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News From the Mandatory Center of Expertise and Design Center

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Web site provides quick access to FUDS info page 2

Corps successfully clears salvage yard page 3

Who you gonna call if you find UXO? page 3

High marks at JPG Phase III for NAEVA Geophysics page 4

Profile: Why QASAS at HNC? page 7

Calendar of Events page 8

New statistical tools for better OE estimates

by Arkie Fanning, Huntsville Center, Systems Engineering Division

Five new statistical tools will soon be available to aid in estimating the amount of ordnance on OE sites.

Designed for Huntsville Center by Dr. Bruce Barrett of the University of Alabama, the new statistical tools for estimating ordnance are still in spreadsheet format, but a user friendly computer program will soon be developed for use in the field. Dr. Barrett also provided a technical paper showing the derivation of the statistical distribution (negative binomial) that is the basis of OE estimates. Each of the five spreadsheets has a unique purpose and can be used to generate "what if" scenarios to better define the amount of ordnance on a site.

The first spreadsheet (table 1, page 6) requires the user to enter the area of the sector (in acres) and the area of the grids that have been investigated. (If GridStats were used, then the percent of each grid investigated must be calculated and entered here.) Then the actual number of UXO found is entered. The spreadsheet returns the expected density and number of UXO that for the sector.

The second spreadsheet (table 2, page 6) requires the user to enter a specified UXO count. The tool compares that count to that calculated in table 1 and calculates the probability of having a lower UXO count in the sector. This information can be used to obtain realistic OE intervals for a sector.

The third spreadsheet (table 3, page 6) requires the user to provide a density estimate for the sector. The spreadsheet will then return the expected number of OE items for that sector based upon that density estimate.

The fourth spreadsheet (table 4, page 6) requires the user to enter a probability value, and it returns the expected value of OE and the OE density that is less than or equal to that probability. For instance, if we want a 95% probability that our estimate is correct, then we would enter 95 into the box, and the resulting UXO count (for example, 100) is the expected

Tools continued on page 6

Developing a risk method for the Range Rule

by Scott A. Hill, U.S. Army Environmental Center

The U.S. Army Environmental Center (USAEC) has been tasked to develop and promulgate the U.S. Department of Defense (DOD) Range Rule. The proposed rule states that assessments must be performed to address overall risks posed by closed, transferring, and transferred military ranges. It also identifies a process for evaluating appropriate response actions on subject ranges that specifically address safety, human health, and the environmental risks posed by military munitions and military ranges.

DOD and the U.S. Environmental Protection Agency (EPA) have agreed that DOD will develop a methodology to assess potential risks at these ranges. Those agencies have worked together in developing the Range Rule Risk Methodology (R3M) to meet the needs of the Range Rule. USAEC has been tasked to help develop the methodology in conjunction with promulgation of the Range Rule. Therefore, USAEC is working with experts from DOD and EPA who provide technical guidance and support for R3M development. USAEC is collecting the input from the DOD and EPA and working with a contractor to further refine the methodology.

Risk method continued on page 6

Web site provides quick access to FUDS info

by Thomas M. DeWitte, U.S. Army Corps of Engineers, Rock Island District

Funded through Huntsville Center, Rock Island District has developed a World Wide Web (WWW) site that makes documents for Defense Environmental Restoration Program—Formerly Used Defense Sites (DERP-FUDS) Ordnance and Explosives projects available to the public. Today, the Project Information Retrieval System (PIRS) web site has over 100,000 pages of documentation online for 1,450 documents. Those documents provide information for over 650 sites across the United States. The types of documents that can be found on the web site are:

