels of conflict. History shows that non-battle casualties exceed battle casualties. In the future as we downsize, the value of the each individual will have a greater impact on the outcome of the conflict than ever before. A warfighter who is healthy and safe is more productive, effective, and efficient. This program’s thrust areas include: prevention of disease and injury; sustained enhancement of human performance; and successful integration of humans and weapon systems. **Figure 4** summarizes some of the activities conducted in this area.

Key Elements to Sustaining Readiness	Program/Initiatives	Summary of Program/Initiative
Ensuring Worker Health & Safety	AF Occupational and Environmental, Safety, Fire Protection and Health (AFOSH) Program	The AFOSH Program mitigates threats through risk-based approaches involving engineering changes in the environment, life support equipment, personal protective equipment, health education and surveillance, and health promotion and fitness programs to reduce occupational injuries and illness. AF expenditures on workmen compensation claims decreased by 2% representing a cost avoidance of over \$2 million.
	The Operational Risk Management (ORM) Program	The ORM program provides a process for reducing or offsetting risk to make well-informed decisions and ensure mission success. Additionally, the Safety Center is developing a capability to understand and analyze the root cause of injuries through epidemiological approaches to better target injury prevention strategies.
	The Bird Aircraft Strike Hazard (BASH)	The Safety staff has invigorated the BASH program by creating appropriate changes to mishap investigations requiring safety education, and promoting techniques of airfield management to reduce the incidence of wildlife strikes to aircraft.
	The Weapon Safety Program	The program has developed and fielded the Base Explosive Exception Matrix (BEEM). This software program allows the AF to identify, prioritize, and develop investment strategies to correct waiver and exemptions to explosive safety standards. Additionally, the program helps to assure that stored weapons do not pose a threat to AF personnel and surrounding communities.
Enhancing Force Readiness	Training	Training efforts in the AF will move from the T-37 Primary Jet Trainer to the Joint Primary Aircraft Training System (JPATS) in the year 2000. Detailed analysis of cockpit space using upper and lower limits of body size required to safely and effectively operate the aircraft will ensure that pilots being trained will be matched to an aircraft that is most compatible with their physical size.
	The Advanced Tactical Anti-G Suit (ATAGS)	ATAGS, developed at Brooks AFB, is the most significant improvement in the anti-G suit since World War II. The suits, which are worn like trousers, provide compression which helps the fighter pilot avoid losing consciousness when experiencing high G forces. ATAGS reduces the amount of strain on the pilot to avoid loss of consciousness.
	Force Readiness	As the AF prepares for a variety of wartime and contingency operations, it is necessary that we take steps to maximize the abilities of our warfighters and support personnel to perform at their highest levels for sustained periods. A number of initiatives are planned involving human factors, medical surveillance, and predeployment preparations to support this effort.

**Figure 4. Summary of Key AF Programs to Sustain Readiness**

**ESOH PRINCIPLE III: BEING A GOOD NEIGHBOR**

At the heart of being a good neighbor is communication. Each Air Force installation seeks to be a responsible neighbor, sensitive to community problems, and an active participant in programs to improve the local quality of life. Part of being a good neighbor is to reduce the present impact of past contamination and to complete cleanups based on sound science and dialog with the community. The Air Force has over 1,800 sites out of 4,074 that have been remediated or that require no further action. Just over 2,000 sites still require action and this year our focus continues to move from studying site problems to cleanup and closure. Over 75% of program funding is directly used for cleanup.

The Air Force’s participation in the Federal Facilities Environmental Restoration Dialogue Committee (FFERDC) and the effort to incorporate the Committee’s recommendations into Air Force Policy has provided a firm foundation for a Community Base Environmental Program (CBEP). The FFERDC recommended establishing Restoration Advisory Boards (RABs) as an avenue of communicating with the public and other stakeholders. The Air Force has established RABs and they are proving to be a valuable asset to our Restoration Program. Partnering with the RABs and establishing the regulatory community performance-based clean up is meeting community needs while more efficiently using the Air Force’s limited restoration funds. The experience gained from RABs points the way to even greater collaboration with our community neighbors in ESOH activities. This collaboration would be facilitated by expanding RABs to Community Based Advisory Boards, or CABs. Vandenberg is one base that has already made this transition from RABs to CABs.

We share with every community the goal of effectively spending American tax dollars and of assuring the protection of human health and the environment. We are developing a new tool which will help achieve this goal called the Enhanced Site-Specific Risk Assessment (ESSRA). When risk assessments are performed using generic values for pathways and receptors, calculations for acceptable contaminant levels are very conservative. Programs designed to meet these conservative clean up contaminant levels can be very expensive while providing little additional risk reduction. A site specific risk assessment uses the actual local pathway and receptor values to calculate a clean up contaminant level based on local conditions that is protective of human health and the environment. ESSRA will be an essential tool for stakeholders in the formulation of cleanup decisions.

Finally, the Base Realignment and Closure (BRAC) program illustrates that we can finish clean up and return funds to our Total Obligation Authority. It demonstrates that good environmental practices are the foundation to future clean up and that clean up does build new communities where people can thrive. **Figure 5** summarizes some of the major Air Force initiatives concerning this principle.

Key Elements to Being a Good Neighbor	Summary of AF Initiatives
Completing clean-up of contaminated sites to levels that protect human health and the environment.	Currently, the AF has 4,074 restoration sites in the AF management inventory. More than 45% of these sites have been remediated or assessed as requiring no further action and 75% of program funding is now directly used for cleanup actions. The AF is committed to meeting the Defense Planning Guidance and risk reduction or remedies in place for all high risk sites by 2002, medium risk sites by 2008, and low risk sites by 2015.
Positive participation in community ESOH programs.	AF installations voluntarily participate in a wide range of ESOH community programs like Groundwater Guardian and Tree City.
Restoration Advisory Boards (RABs).	Establish RABs as a major route of communication between local communities and AF installations.

