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Can indoor air quality be improved by office workers who bring houseplants to work? Two air quality specialists have been looking at scientific literature for an answer.

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Excess materials are being offered for exchange to save repurchasing costs and reduce hazardous waste at Edwards Air Force Base.

# Report to STAKEHOLDERS

<http://www.edwards.af.mil/penvmng/index-toc.html>

## Technology defuses costs of UXO cleanup

**I**n an effort to defuse potentially explosive costs, Edwards Air Force Base (AFB) Military Munitions Response Program personnel have turned to aerial technologies. Their effort involves three technologies capable of more accurately and completely surveying areas known or suspected to contain unexploded ordnance (UXO) or munitions contamination.

“The use of these technologies helps us focus on areas where there could be a potential risk to human health or the environment,” said Paul Schiff, program manager of the Military Munitions Response Program (MMRP).

At Edwards AFB, the cleanup of UXO on non-operational ranges falls under the MMRP, which has five closed ranges. These ranges coincide with the occupied portions of the base, including Main Base, South Base, North Base, Air Force Research Laboratory, and the areas around the entry gates. The surveys covered the five closed ranges and adjacent off-base areas using a combination of aerial surveying technologies, Light Detection and Ranging (LiDAR) coupled with orthophotography and helicopter magnetometry, also known as HeliMag (see sidebar, page 6, for details).

### DOD-wide problem

These are the same three technologies used in pilot programs to survey many of the 2,500 Department of Defense (DOD) military munitions sites. The 2,500 sites consist of roughly 10 million acres known or suspected to contain munitions. Using ground-based technologies, the surveys would cost tens of billions of dollars.

The Defense Science Board Task Force on UXO estimates that 20 percent of the suspected acres across DOD actually contain munitions contamination. The same may be true at Edwards AFB. To find out, the MMRP is conducting a Wide Area Assessment (WAA) using all three aerial technologies tested by DOD. Collectively, this multilayered approach will provide the information needed to identify and

See *Technologies*, page 6

### Wide Area Assessment Looks for Military Munitions Like These



*BLU-61/B: Anti-Personnel Bomblet*



*3.5-inch High Explosive Anti-Tank Rocket Warhead*



*2-inch Illumination Mortar*



If you have a question about the Edwards Air Force Base Environmental Management program, you may address it to Stakeholders Forum, Attn: Gary Hatch or Miriam Horning, 5 East Popson Ave., Edwards AFB, CA 93524-8060, or send e-mail to: [95ABW.PAE@edwards.af.mil](mailto:95ABW.PAE@edwards.af.mil)

### Next RAB Meeting

**Feb. 8, 2007**  
**5:30 p.m.**

**California City**  
**Location To Be Determined**

**The public is invited.**

**Q.** What types of cleanup are included in the Edwards Air Force Base Environmental Restoration Program?

**A.** The Air Force Environmental Restoration Program (ERP) is divided into three program categories.

- Installation Restoration Program (IRP) — cleanup of hazardous leaks and spills that occurred in the past
- Military Munitions Response Program (MMRP) — cleanup of closed munitions ranges
- Building Demolition/Debris Removal (BD/DR) program — cleanup of deteriorated and unused structures and debris

People often use IRP and ERP interchangeably. But, as described above, the Installation Restoration Program is part of the Environmental Restoration Program.

**Q.** Preventing pollution at the base is important to me. What can I do to prevent and reduce pollution?

**A.** Everyone has a role to play in preventing and reducing pollution. That role begins with awareness.

On Sept. 20, Environmental Management joined federal, state and local government agencies to celebrate National Pollution Prevention Week. Activities at Edwards Air Force Base included sharing information about pollution prevention with the base community at the Base Exchange, Sept. 20. As recognized in this year's Pollution Prevention Week theme — "The Future is Now" — the actions we take today to prevent pollution are critical if we are ever to realize a future free of the many types of harm polluted environments pose.