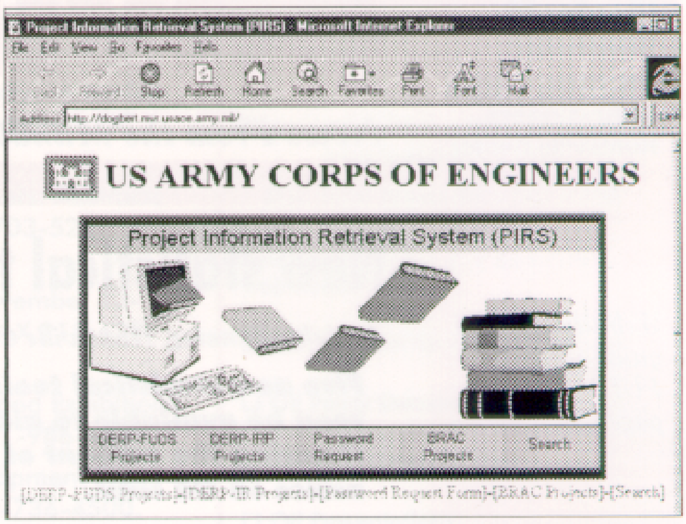
- Inventory Project Reports (INPR)
- Archive Search Reports (ASR)
- Engineering Evaluation/Cost Analysis (EE/CA) work plans and final reports
- Removal Action (RA)/Time Critical Removal Action (TCRA) work plans and final reports

The objective of the PIRS web site is to improve the capability to retrieve and distribute documents. Use of PIRS decreases document access time, reduces redundant hard copy storage at multiple sites, improves customer service, reduces office space, and reduces printing and mailing costs.

To help the user sort through the vast wealth of information, the web site offers interactive maps and a search engine.

Three interactive maps of the United States enable the user to select either the state, Corps district, or EPA region that a site lies within. The user then selects the site from a current alphabetical listing to access the specific information.

A second aid to the user is the PIRS search engine. The PIRS search engine has indexed every word on the web site, offering the capability to instantly search through thousands of pages of documentation that otherwise would be scattered across the United States in Corps of Engineers' office file cabinets. This powerful searching tool lets Corps ordnance specialists and contractors search for documentation detailing how others handled a certain munition at another site, thereby promoting information sharing.



The PIRS web site address is http://dogbert.mvr.usace.army.mil. Developed by Rock Island District, the site delivers access to 1,450 documents on formerly used defense sites, including inventory project reports, removal action plans and reports, and engineering evaluation/cost analysis work plans and reports.

The PIRS web site is useful to more than ordnance specialists, however. In Rock Island District's Ordnance and Explosives Section, technical managers use the web site daily to access reports for the site they are currently working on. Before PIRS, the technical manager could wait up to two weeks for a copy through the mail. The PIRS web site not only saves the technical managers time and money, it also saves the geo-district time and money by not having to process the request for copies of documents.

The general public is also benefiting from the PIRS web site. Over 200 persons visit the PIRS web site every day. Of those 200, approximately 125 are non-military users. Several individuals have taken the time to e-mail the PIRS webmaster to comment on how they have used the PIRS web site to assist in checking the history of a piece of real estate that used to be a military facility.

As Federal resources continue to dwindle, the need to access our information digitally and to make it available to the public in an automated manner will become the norm instead of the unique. Web sites like PIRS are currently being developed by other government agencies, such as EPA and NASA. The reasoning is simple: reduce the costs associated with handling document hard copies by keeping digital versions of the files on a centralized web site. Providing public documents via the Internet improves our image by giving the public quick access to information that shows how the Department of Defense DERP-FUDS program is literally making the world a safer place for the citizens of the United States by cleaning up long-forgotten military facilities and removing ordnance that still poses a health hazard to the public.

Thomas DeWitte is the Team Leader of the PIRS development team at Rock Island District. He is an engineer and Certified Webmaster. Tom's e-mail address is Thomas.M.DeWitte@mvr02.usace.army.mil

Corps successfully clears salvage yard

by Bob DiMichele, Huntsville Center PAO

Dick's Auto Works in Fontana, CA, is not a typical ordnance and explosives removal site. It isn't a formerly used defense site. It isn't military property. It's a salvage yard for scrap metal and the site of a fatal ordnance accident.

Last March 18, a detonation occurred at the salvage yard that killed one civilian worker and wounded two others. The scrap yard had been buying ordnance scrap from nearby military installations, and a piece of live ordnance exploded as a worker was cutting it up for recycling. San Bernardino County Sheriff deputies responded, declared a military emergency, and called the 259th Explosives Ordnance Disposal (EOD) Company, which made the initial response.

The Ordnance and Explosives Team from the U.S. Army Engineering and Support Center, Huntsville, AL, was called in to relieve the 259th EOD on April 3 and secured the site.