**Figure 5. Summary of Key Elements of Being a Good Neighbor**

For further information pertaining to the three principles of the ESOH Program and the upcoming White Paper, please contact Lt. Col. John Garland, SAF/MIQ at DSN 227-1019 or e-mail [garlandJ@af.pentagon.mil](mailto:garlandJ@af.pentagon.mil). ■

## ***TINKER AFB DEVELOPS A POLLUTION PREVENTION INVESTMENT STRATEGY***

The mindset for pollution prevention at Tinker AFB is one rooted in a business approach that encompasses all aspects of environmental stewardship. This includes air, water and land initiatives with a genuine focus on reducing occupational health and safety exposure to Tinker AFB's workforce. The bottom line for pollution prevention initiatives at Tinker AFB is; does it make ESOH and economic sense? With this approach, Tinker AFB has found that when implemented properly, pollution prevention saves money while accomplishing many other beneficial results.

Historically, through partnerships with industry, technology development and transfer, and notable source reduction within its fences, Tinker AFB has developed a broad-based approach to acquisition pollution prevention (APP). Tinker AFB is a model for how pollution prevention should operate while maintaining aging weapon systems efficiently and effectively.

### **Overview of Tinker AFB's Investment Strategy**

Tinker AFB has developed an investment strategy that has been adopted by HQ AFMC and focuses on a business-oriented approach to pollution prevention. The investment strategy is based on the premise that pollution prevention is both ESOH and economically favorable. The foundation of the strategy is to empower the installations to attack pollution at the source so that they can justify, fund, and implement projects. As a result, the strategy focuses source reduction within available resources which is imperative in light of shrinking budgets across the DoD.

One of the objectives of the strategy is to identify coalitions, partnerships, and establish Memorandum of Understandings (MOUs) in order to accomplish the goals of the center and the surrounding community. The strategy also favors technology advancement and exportability as an investment in the future of the installation, command, Air Force, and DoD.

The magnitude of the investment requirements for a depot facility are large. The Pollution Prevention Division has taken a systematic team approach to meet these requirements. One aspect of this effort involves capturing outside funds to accomplish the installation's objectives and thereby involving the surrounding community in future coalitions.

Tinker AFB's commitment to partnering with private industry is exemplified in the Alternative Fuels Program, a joint venture between Tinker AFB and Oklahoma Natural Gas (ONG). In order to improve or simply maintain air quality standards and to keep up with increasing environmental constraints, it is necessary to investigate and promote new technologies such as the use of compressed natural gas (CNG). This program is aimed to reduce atmospheric pollution and curb the consumption of the earth's fossil fuels. The program was developed to serve as a testing ground for the feasibility of CNG vehicles in the private sector. The Air Force did not have funds to explore this technology; therefore, Tinker partnered with ONG to advance the technology. ONG was responsible for R&D and all costs except for fuel and compression costs. Tinker is responsible for the latter. To date, Tinker has converted 270 vehicles including fire trucks, ambulances, station wagons, and buses to CNG. As a result, Tinker has reduced CO2 emissions by 9600 pounds and reduced annual gasoline usage by 141,000 gallons.

### **Framework for Success**

The intimate relationship between the System Program Office (SPO), Integrated Environmental Team (IET), and Aircraft Maintenance Operations has greatly contributed to the success of the APP Program at Tinker AFB. Centralized engineering at Tinker AFB provides the framework necessary to maintain these relationships. The centralized pollution prevention engineering setup, specific to Tinker AFB, has connected all players necessary to make pollution prevention for weapon systems in the Operation and Sustainment (O&S) phase feasible. This systematic approach has become the platform on which business is now conducted at Tinker AFB.

The key to the success of the APP Program lies in the infrastructure established through the Pollution Prevention Division. P2 engineers are placed in areas of greatest influence throughout the depot (i.e., the weapon system SPO and product directorates). The engineers work hand in hand with production engineers, providing environmental support while becoming proficient and knowledgeable in the production processes that generate pollution. The P2 centralized engineering effort also dedicates P2 engineers to the weapon systems. This integrates P2 objectives and initiatives into the authority guiding all SPO production efforts.

Each of the P2 engineers is also a member of the Integrated Environmental Team (IET), providing a direct link to Bioenvironmental Engineering and Base Safety. The Integrated Environmental Team (IET) uniquely combines the resources of Environmental Management, Base Safety, and Bioenvironmental Engineering. This team is the foundation for advancing the current ESOH philosophy accepted by the Air Force. Additional resources are made available through various working groups.

Through the above infrastructure, Tinker AFB has created a team capable of identifying, approving, and implementing pollution prevention projects, which are sensitive to occupational health and safety, into production operations while at the same time having a direct impact on APP. This is achievable by having weapon system Single Managers (SMs) in the loop for the entire process.

Working collaboratively, Tinker AFB's SMs, P2 personnel, production engineering, and industrial technologist have researched and prototyped a new environmentally acceptable chemical stripper that strips the most difficult coatings in less time than currently used materials. Transition to full production is pending a waste treatment study currently underway. When implemented, the stripper will eliminate over 400K pounds of methylene chloride usage annually at Tinker AFB. The stripper dubbed "purple goop" improves mission capability, requires a smaller volume of material for successful stripping, and will prove to be a lifesaver for Tinker and other contract facilities once the Aerospace NESHAP kicks in, 1 Sept. 1998, because it contains no hazardous air pollutants (HAPs).

## Resources

Instead of requiring and expecting production operations to dedicate manpower and resources to pollution prevention objectives, the Tinker AFB APP program takes pollution prevention to the customer. This program allows production to focus on their mission of maintaining airframes, engines, and accessories. P2 engineers learn the production processes and how to implement P2 initiatives without impacting mission requirements. Often P2 projects not only save money but flow-time, an increasingly important commodity to the operation and readiness of the Air Force.

Additional resources are made available to support pollution prevention efforts through various working groups. The IET sponsors many working groups including the newly formed ESOH working group {formerly separated as the Air Force Occupational and Environmental, Safety, Fire Protection and Health, and the Environmental Protection Committee Working Group (EPC WG)} chaired by the Center Director (CD). Other working groups include base-wide ODC, APP, Air Quality, Hazardous Waste, and Hazardous Material working groups. The Pollution Prevention Division also chairs SPO and production sponsored working groups. Each of these working groups provides a vital communication link necessary for the efficient transfer of technology to other weapon systems and installations. These working groups are complemented by informative P2 newsletters which are published on a regular basis. Environmental and depot level working group action items are in turn briefed to the MAJCOMs through the Board of Directors at the semi-annual Weapon System Roadmap Meetings.