Programs like HazMER (see page 4) represent the move to prevent pollution at the source, before it is created. This can be done by conserving energy, recycling, reducing, reusing and lowering pollution levels, using alternative cleaning materials and carpooling. These activities protect the environment and the economy.

National Pollution Prevention Week seeks to increase base-wide awareness of pollution prevention and to encourage base workers and residents to practice pollution prevention year round.

With this year's theme in mind, here are things each of us can do to help stop pollution at the source:

- Recycle plastics, glass, aluminum, newspapers, used motor oil, transmission and brake fluids; be aware that universal waste — fluorescent bulbs, batteries, TVs, computers, computer monitors — is prohibited in trash
- Use reusable cups and containers for lunches instead of disposable bags
- Use environmentally safe cleaning products
- Use a commercial car wash instead of washing your car at home
- Carpool

*Report to Stakeholders* is a publication of the Edwards AFB Environmental Management Division. Its purpose is to inform and educate the public, base workers and residents about continuing Environmental Management efforts at Edwards AFB. It currently has a circulation of 6,000, including about 2,000 subscribers.

Contents of the *Report to Stakeholders* are not necessarily the official view of, or endorsed by, the U.S. government, the Department of Defense, or the Department of the Air Force.



Commander 95th Air Base Wing..... Col. H. Brent Baker, Sr.  
Base Civil Engineer..... James Judkins  
Division Chief, Environmental Management..... Robert Wood  
Branch Chief, Environmental Restoration..... Ai Duong  
Branch Chief, Environmental Conservation..... Gerald Callahan  
Branch Chief, Environmental Quality..... Robert Shirley

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Comments or questions should be directed to: Gary Hatch, 95 ABW/PAE, 5 E. Popson Ave., Bldg. 2650A, Edwards AFB, CA 93524-8060, (661) 277-1454. E-mail: [95ABW.PAE@edwards.af.mil](mailto:95ABW.PAE@edwards.af.mil)

*Report to*  
**STAKEHOLDERS**





**BIG GREEN BENZENE FILTER?** — Air quality specialists, Andrea Brewer, left, and Madeline Almodovar, contractors in Environmental Management, discuss how houseplants, like the big green *Dracaena* “Warneckii” that sits on Brewer’s desk, might reduce indoor pollutants. The *Warneckii*, for instance, is especially effective in the removal of benzene, according to one study.

## Growing Better Air

The following Web sites provide information about indoor air quality available from the EPA and California Air Resources Board (CARB)

**EPA Indoor Air Quality Program** — [http://www.epa.gov/iaq/green\\_ieq.html](http://www.epa.gov/iaq/green_ieq.html)

**CARB Indoor Air Quality and Personal Exposure Assessment Program** — <http://www.arb.ca.gov/research/indoor/indoor.htm>

**U.S. Green Building Council** — <http://www.usgbc.org>

**U. S. EPA “Indoor Air Pollution: An Introduction for Health Professionals”** — <http://www.epa.gov/iaq/pubs/hpguide.html#faq7>

# Office plants, a boon to indoor air quality?

**C**reating a healthy environment for office occupants, free of pollutant concentrations, might mean going *greener* according to the Environmental Protection Agency’s (EPA) *Green Building* Web site.

Experts at the EPA and California Air Resources Board cite indoor air pollution as a potential health threat. Their Web sites warn that indoor pollution sources release gases or particles into the air. Inadequate ventilation, high temperature and humidity levels can increase concentrations of some pollutants over time. When there is too little exchange of outdoor air for indoor air, pollutants can accumulate to levels that can pose health and comfort problems. The effects of poor indoor air quality range from short-term effects — eye and throat irritation — to long-term effects including asthma, heart disease and cancer.

Are plants any help in improving indoor air? There appears to be some disagreement among the experts.

Andrea Brewer and Madeline Almodovar, contractors who work as air quality specialists for Environmental Management at Edwards Air Force Base, have been exploring the scientific literature on green buildings and indoor air quality.