"It was a very hazardous place," said Brad McCowan, of Huntsville's Engineering Directorate. McCowan handled most of the project management duties for the Fontana site, completing the removal action on August 13—on time and under budget.

McCowan said that Huntsville Center requested a million dollars for the cleanup; however, the project totaled only about $856,000, so $144,000 were returned to Corps' headquarters.

Safety, though, was of primary concern. Huntsville Center's safety experts responded first for the Corps, eventually turning over safety duties to Los Angeles District. The Sacramento District responded initially with an industrial hygienist, but Huntsville later took on that role.

The removal effort required ordnance experts to sort through hundreds of tons of scrap metal and remove any explosive hazard that might exist. According to McCowan, the ordnance removal contractor, ATI, found 113 ordnance items ranging from a grenade to a 2,000-pound warhead from a Navy missile. Thirty-three of those items were verified as live.

ATI workers also found a live 105-mm tank round. "The potential existed for another accident, another fatality," McCowan explained. In addition, the EOD unit found more than fifty pieces of OE before the Corps arrived.

"The variety of ordnance exceeded a typical FUDS. It appeared to be representative of all the military services," McCowan said. "The items were found, piece by piece, mixed in with old car parts and other metal scrap."

ATI searched in nearly 3,000 10- by 10-foot grids at two different scrap yard sites. At the yard on Sultana Avenue, ATI examined 750 tons of scrap, 425 tons of it OE-related scrap, and moved 100 cubic yards of concrete and dirt.

In addition to ordnance safety issues, the Fontana site posed a hazardous and toxic waste concern. "We had to protect against contaminants in the soil, such as lead and cadmium, so we regularly conducted air monitoring. We didn't want to get dust up in the air with those contaminants," McCowan said. The area is highly industrialized, not isolated, and a commuter train route is directly adjacent to the property.

The 4-1/2 month project was concluded successfully by properly disposing of all the scrap yard's dangerous munitions without harm to the public. In fact, the Defense Reutilization and Marketing Office (the defense organization that sells the metal scrap to the private sector) has asked Huntsville Center's OE Team to investigate another salvage yard in Fontana for the same public safety hazard. □

Who you gonna call if you find UXO?

by Greg Bayuga, Huntsville Center CX

USACE employees discovering unexploded ordnance (UXO) may not be that uncommon. Therefore, USACE employees working on potential OE sites need to know their responsibilities when UXO is found.

Sometimes formerly used defense site property is privately owned and other times the land is pubic property. In either case, however, during site investigations, if UXO is discovered on the surface, you must inform the landowner. The landowner then calls the local law enforcement agency to remove and dispose of the immediate hazard. The local law may choose either to deal with the hazard or call the military Explosive Ordnance Disposal (EOD) unit.

If UXO is discovered on an installation during a site investigation, you must notify the installation commander or facility manager. The installation calls EOD, which responds to the hazard. In either case, Huntsville Center should be notified of the UXO discovery.

Once the EE/CA or removal action is underway, the procedures for the discovery of UXO are outlined in the work plan and must be followed.

Remember, don't touch or otherwise disturb the UXO, look out for additional UXO, and mark the location so the response team can easily find the location. Remember, safety first!

Huntsville phone numbers: Ordnance and Explosives Safety Group 205-895-1598. After duty hours call 205-895-1180 and ask for Wayne Galloway or Greg Bayuga. For questions on this process call Greg at 205-895-1596. □

High marks at JPG Phase III for NAEVA Geophysics

by John D. Allan, NAEVA Geophysics, Inc.

Results from phase III of the Unexploded Ordnance Advanced Technology Demonstrations at Jefferson Proving Ground (JPG) show that ordnance detection statistics have improved markedly over phase II, with some demonstrators using magnetometer and electromagnetic induction combinations yielding probability of detection (PD) rates of over 90%. Sponsored by the U.S. Army Environmental Center and the Naval Explosive Ordnance Disposal Technology Division, the demonstrations help assess technologies suitable for the detection, identification, and excavation of unexploded ordnance. Selected from 32 applicants, the 15 phase III participants performed their demonstrations within preset parameters, or scenarios. Among the best performers, NAEVA Geophysics, Inc., surveyed two 10-acre tracts, the Aerial Gunnery Range and the Artillery and Mortar Range (scenarios 1 and 2, respectively).