Tinker AFB's thrust to get away from ODSs for use in refrigeration equipment has pioneered the use of FRIGC. FRIGC is an azeotropic mixture, that is on the EPA's Significant New Alternative Program (SNAP) approved list, for replacing R-12. Tinker AFB's support has generated wide interest for FRIGC becoming the standard replacement for this class of chemicals within AFMC.

## Depot Level Operations

In the Air Force, depot operations are primarily focused on maintaining airframe, engines, and accessories for the SPO. Typical depot maintenance processes include paint/depaint, non-destructive inspections (NDIs), parts and accessories cleaning; as well as, many more maintenance processes. These processes are performed in the various product directorates, such as the Aircraft Directorate (LA), Propulsion Directorate (LP), and the Commodities Directorate (LI). All product directorates are supported by the Integrated Environmental Team (IET), Industrial Technology Directorate (TI), and Civil Engineering (CE).

The five depot facilities within HQ AFMC produce over 90% of the Air Force's pollution. Therefore, it makes sense to focus P2 efforts at these five facilities. An effective APP Program must have in-depth exposure on how these depot facilities operate. Therefore, it is necessary to link the P2 program to the processes that generate the pollution which is to be prevented. Tinker AFB has been successful at reducing pollution at its source and was recently recognized as an EPA Region 6 Pollution Prevention Success Story for 1997 in this area.

Based on the experience at Tinker AFB, an excellent P2 program must identify, validate and implement P2 projects that improve the ESOH aspect of depot operations without sacrificing mission requirements. Impact on production flowdays and operational costs must be considered in all P2 initiatives. Any loss of flow-time is unacceptable to the Designated Acquisition Commander (DAC), SPOs, MAJCOMs, and the aforementioned product directorates.

Tinker AFB has partnered with Oklahoma Gas & Electric (OG&E) to identify base-wide energy conservation and wastewater minimization opportunities. The assessment identified the potential for a 200,000 gal/day wastewater reduction and an energy savings of over \$190,000/yr. In February 96, Tinker hosted an OG&E sponsored technology seminar for corporations throughout the State of Oklahoma. The seminar enhanced technology transfer and improved communications between the Tinker AFB and local industries.

## Tracking Pollution Prevention - A Team Effort

P2 engineers, track their pollution prevention efforts for the organizations to which they are dedicated. Again, because the program provides this support to the production organizations, production can focus on their mission. This increases the accuracy and hence the relevancy of all P2 tracking efforts.

The metrics and roadmaps used for P2 tracking efforts tie material usage to process Technical Orders, the lifeline for preventing pollution in acquisition. Technical Orders can then be changed, thus, closing the loop for a permanent and successful P2 effort.

## Technology Transfer

Centralized engineering not only provides an efficient system for making progress, it also enables efficient technology transfer. The realm of influence created by the APP program at the Tinker AFB provides an avenue for expedient technology transfer. A successful P2 effort developed for one weapon system is easily transferred to other weapon systems via the P2 engineers in the product directorates. Each of these weapon systems can in turn transfer P2 ideas and solutions to their field units; as well as, the other depot facilities. Because of the centralized team, success in one product directorate is always transferred to other applicable areas throughout the center's product directorates. Direct technology transfer is complemented by the Environmental Working Groups and newsletters managed and published in the P2 division at Tinker AFB. In this respect, the APP program exemplifies a team effort while solving individual problems. The walls of communication have been opened; therefore, increasing the efficiency of technology transfer.

The Environmental Management Directorate has also created a Technology Office (EMT), exclusively dedicated to technology transfer, partnerships, and advancement. Technology coalitions are the key to successful

development & demonstration of projects, commercial off-the-shelf (COTS) technology applications, and funding partnerships.

The EMT Division at Tinker AFB has pursued an aggressive technology transfer with the Department of Energy's (DOE) Pacific Northwest Laboratories (PNL). In July 95, engineers from Tinker AFB toured PNL facilities in an effort to identify technologies applicable to Tinker AFB's industrial needs. On 13 August 95, Tinker AFB and DOE signed an MOU to form a technology transfer coalition. To date, 12 technology transfer opportunities have been identified and are currently being pursued.

### Issues

Tinker AFB's APP program is an efficient mechanism for implementing P2 technology into production operations and then transferring these technologies throughout the command. Obtaining weapon system buy-in is not a milestone in Tinker AFB's APP program, it is the cornerstone of its existence. Further, an impressive track record that includes no Notices of Violation (NOVs) for compliance in the past five years supports Tinker AFB's commitment as a leader in environmental excellence. Additionally, coalitions, partnerships, and MOUs with private industry, universities, and governmental agencies add to the broad base of support Tinker AFB shares with its surrounding community, the command, the Air Force, and the DoD.

For further information, please contact Marc Taylor at DSN 336-3832.