In *How to Grow Fresh Air*, scientist Dr. B.C. Wolverton, who conducted research to create a breathable environment for a NASA lunar habitat, presents the case for houseplants used as air purifiers and filters of common pollutants such as ammonia, formaldehyde and benzene.

According to Wolverton, some houseplants offer benefits to the indoor environment. The bamboo palm, for example, is rated as highly effective in pumping moisture into the air. It is also one of the top-rated plants tested in Wolverton’s study for the removal of benzene, trichloroethene and formaldehyde. The palm is only surpassed in its ability to remove formaldehyde by the rubber plant, which Wolverton rates as “the best (among ficus plants tested) for removing chemical toxins from the indoor environment.”

The EPA Indoor Air Quality Program, the Lawrence Berkley National Laboratory and the U.S. Green Building Council tend to focus on proper ventilation and air exchange to solve indoor air quality problems, Brewer said.

An EPA Web site on indoor air quality notes that “While it is true that plants remove carbon dioxide from the air, and the ability of plants to remove certain other pollutants from water is the basis for some pollution control methods, the ability of plants to control indoor air pollution is less well established.” Citing “extremely uncertain” data on the benefits of plants to control indoor air pollution, the EPA concludes “plant removal mechanisms appear to be inconsequential compared to common ventilation and air exchange rates. In other words, the ability of plants to actually improve indoor air quality is limited in comparison with provision of adequate ventilation.”

Brewer and Almodovar recommend reviewing the information on Web sites and in published literature to learn more about indoor air quality and the potential benefits of plants.

# HazMER puts excess items back to work

*Hazardous materials that aren't used end up costing too much. They take up shelf space while their expiration dates tick away. Eventually, the alarm buzzer sounds and they must be sent off for disposal — at additional cost. Wasted in this scenario are the cost of purchasing this item and the cost of hazardous waste disposal. What's more, if hazardous waste reduction goals are not met at Edwards Air Force Base (AFB), hefty state regulatory fines could result. To keep hazardous waste from costing more than it should, a new Hazardous Material Excess Reutilization (HazMER) program at Edwards AFB puts unused items back to work.*

**S**itting on the shelves of the Consolidation Recycling and Universal Waste (CRUW) facility at Edwards Air Force Base (AFB) is an item costing \$17,050. It's perfectly usable and in unopened condition. It's even free to Hazardous Material Distribution Support Centers (HDSCs) on base so someone can use it. But unless someone wants it, it will have to be sent away for hazardous waste disposal at an additional cost of about \$100.

“Military aircraft use materials that are unique, in some cases, one-of-a-kind items developed to very specific technical standards, so they can be quite costly,” said Layi Oyelowo, an environmental program manager who oversees the HazMER program. “But some of these items, like adhesives, spray paints and lubricants, can be used for other things, like repairing a vehicle. That means they are marketable to others on base. It's this internal market at the HDSC we're hoping to reach with the HazMER program, and initially, at least, we're focused on cost-free exchanges within Edwards Air Force Base.”

Since April, the HazMER program has been matching up excessed items, like the expensive adhesion promoter, with a new customer who can put such items to good use elsewhere. In doing so, Edwards AFB is meeting its commitment to reduce hazardous waste while



**ANY TAKERS?** — Hazardous Distribution Support Centers (HDSCs) at Edwards AFB can have this excessed \$17,050 adhesion promoter for free. A new hazardous materials exchange program seeks to avoid costs for repurchase and hazardous waste disposal by taking in excessed items and offering them free to other HDSCs that can put them to use.

saving significant costs for repurchasing and hazardous waste disposal.

Managers at the CRUW, located in Building 4904, are eager to get the word out about the opportunity to get free excessed items like adhesives, spray paint, strippers and lubricants, including oil, at their facility.