Instrumentation

NAEVA used Geonics EM-61 electromagnetic units and Scintrex Smartmag SM-4 cesium-vapor magnetometers. Both the EM-61 and SM-4 systems are man-portable. Together those instruments can detect ferrous and nonferrous metallic objects. The EM-61 metal detector is capable of sensing small, shallow metallic objects (ferrous or nonferrous), while the magnetometer is preferred for detecting large, deeper ferromagnetic objects beyond the range of reliable EM-61 metal detection.

The Geonics EM-61 is a time-domain electromagnetic instrument consisting of two air-cored coils, batteries, processing electronics, and a digital data recorder. The coils are arranged so that the larger coil (EM source and receiver) lies 40 centimeters below a second receiver coil. Secondary voltages induced in both coils are measured in millivolts. The EM-61 is designed to detect shallow metallic objects (ferrous or nonferrous) with good spatial resolution.

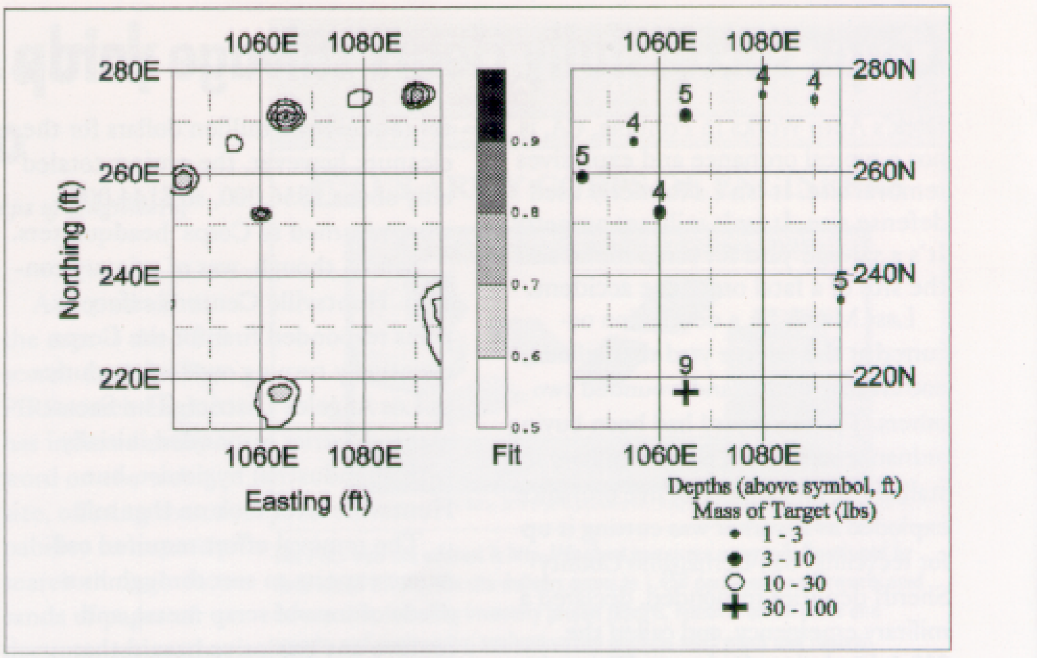


Figure 1. MAGFIT plots the least squares certainty (fit) of multiple targets (left) and produces a symbol plot showing the size and depth of each target (right). This software can run without constant user interaction, enabling the efficient interpretation of large data sets produced by modern insturments.

The Scintrex Smartmag SM-4 cesium-vapor magnetometer measures the total magnetic field with a sensitivity of ±0.01 nT (range 15,000 to 100,000 nT) at rates from 1 to 10 samples per second. The SM-4 system includes the cesium sensor, associated electronics, a carrying harness, ENVI control console, ENVIMAP operating software, and rechargeable batteries.

Data Acquisition

EM-61 data were collected over the Aerial Gunnery and Artillery and Mortar Range with a sensor separation of about 1 meter. Initially, three EM-61 units were "ganged" together providing a 10-foot sweep width. The EM-61's operated in wheel odometer mode, collecting data every 0.63 feet along lines. Even with pulsed synchronization, some increased background noise between instruments was experienced in the "ganged" mode. Consequently, individual EM-61 units were separated and operated independently. Magnetic data were collected in continuous reading mode (10 readings/second) with a 5-foot line separation. A separate base station magnetometer acquired data for magnetic diurnal drift corrections.