*This article was submitted by Marc Taylor, OC-ALC/EMV. ■*

ESOH WWW Site Description	ESOH WWW Site Location
USAF ESOH Technical Planning Integrated Product Team (TPIPT)	<a href="http://xre.brooks.af.mil">http://xre.brooks.af.mil</a>
ESOH Service Center	<a href="http://www.brooks.af.mil/ESOH/esohtome.htm">http://www.brooks.af.mil/ESOH/esohtome.htm</a>
U.S. Navy ESOH Home Page	<a href="http://www.enviro.navy.mil">http://www.enviro.navy.mil</a>
DOE Office of Environment Safety & Health (ES&H) Technical Support	<a href="http://www.er.doe.gov/production/esh/er8home.html">http://www.er.doe.gov/production/esh/er8home.html</a>
USAF Center for Environmental Excellence (AFCEE)	<a href="http://www.afcee.brooks.af.mil">http://www.afcee.brooks.af.mil</a>
USAF Civil Engineer Support Agency (AFCESA)	<a href="http://www.afcesa.af.mil">http://www.afcesa.af.mil</a>
USAF Safety Center	<a href="http://www-afsc.saia.af.mil">http://www-afsc.saia.af.mil</a>
USAF Bird Aircraft Strike Hazard	<a href="http://www-afsc.af.mil/AFSC/Bash/home.htm">http://www-afsc.af.mil/AFSC/Bash/home.htm</a>
USAF Flight Safety Statistics	<a href="http://www-afsc.saia.af.mil/AFSC/RDBMS/Functions/stats/fltstats.html">http://www-afsc.saia.af.mil/AFSC/RDBMS/Functions/stats/fltstats.html</a>
USAF Operational Risk Management Program	<a href="http://www-afsc.saia.af.mil/AFSC/RDBMS/ORM/ormintro.htm">http://www-afsc.saia.af.mil/AFSC/RDBMS/ORM/ormintro.htm</a>
U.S. Army Safety Center	<a href="http://safety.army.mil">http://safety.army.mil</a>
Agency for Toxic Substance & Disease Registry (ATSDR)	<a href="http://atsdr1.atsdr.cdc.gov:8080/atsdrhome.html">http://atsdr1.atsdr.cdc.gov:8080/atsdrhome.html</a>
Center for Disease Control (CDC)	<a href="http://www.cdc.gov">http://www.cdc.gov</a>
DAEDALUS: The Aeromedical On-Line Library	<a href="http://www.brooks.af.mil/AL/SD/DAEDALUS/">http://www.brooks.af.mil/AL/SD/DAEDALUS/</a>
Material Safety Data Sheet (MSDS) Search - U.S. Depot of Commerce	<a href="http://research.nwfsc.noaa.gov/msds.html">http://research.nwfsc.noaa.gov/msds.html</a>
National Institute of Occupational Safety and Health (NIOSH)	<a href="http://www.cdc.gov/niosh/homepage.html">http://www.cdc.gov/niosh/homepage.html</a>
National Institute of Environmental Health Sciences (NIEHS)	<a href="http://www.niehs.nih.gov">http://www.niehs.nih.gov</a>
National Institute of Health	<a href="http://www.nih.gov">http://www.nih.gov</a>

## **COMMUNITY CROSS-FEED**

### **FEEDBACK FROM THE READERS**

Read the F-22 story in the MONITOR with great interest, but nowhere was the cost to do these wonderful things mentioned! Was this an oversight or was it just too costly to say? My guess it's the latter.

Cost is an important element in all of this effort - and most of us don't have a clue as to how to price things out. If we can see costs associated with the articles in the MONITOR, we can begin to develop a gut feel for what to expect on our weapon systems.

*Ms. Irene Gorczyca, ESC/AWE, Hanscom AFB, MA*

I am the Program Director for the Army Acquisition Pollution Prevention Program. As such, I look forward to viewing the MONITOR each time it is published. Your May 1997 edition was particularly good and will provide some great information for the Army PMs.

*Mr. George Terrell, HQ AMC/AMCRD-E, Alexandria, VA.*

This is the best and only mechanism available where different weapon systems are shown with the process improvements and technology initiatives. The MONITOR provides the Air Force a positive source of communication among the various weapon systems. Keep up the good work!

*Capt Sheila Scott, 95AMDS/SGPB, Edwards AFB, CA.*

The Depot Maintenance-Hazardous Material Management System (DM-HMMS) is the logistics depot standard system for hazardous material management in use by the majority of Department of Defense depots. It is the Air Force Materiel Command's system of choice. DM-HMMS is the system being used by Edwards AFB to maintain information on hazardous materials being used for the F-22. As such, we would be very interested in having an article featuring our system included in a future copy of the MONITOR.

*Excerpts from a letter received from Mr. Brian F. Drew, JLSC/DM, Wright-Patterson AFB, OH. ■*

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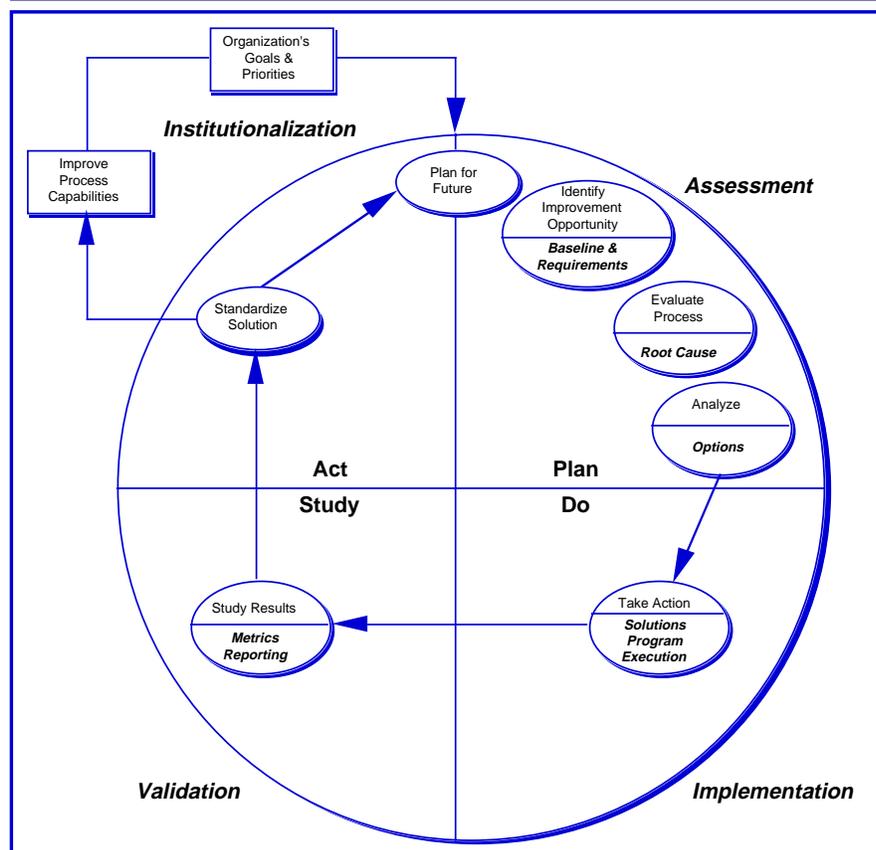
### **PERSPECTIVES IN PROFILE: ROOT CAUSE ANALYSIS IS THE KEY TO PRODUCTIVITY IMPROVEMENT VIA POLLUTION PREVENTION**

Based on our P2 experience at the Arnold Engineering Development Center (AEDC), we agree with Mr. Tad McCall's statement (made in the March 1997 issue of the MONITOR) that Environment, Safety and Health programs enhance rather than detract from the weapon system program. We further believe that in order to realize the benefits of the "greater opportunities for new efficiency," we need to translate the lessons learned from successful Pollution Prevention (P2) programs from industrial leaders (such as Dow, 3M, Ford and others) to Air Force facilities.