Currently, their shelves are stocked with about \$32,000 worth of these and similar items.

Many of these items were overstocked having been bought in bulk. Ordering restrictions have been put in place at Edwards to minimize overstock and off-specification items. Excess occurs, however, usually because a project has ended or changed. Before HazMER, unused items would languish on the shelves of numerous, separate hazardous material pharmacies, or Hazardous Material Distribution Support Centers, as they are now called, until their expiration date. Sometimes, the expiration dates could be extended through General Services Administration (GSA). But if that didn't happen they were taken to the Defense Reutilization and Marketing Office (DRMO) for sale to other military organizations or the public. If they weren't sold, they were disposed as hazardous waste at a cost to Edwards AFB.

Since July, people who order items using the computer-based Hazardous Material Management System (HMMS) see an advertisement telling them when the same item is in the HazMER inventory. The advertisement lists the item by its national stock number (NSN), which may not be all that revealing about the product and its use. Oyelowo hopes HMMS will eventually include a pop-up window that provides more detail. In the meantime, HDSC personnel are encouraged to make periodic visits to the CRUW to see with their own eyes what is sitting on the shelves.

The items stocked at CRUW come from these pharmacies which benefit from the service in two ways. They can send items to the CRUW that they otherwise might have had to excess and process as hazardous waste. Or they can find items at the CRUW that they would have purchased in the past, which now can be obtained free. Either way they win. The CRUW pays for any subsequent hazardous waste disposal for all items transferred to their care. And the pharmacies pay nothing for anything they find and can use from the CRUW's HazMER program inventory.

Edwards AFB wins by meeting tough California standards that require annual reductions in waste and avoids stiff fines when those standards are met. The HazMER program supports pollution prevention efforts to stop pollution at its source, before it is created. With reductions in hazardous waste and eventually increasing the use of environmentally friendly products, the base will get there. To reach this goal, everyone and everything has to take part in the work.

"All we're asking is that before the HDSC excesses a hazardous material, they give it a last look to see if it can be offered for re-use or exchange," said Oyelowo. "Before ordering an item, we hope they check the CRUW's inventory to see what is available."



**ATTENTION EXCESS SHOPPERS** — Managers of a new Hazardous Material Excess Reutilization (HazMER) program are hoping to attract Hazardous Material Distribution Support Center (HDSC) shoppers to their warehouse where \$32,000 worth of unused, unopened, excessed items sit on their shelves. Many of these items, like spray paint, lubricants and adhesives, can be repurposed for vehicle and facilities maintenance. "You need to see what is in the inventory to know if you have a use for it," said David Parker, a contractor who works in the HazMER program.



Consolidation Recycling and Universal Waste (CRUW) facility, Building 4904

## Want to know more?

For more information about the HazMER program, items in their inventory and CRUW, contact Layi Oyelowo at 277-1457 or send e-mail to [layi.oyelowo@edwards.af.mil](mailto:layi.oyelowo@edwards.af.mil).

# Eliminators

*Cleanup of munitions sites can be costly, and not all sites pose an equal risk to humans. To reduce costs, save time and eliminate guesswork, the Military Munitions Response Program at Edwards AFB has employed the following three technologies. Each provides a layer of information that will be used to prioritize sites for cleanup.*



**LiDAR (Light Detection and Ranging)** — Using the same principle as RADAR, LiDAR detects munitions-related features (craters, berms, aiming circles, burial pits) by sending out pulses of light from an aircraft; the time it takes for the light pulse to return determines the distance to the object

**Orthophotography** — A high-resolution, digital, aerial photograph in which distortion from the camera is corrected so the image is spatially accurate; ortho-imagery provides direct identification of surface features associated with munitions activity and confirmation/discrimination of LiDAR feature identification

### HeliMag (helicopter magnetometry)

— A metal and ferrous (iron) material detector is mounted on a helicopter that flies low to find surface and subsurface metal objects; the data collected is used to define the size and density of munitions in an area



## Technology

From page 1

define areas with actual UXO or munitions contamination, thereby reducing the areas that will require further site investigation and response.