With permanent grid nodes already established on the demonstration sites on a 100-foot by 100-foot basis, the survey lines were controlled by chain on 10-foot-spaced north-south survey grid lines with reference points every 20 feet in order to assure better than ±1 foot accuracy.

Data analysis and interpretation

The EM-61 data were plotted in profile for each survey line and interpreted using Geonics DAT-61 software. The magnetic data were processed and analyzed using the MAGFIT method. MAGFIT is a unique and proprietary computer program developed by G. Hunter Ware and Hunter Andreas Ware. It scans the theoretical anomalies of a very large number of magnetic dipole models (all locations, depths, orientations, and dipole moments of interest) over the field data, and identifies the best

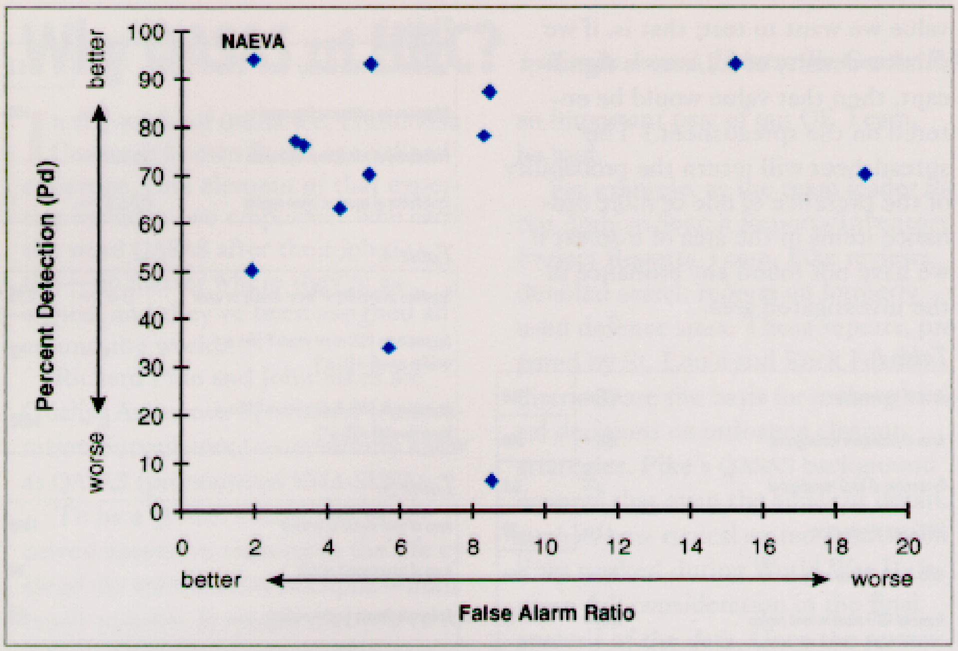


Figure 2. Probability of detection (PD) versus false alarm ratio for demonstrators participating in at least two search scenarios at phase III of the Unexploded Ordnance Advanced Technology Demonstrations at Jefferson Proving Ground. The goal is higher detection with fewer false alarms.

models using a "best least squares fit" criteria. MAGFIT yields model fit contours (in percentages) around the best fit location, in plan or cross section. It also calculates estimated mass and depth for the buried ferromagnetic objects. An example of a MAGFIT contour plot of a small portion of the JPG survey is shown in figure 1. Location, depth, and size estimates from both the DAT-61 and MAGFIT methods were integrated before predicting the final target locations and depths.

Survey Results

NAEVA's survey results for the combined scenarios yielded a PD of 94% and a false alarm ratio of 1.96 (that is, the number of false alarms per ordnance item detected). That PD rate ranks the highest among those geophysical demonstrators who participated in at least two search scenarios (figure 2). Based on the false alarm ratio, which is a measure of the likelihood of ordnance in target excavations, over one-third of NAEVA's target excavations would have resulted in ordnance finds. That result is better than other combined-scenario demonstrators with similar detection rates. Finally, NAEVA's false alarm rate, 24.8 false alarms per hectare, is relatively low among *all* demonstrators.