These industrial programs show that the most striking P2 successes address the waste before it is generated, however, many times the success didn't occur until management "encouraged" engineers "to go back for a second look." Based on this experience, two key questions then to ask are: "Is there a critical issue related to P2 successes?" and "How can we examine this critical issue at the outset rather than having to take a second look?"

P2 projects generate substantial cost savings when the **P2 option is matched with the root cause of the source of the waste instead of its symptoms**. The critical issue of root cause analysis in P2 successes is not a surprise because P2 is a process of change. Fortunately, this concept is easy to apply to Air Force facilities because the Continuous Improvement Process (CIP) outlined in the QAF Program highlights the importance of defining the root cause of an opportunity before trying to evaluate solutions (see [Figure 6 on page 11](#) for the relationship between AEDC's P2 Process Methodology and the CIP).

At AEDC, we have applied these lessons learned by first modifying the Air Force methodology for Pollution Prevention Opportunity Assessments (PPOAs) to include the intentional definition of the root cause of the



**Figure 6. AEDC's P2 Process Methodology**

generation of the waste before considering P2 options. We have also categorized the repeating patterns to waste generation that are independent of the product or industry which allow us to approach each facility from the same P2 perspective. For example, the P2 perspective of industrial processes at AEDC shown in Figure 7 (see page 12) can apply to any other Air Force facility. Materials are used at specific points in the process where they are converted to products or wastes. At Air Force facilities, almost all materials purchased become wastes because the mission is usually a service (e.g. test results, maintenance of aircraft, training of Air Force personnel) not a product.

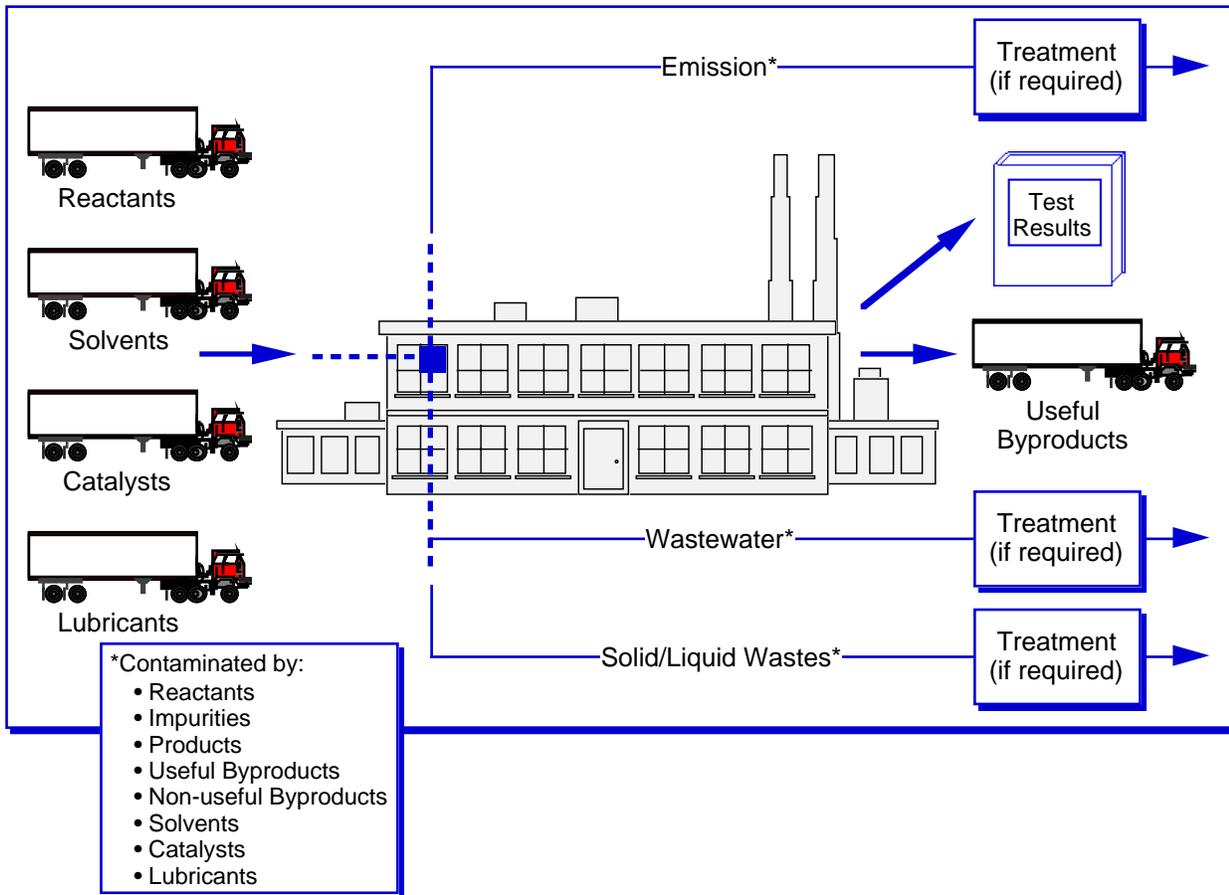
Knowing these repeating patterns has allowed us to develop two diagnostic lists: one for all 4 of the categories of root causes and one

for all 8 of the categories of components of wastes. The 4 categories of root causes are the **chemistry** of the process, the **engineering** of the process, the way the process is **operated** and the way the process is **maintained**. The list of 8 categories of the components of wastes is also shown in Figure 7 (see page 12). These two diagnostic lists allow us to quickly identify viable P2 options because they transform the subjective question "What is the root cause of your waste?" to the easier, multiple-choice question "Which of the items on these lists are root causes for your waste?"