### As much data as possible

“This wide area assessment approach places the three technologies onto aircraft to fly over specified areas and gather as much data as possible with the least amount of effort and budget. The end goal is to identify UXO hazards or other unexplained anomalies that may lead to further evaluation in the program,” Schiff said.

LiDAR, flown in January on a Pilatus PC-12 turbo-prop utility aircraft, gathers data by sending out pulses of light from an aircraft. The time it takes for the light to bounce back determines the range of a given object. The LiDAR data creates high-resolution, bare-earth, digital elevation models to identify munitions-related features such as bomb craters, target berms or aiming circles and burial pits.

Flown with LiDAR, orthophotography is high-resolution aerial photography that can confirm the findings in the LiDAR. By overlaying the LiDAR image with the orthophotography image, better conclusions can be drawn as to whether a feature is a munitions-related feature.

Lastly, HeliMag was flown over areas where the LiDAR coupled with orthophotography and some limited ground-based site surveys identified potential significant findings. HeliMag involves mounting what is essentially a large metal detector on an MD 530F helicopter which flies low to find surface and subsurface metal objects.

“Though we still have a lot of data review ahead of us, we think the use of these technologies will help us rule out a lot of areas where there is no sign of past munitions use, based on historical data and records, and focus on the areas where there is a potential

risk to human health and the environment,” Schiff said.

### Just the start

“This wide area assessment approach is just the first step in a long process of identification, investigation and cleanup activities,” Schiff said. “But we believe that this approach is in the best interest of the public, stakeholders and taxpayers. These technologies show promise in reducing overall program cost and effort.”

Though Edwards AFB is a flight test center, historical records show that the area was used for munitions activities before becoming a flight test center. Starting in 1933, the Edwards area was used as the Muroc Bombing and Gunnery Range and later became a major bomber training base during World War II.

The MMRP at Edwards AFB follows the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, or CERCLA. The process has many steps before the actual cleanup of UXO begins, unless a time-critical UXO removal action is necessary to immediately protect human health.

The CERCLA process includes a preliminary assessment where historical information is gathered about a site. This is followed by site inspection to verify the historical record. Site excavation activities are performed and soil borings and monitoring wells are installed in the remedial investigation phase. A feasibility study, in which various cleanup options are evaluated and compared, is the next step in the process. The decision and cleanup phases at the end of the process include a Record of Decision, or decision document, which formalizes what cleanup will be conducted, and, finally, remedial action and long-term management where the final cleanup action is implemented and maintained.

The MMRP at Edwards is currently in the preliminary assessment phase. Findings from the WAA and the preliminary assessment will be used to determine what should come next.

# Destruction, disease make California ground squirrel an unwelcome visitor

**F**lourishing populations of California ground squirrels continue to cause problems on base, according to biologists working at Edwards Air Force Base. To help control their numbers, there are a few steps residents can take to make their houses and work areas safer and less attractive to this unprotected, invasive species.

California ground squirrels are considered invasive because, even though they are native to California, they are not native to the base. They damage the environment and compete with native animals for food and territory. Their populations flourish here because of plentiful food and shelter in the developed areas of the base and the lack of an effective predator to keep them in balance.

The California ground squirrel is active mainly during the day, primarily herbivorous, and will not travel far from its burrow

to look for food. Potential predators on base are active primarily at night when the squirrel is safe inside its burrow.

An adult California ground squirrel is brownish-gray in color, typically 14 to 18 inches long, with a semi-bushy tail.

Though California ground squirrels can climb trees and structures, they live and seek shelter in ground burrows. These burrows can be up to 30 feet or more in length and are usually composed of a network of catacombs.

These burrows damage plant root systems, disturb the soil, damage the structural integrity of buildings, pose as a serious tripping hazard and create mounds that can damage machinery.