Summary Comments

Regarding instrumentation, both the Geonics EM-61 and Scintrex SM-4 Smartmag units are high-quality commercially available instruments. Indeed, the Geonics EM-61 units are perhaps the most frequently used instruments by JPG demonstrators. Consequently, our success should not be attributed to any "newly developed secret instrumentation" that is more "sensitive" than those used by competitor demonstrators. We are of the opinion that although the quest for new and innovative instruments should continue, the sensors we utilized at JPG already typically have an *instrument noise* level well below that of the *terrain noise*. Navigation and grid control were accurately maintained by chain rather than by using more "sophisticated" but oftentimes less accurate GPS methodology.

Regarding data processing and interpretation, the DAT-61 software is commercially available, and while the MAGFIT software is proprietary, its theoretical basis has been published.

We believe our success is attributed first to our experienced field crews carefully executing precise field procedures during data collection, assuring the first step in a successful program: high quality raw data. Second, regarding processing and interpretation, we did not rely solely on computer software to make our target selection. Data were processed and analyzed using model-based software, but all final target selection/discrimination was reviewed manually, so that human judgment could be applied. Our results demonstrate the validity of such interpretational procedures, providing the data collection locations are accurate, and the signal (message) to noise (instrument plus terrain) ratio of the instruments is satisfactory. Further efforts in research and development need next be applied to the task of enhanced target characterization.

John D. Allan is president/principal of NAEVA Geophysics, Inc., and its parent North American Exploration of Virginia, Inc.—service companies in environmental geophysics and mineral exploration. Mr. Allan, a registered geologist, has over 20 years experience in designing, conducting, and interpreting geophysical surveys for environmental applications and mineral exploration. His e-mail address is naevageo@aol.com. □

Tools continued from page 1

number of UXO items in the sector. In other words, we are 95% certain that there are 100 or fewer OE items in the sector. Table 4 uses the information in table 3 as the baseline from which the projection is made.

The fifth spreadsheet (minimum detection) allows the user to determine the probability of there being one or more ordnance items in a sector (or any given area) when investigation has not shown any OE. This is similar to the minimum discrimination level often used in HTRW settings where the question is "can my instrumentation detect a given level of a chemical in the soil or water?" Our instrumentation is, in effect, our statistics. If we are not finding OE, does that mean that there is not OE to be found, or does it simply mean we are not taking enough samples to determine if there is OE at the site? This tool requires the sector area, the area investigated, and the comparison density. (Comparison density is the value we want to test; that is, if we think a density of 0.1/acre is significant, then that value would be entered on the spreadsheet.) The spreadsheet will return the probability of the presence of one or more ordnance items in the area of interest if we have not found any ordnance in the investigated area.

Table 1.

Area of total region	A(T) =	1000
Area of subregion investigated	A(I) =	500
Proportion of total investigated	p =	0.5
UXO count in subregion	k =	20
UXO density in subregion	D(I) =	0.04
Expected UXO count in total region	E(N) =	41
Expected density in total region	D(T) =	0.041

Table 2.

Specified total count	N* =	100
Corresponding density	D* =	0.1
Probability of lower total UXO count	P(x ≤ N*) =	1
Probability of equal or lower density	P(D ≤ D*) =	1

Table 3.

Specified total UXO density	D* =	0.1
Approximate corresponding count	N* =	100
Probability of lower total UXO count	P(x ≤ N*) =	1
Probability of equal or lower density	P(D ≤ D*) =	1

Table 4.

Specified probability of lower density or count	(1-α*) =	0.95
Approximate UXO count where P (this or smaller count) = (1-α*)	N* =	52
Approximate UXO density where P (this or lower density) = (1-α*)	D* =	0.052

Table 5.