In many cases, determining the root cause of the waste generation has identified opportunities to achieve the mandated P2 reduction metric without losing the benefits afforded by the use of a particular hazardous materials. This was especially important when there was no "drop-in" replacement for a targeted hazardous material or when the cost for converting to a new chemical was prohibitive. For example, addressing the root causes of losses of TCE [the heat transfer fluid in the system to sub-cool and dry hundreds of thousands of cubic feet per minute of air in the Engine Test Facility (ETF)] has avoided the need to spend \$20 million for a substitute. Also, a major hazardous waste acid stream from the chemical cleaning facility has been significantly minimized by stretching out the dump cycle, limiting contaminants that must be purged from the process, evaporating excess water from the acid bath, and installing a filter so that the intended by-product of the principal reaction (iron phosphate) can be removed as a solid instead of a more dilute liquid. In another case, usage of CFC-113 for cleaning fuel cell panels was reduced by 98% by using an aqueous cleaner in all steps but the final rinse and verification steps.

*Lt Lance Turner, Arnold AFB, TN  
Mr. Chuck Parmele, SAIC, Oak Ridge, TN*

*If you have used root cause analysis as a methodology to solve your ESOH issues or to enhance productivity, please let us know about your efforts (e-mail: [john.biggs@guardian.brooks.af.mil](mailto:john.biggs@guardian.brooks.af.mil)).* ■



**Figure 7. P2 Perspective of Industrial Processes at AEDC**

***ACQUISITION STRATEGY FOR COMFORT PALLETES ELIMINATES THE REQUIREMENTS FOR ODSs***

The Air Transportable Galley Lavatory, also referred to as comfort pallet, is commonly used in multiple Air Force weapon systems. The maintenance of the comfort pallets is managed by the Machinery, Materials, and Tools (MMT) Materiel Group for the Air Force, located at the WR-ALC. The MMT Materiel Group provides global sustainment support for 188 Federal Stock Classes. The group’s sustainment support activities includes procurement, distribution, repair, as well as technical/engineering support for items within these classes. Some of the diverse Federal Stock Groups (FSGs) managed by this group are summarized in **Figure 8**.

**Requirements Driving Comfort Pallet Modifications**

In 1989, the MMT Materiel Group’s Single Manager, the Military Airlift Command operators and maintainers (now Air Mobility Command (prime owner/user)), and C-141 management hosted a meeting to discuss the current condition of the comfort pallets in the Air Force, particularly for the C-141. It became evident that the old comfort pallets, which were now 20-35 years old, were becoming unsupportable and were no longer cost effective to maintain. Some parts of the system were so

- Federal Stock Groups (FSG)\***
- Bearings (FSG 31)
  - Industrial Plant Equipment and Machinery (FSG 34)
  - Hand Tools (FSG 51)
  - Precision Measurement Tool and Gages (FSG 52)
  - Paints, Sealants and Adhesives (FSG 80)
  - Kitchen/Galley Items (FSG 73)
  - Containers (FSG 81)

*\*All related technical and engineering data for these items are managed by the MMT Materiel Group*

**Figure 8. A Partial Listing of Items Managed by the MMT Materiel Group**

obsolete that they were being manufactured locally, thereby adding to the overall cost for sustainment. The stakeholders decided to acquire one comfort pallet to replace the two currently in use. The MMT Materiel Group Manager undertook a project to pursue acquisition of a comfort pallet which would meet all requirements. The comfort pallet acquisition strategy developed at WR-ALC incorporated the requirements for the C-17 comfort pallet which was in development at that time.

### **Environmental Benefits Resulting from Acquisition Strategy**

The comfort pallet acquisition strategy has resulted in the procurement of commercial off-the-shelf (COTS) technologies for all major subassemblies such as oven, refrigerator, brewer, water and waste systems. The prime environmental benefit of this initiative has been the procurement of a refrigerator that is Freon free and uses a totally electronic module to provide the cooling capability to operate the refrigerator. The existing thermoelectric technology was repackaged to meet Air Force requirements and has eliminated the use of ODSs in the comfort pallet. Additionally, this new technology provides a higher mean time between failure than conventional ODS using refrigerators. The C-17 prime contractor and the Air Force are currently evaluating the use of the thermoelectric refrigerator on the C-17. The C-5 Program Office at Kelly AFB, is also reviewing the technology for future requirements on the C-5.

For further information regarding this effort, please contact Mr. Richard Weeks, the MMT Materiel Group Single Manager at DSN 468-2367. ■

## **ROLE OF TOXICOLOGY IN THE RISK ASSESSMENT PROCESS**

A technical paper entitled "An Overview of the Risk Assessment of Hazardous Materials and the Role of Toxicology" authored by Dr. David Mattie, Armstrong Laboratory Occupational and Environmental Health Directorate Toxicology Division (AL/OET), was recently published in the Annals of Clinical and Laboratory Science, Vol. 27, No. 3. The chemical risk assessment process is discussed along with its role in evaluating hazardous materials in the workplace and environmental settings. The recent emphasis on environmentally-friendly chemicals resulted in the need to evaluate and select alternatives for hazardous materials. Risk assessment is used to evaluate the toxicity of these chemicals and allow the least hazardous material to be selected providing the material meets performance and compatibility criteria.

An overview of toxicology is presented to provide a better understanding of the role of toxicology in the risk assessment process. A brief overview of toxicity screens and tests are presented to help make the use of toxicity data more meaningful.

Specific examples of how toxicology data is used in the risk assessment process are presented. One example involves toxicological examination of four potential substitutes for replacement of Halon 1301 for fire protection purposes in unoccupied spaces, such as aircraft engines or dry bays. Another example involves providing toxicity studies of trichloroethylene (TCE) to better define its impact and decrease the uncertainty factors concerning human health risk. The more realistic risk assessment should result in a higher standard for human exposure and result in lower remediation costs concerning removing TCE from groundwater.