They not only damage landscaping and structures, they can also harbor fleas that can spread diseases such as the plague.

## Ways to discourage a wildlife intruder

- Do not feed the squirrels
- Do not try to handle squirrels
- Eliminate any brush or rock piles that may provide shelter for squirrels
- Keep trash in sealed containers



## UNWANTED

*Don't be tempted to welcome the California ground squirrel, pictured below. It is not a native of Edwards Air Force Base and can be a hazard to health. Base residents and workers are discouraged from taking actions that would make ground squirrels feel at home, such as feeding them or providing them with shelter.*



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**RAB Members****BORON**

Hugh Jamison (760) 762-6658 Home  
 hbj@ccis.com

**CALIFORNIA CITY**

Bob Smith (760) 373-4317 Home  
 bsmith@ccis.com

**LANCASTER**

Peter Zorba (661) 723-6234 Work  
 pzorba@cityoflancastrca.org  
 ALTERNATE: Frank Roberts (661) 723-6018 Work

**MOJAVE**

Victor Yaw (661) 824-2886 Home  
 vyaw@charter.net (661) 275-4296 Work

**NORTH EDWARDS**

Ruby Messersmith (760) 769-4357 Home  
 messersmith2@verizon.net

**ROSAMOND**

David Newman (661) 722-6433 Work  
 dneuman@ispwest.com  
 ALTERNATE: Leslie Uhazy (661) 256-8209 Home  
 luhazy@avc.edu (661) 722-6417 Work

**EDWARDS AFB**

**Housing**  
 Michelle Tucker (661) 258-9030 Home  
 mztucker@usa.net

**Main Base Air Base Wing**

Vacant

**Main Base Test Wing**

Dean Baker (661) 277-5649 Work  
 dean.baker.ctr@edwards.af.mil

**NASA Dryden**

Gemma Fregoso (661) 276-2817 Work  
 Gemma.V.Fregoso@nasa.gov  
 ALTERNATE: William Brandweiner (661) 276-3339 Work  
 William.Brandweiner@dfrc.nasa.gov

**North Base**

Vacant

**South Base**

Julie Newton (661) 275-0551 Work  
 julie.newton@edwards.af.mil

**AF Research Lab/  
Propulsion Directorate**

Milton McKay (661) 275-5191 Work  
 milton.mckay@edwards.af.mil

Published data and documents relating to the Environmental Restoration Program are available for public review in information repositories at four locations. The current information repositories are located in the cities of Boron, Lancaster and Rosamond, as well as Edwards AFB. They are updated when new documents are released.

If you have any questions about information in the repositories, please contact Gary Hatch, Environmental Public Affairs at (661) 277-1454 or through e-mail at 95ABW.PAE@edwards.af.mil.

**Location Days and Hours of Operation**

Location	Days and Hours of Operation
<b>Edwards AFB Library</b> 5 W. Yeager Blvd. Building 2665 Edwards AFB, Calif. (661) 275-2665	Mon-Thurs 9:30 a.m. - 7 p.m. Fri 9:30 a.m. - 6 p.m. Sat & Sun 10:30 a.m. - 6 p.m.
<b>Kern County Public Library</b> Wanda Kirk Branch 3611 Rosamond Blvd. Rosamond, Calif. (661) 256-3236	Tue & Wed Noon - 8 p.m. Thurs-Sat 10 a.m. - 6 p.m.
<b>Los Angeles County Public Library</b> 601 W. Lancaster Blvd. Lancaster, Calif. (661) 948-5029	Mon-Wed 10 a.m. - 8 p.m. Thurs & Fri 10 a.m. - 5 p.m. Sat 11 a.m. - 5 p.m.
<b>Col. Vernon P. Saxon, Jr. Aerospace Museum</b> 26922 Twenty Mule Team Road Boron, Calif. (760) 762-6600	Mon-Sun 10 a.m. - 4 p.m.



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