Dr. Mattie concludes his paper with a description of Tri-Service Toxicology. Tri-Service Toxicology is the collocation of laboratory services from three Department of Defense (DoD) Services (Army, Navy, and Air Force) at Wright-Patterson AFB, Ohio. Laboratory services are provided on a fee-for-service basis to DoD. Collaboration with industry and academia is possible through cooperative research and development agreements (CRDAs) and memorandum of agreements (MOAs). Tri-Service Toxicology serves to identify the potential human health hazards of new and current chemicals and materials, develop innovative risk assessment methodologies, and investigate mechanisms of occupational toxicity.

Reprints of this technical paper may be obtained from Dr. David Mattie, AL/OET, at DSN 785-5150 ext. 3105 or E-mail to <[mattied@falcon.al.wpafb.af.mil](mailto:mattied@falcon.al.wpafb.af.mil)>. ■

### **AL/OE NEWSLETTER**

The Armstrong Laboratory Occupational and Environmental Health Directorate (AL/OE) provides a newsletter with environment, safety and occupational health (ESOH) information. Laboratory services information is also provided. E-mail John Biggs at [john.biggs@guardian.brooks.af.mil](mailto:john.biggs@guardian.brooks.af.mil) or call at DSN 240-5452/210-536-5452 to be put on the mailing list. ■

## ***NATIONAL ENVIRONMENTAL TRAINING AWARD AT BROOKS AFB***

The Human System Center (HSC) Environment, Safety and Occupational Health (ESOH) Education and Training Requirements Consult Service (RCS) was selected as recipient of the annual "Environmental Education Award" by the National Environmental Training Association (NETA). The Consult Service is part of the USAF School of Aerospace Medicine (SAM), located at Brooks AFB.

The award was accepted by one of the RCS staff members at the NETA's Awards luncheon in San Francisco on 29 Apr. 97. BrigGen Robert Belihar, HSC Commander, formally presented the award to the RCS group on 9 Jun 97 at Brooks AFB, TX. Members of the multi-disciplined RCS staff include Ms. Betty Brooks, Director, and staff members, Ms. Mary Shows, Ms. Tamee Tennison, Mr. Al Whipple, Ms. Donna Parker, and Ms. Miriam Ortiz. The award was earned by the RCS for developing a comprehensive ESOH education and training program (Monitor Vol. 3, No. 5, Sept. 1996). The RCS conducted a major undertaking of data collection and analysis of ESOH education and training requirements. Using the Air Force Materiel Command (AFMC) as a model test case, the effort resulted in a comprehensive listing of ESOH tasks and sub-tasks for over 1,000 USAF military and civilian occupational specialties. These requirements serve as a road map for ESOH education and training. The requirements are currently available for Air Force-wide use by any organization, installation, or MAJCOM.

The data collection and analysis were accomplished through a series of workshops involving subject matter experts (SMEs) and reviews by Career Field Managers from USAF functional areas. The SME panel was composed of members representing a variety of Air Force ESOH professions with each panel member being an expert with a broad background of experience within their respective profession. This effort represents the first two phases of a four-phase ESOH Education and Training Program. The four phases are as follows: initial data collection and training needs analysis, identification of training shortfalls, training development, and continuing requirements analysis.

The initial phase of data collection marks the Air Force's movement towards becoming a leader in ESOH education and training. No other service is taking such strides in integrating ESOH training and developing training that addresses environment, safety and occupational health as interrelated fields. The RCS provides the momentum to plan and build the support system necessary for the success of this Air Force program.

Ultimately, the ESOH Education and Training Program will provide the foundation for an ESOH program that inherently addresses and enhances everyone's work environment. The program's intent is not only to develop aware personnel, but more importantly to implement sound practices that will minimize or eliminate health and environmental hazards for personnel throughout the Air Force.

Further information on the RCS can be obtained through the following internet address: <<http://rcs-esoh.satx.disa.mil>> or by calling DSN 240-3403/Comm. (210) 536-3403. ■



## TECHNOLOGY TRANSFER

Air Force Pollution Prevention Technology Needs have been identified by the USAF Technology Planning Integrated Product Team (TPIPT). Details related to these needs have been summarized and can be found on the ESOH TPIPT web site (<http://xre.brooks.af.mil>). Summarized below are some examples of the existing technologies identified in the Technology Needs Survey Summary Sheets.

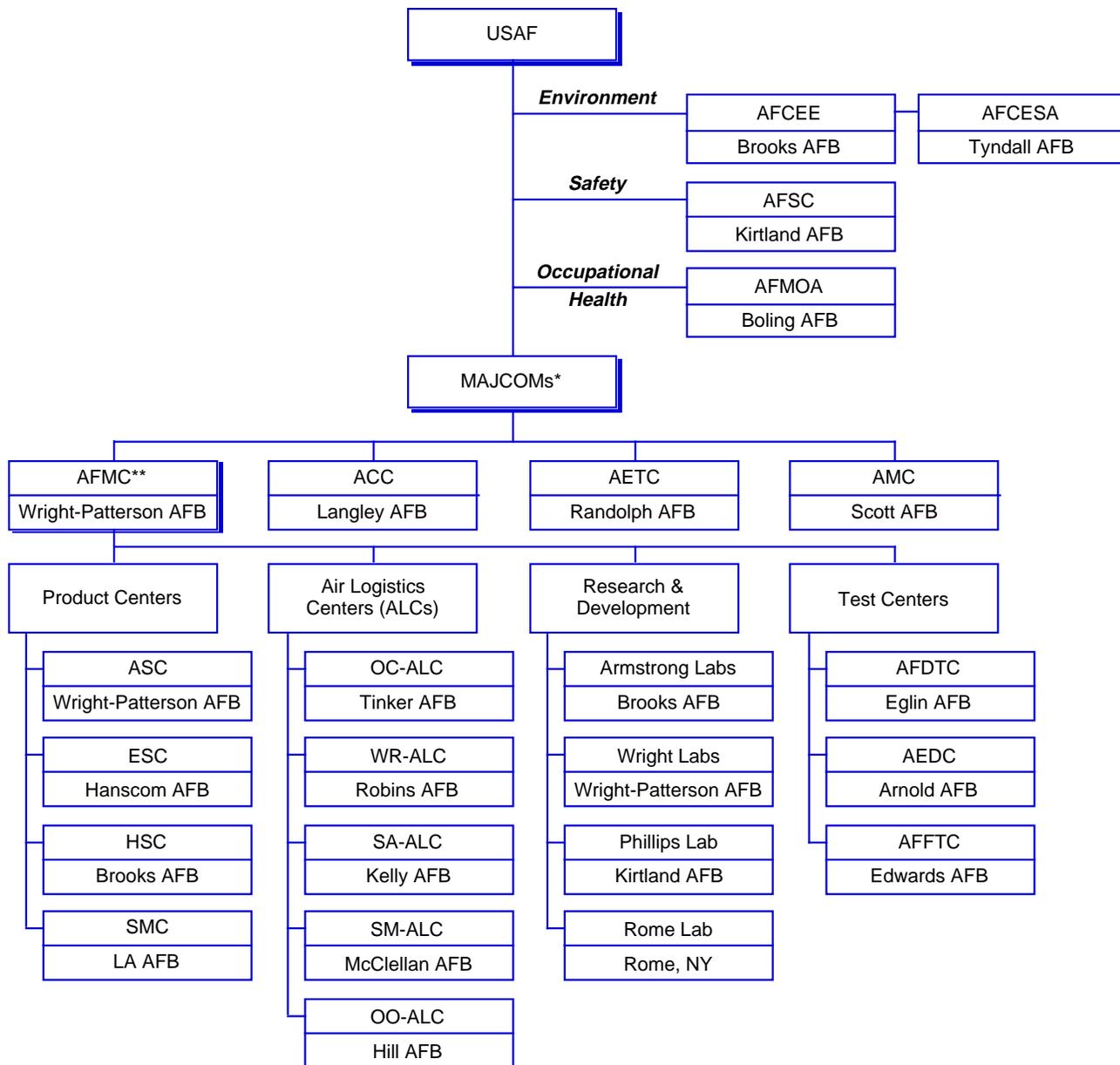
**Lockheed Martin in Denver** is currently using a nonchromate primer called Red Oxide for the Titan IV Program. Red Oxide is a waterborne urethane primer manufactured by Finishes Unlimited (ESOH TNS, #427).

**Spraylat** has developed a nonchromate primer that has been qualified by Naval Air Warfare Center, Aircraft Division (NAWCAD), Patuxent River per military specification MIL-P-85582B. The coating system includes both Type I and Type II coatings. The nonchrome, waterborne, low density Type I epoxy primer is designated at EWDY048A/B. The low IR counterpart is designated as EWAE118A/B (ESOH TNS, #427).

**Spraylat** has currently developed a high solids, solvent based nonchromated primer that is currently under qualification (EWDE139A/EWAE11B) at NAWCAD, Patuxent River under MIL-P23377G (ESOH TNS, #427).

### UPCOMING EVENTS

Date	Meeting	Location	POC	Phone/Fax
15-17 Jul	Weapon System P2 Center Working Group Conf. - 7th Joint Solutions to Common Problems	NDCEE, Johnstown, PA	Ms. Kathy Noll	(814) 269-6859 FAX (814) 269-2798
16-18 Jul	USAFSAM Advanced Environmental/Readiness Operations Course (AEROC)	Brooks AFB, TX, Bldg. 775	Maj Richard McCoy	DSN 240-3831
22-24 Jul	Halon Replacement Symposium	Hope Hotel & Conference Center, WPAFB, OH	Dr. Harvey Paige	(937) 255-9038 FAX (937) 255-9019
29 Jul - 01 Aug	Joint HAZMAT Pharmacy/ HAZWASTE Conference	Kelly AFB, TX, Officers Club	Mr. Ken Duke	DSN 787-3487
04-07 Aug	Annual Joint Service Pollution Prevention Conference and Exhibition	Henry B. Gonzalez Convention Center, San Antonio, TX	Mr. W. Bruce Holt, ADPA	(703) 522-1820 FAX (703) 522-1885
13 Aug	Weapon System P2 Center Working Group VTC	1200-1300 Eastern Time	Mr. Peter Logan	DSN 478-8338
15 Aug	ASC Environmental & Health IPT Meeting	WPAFB, OH, Area B, Bldg 8, 1st Floor Training Room, 0800-1100	Maj Jeff Byer	DSN 785-3054 ext, 310
24-26 Aug	Sixth Annual Aircraft and Airfield Deicing Conference and Exposition	Capital Hilton, Washington, D.C.	Mr. Carter Morris	(703) 824-0504
26-29 Aug	1997 Aerospace Industries Association's Hazardous Materials Management Conference	The Breakers, Palm Beach, FL	Aerospace Industry Association	(303) 690-4245, internet: <a href="http://www.summits.com/aia97">www.summits.com/aia97</a>
03 Sep	Weapon System P2 Center Working Group VTC	1100-1200 Eastern Time	Mr. Peter Logan	DSN 478-8338
09-10 Sep	Advanced Techniques for Painting and Depainting DoD Weapon Systems	Holiday Inn, Johnstown, PA	Ms. Teresa Kishlock	(814) 269-2800 e-mail: <a href="mailto:kishlock@ctc.com">kishlock@ctc.com</a>
15-17 Sep	9th Meeting of the Parties to the Montreal Protocol	Montreal, Canada	The Secretariat	FAX (1) 819-953-0550 e-mail: <a href="mailto:ozone97@marbek.ca">ozone97@marbek.ca</a>
28 Sep - 01 Oct	Professional Conference on Industrial Hygiene	Hyatt Regency Baltimore, Baltimore, MD	AIHA	(703) 849-8888
01 Oct	Weapon System P2 Center Working Group VTC	1100-1200 Eastern Time	Mr. Peter Logan	DSN 478-8338



*\*Other MAJCOMs include Air Force Space Command, Air Force Special Operations Command, Pacific Air Forces, U.S. Air Forces in Europe. Additionally, Air Reserve components include the Air Force Reserve Command and the Air National Guard.*

*\*\*Generates 80% of the Air Force's Hazardous Waste.*

The internet version of the MONITOR will build POC listings and pertinent web sites associated with these organizations. Please submit your POC listings and web site locations to John Biggs (e-mail: [john.biggs@guardian.brooks.af.mil](mailto:john.biggs@guardian.brooks.af.mil)).