Area of total region of interest	1000
Area of investigated region	24
Ordnance density (entire region)	0.2
Probability of 1 or more ordnance items in investigated region	0.9922

For answers to technical questions concerning these tools, contact Mr. Arkie Fanning, PE, at Huntsville Center, 205-895-1762 or e-mail fanninga@smtp.hnd.usace.army.mil. To order these tools, contact Jim Manthey at mantheyj@smtp.hnd.usace.army.mil or 205-895-1588. □

Risk method continued from page 1

The current version of R3M is a three-tiered method that includes both qualitative and quantitative components to evaluate the safety, human health, and environmental risks posed by UXO hazards:

- Tier 1: Qualitative Risk Evaluation (QRE)
- Tier 2: Streamlined Risk Evaluation (SRE)
- Tier 3: Detailed Risk Evaluation (DRE)

Tier 1

The purpose of a QRE is to help identify ranges, or range sectors, that pose little or no explosives safety risk and ranges posing a risk and, therefore, requiring further evaluation. The outcome of a QRE would be the numerical categorization of sectors representing a level of explosives safety risk. Based on the results of a QRE, several risk management options could be recommended: (1) further evaluation using the second tier of R3M (2) further evaluation using the third tier of R3M, or (3) range close-out.

Tier 2

The SRE takes a screening-level approach and estimates the maximum degree of UXO risk to which receptors may be exposed. A most-exposed individual (MEI) receptor is identified, and risks to the MEI are evaluated deterministically, using worst-case assumptions and data. Considering the SRE results, the risk manager may decide one of the following is required: (1) an accelerated response or site-specific removal action, (2) a DRE, (3) no further action. Range sampling activities are considered a component of the SRE; the data gathered for the SRE helps delineate the range and describe UXO present on the range.

Tier 3

The DRE is a comprehensive assessment that incorporates range sampling results and characterization from range sampling activities that must be conducted before the SRE or DRE are completed. The DRE quantifies deterministic and probabilistic risk from UXO, and it assists the risk manager in determining the adequacy of accelerated responses or determining the necessity of site-specific response actions.

USAEC is currently revising R3M in preparation for expanding the development effort. USAEC plans to make the new version available to the Range Rule partnering states, tribes, and other agencies for their review and comment. Additionally, it is planned that the public will be invited to review R3M at the same time through the Internet or by individual request.

Scott Hill, an environmental engineer, is the Range Rule Risk Methodology coordinator for AEC. His e-mail address is sahill@aec.apgea.army.mil. □

Why QASAS at HNC?

by Linda James, Huntsville Center PAO

In the world of ordnance, Huntsville Center is known for its specialized expertise. One element of that expertise includes two employees who carry the word QASAS after their job titles—no matter where they're assigned, and they've been assigned all around the world.

Richard Pike and John Sikes are Quality Assurance Specialists (Ammunition Surveillance)—commonly know as QASAS (pronounced KWA-SUS).

To be a QASAS means you've received extensive training in the life cycle of the ammunition stockpile—from cradle to grave. It means that you've rotated into assignments as often as every two years (much like the military) to give you a breadth and depth of knowledge about ammunition that can't be had by staying in one place. It means being a munitions expert in the truest sense of the word on *all* munitions—chemical and special weapons, as well as conventional. It means working in ammo manufacturing plants, on Army storage depots, in the field with soldiers, at port facilities where prepositioned ammo ships dock, and, because of Huntsville Center's unique ordnance mission, it means a rare assignment here with the Corps of Engineers.

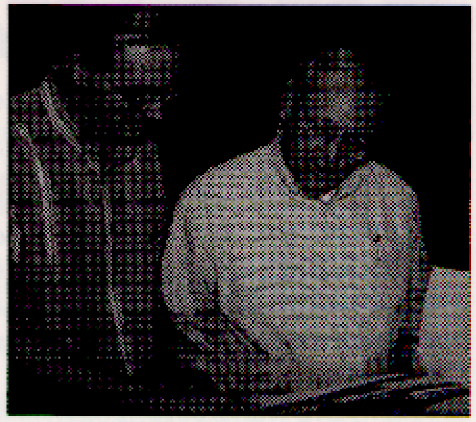
Armed with an in-depth knowledge of ammunition and all the processes that surround the manufacturing, movement, storage, and disposal of ammo, the QASAS expertise seems a perfect fit with the Huntsville Center mission.

Bob Nore, Chief of the Ordnance and Explosives Design Center, agrees. "I have found the QASAS folks to be highly qualified for this kind of work. Their quality assurance background has been very helpful in establishing work procedures and in setting the direction of our quality assurance policies. Both John and Richard have been an important part of our OE Team," he said.

For example, as the team leader for the Archive Search Reports/Inventory Project Reports Team, Pike reviews detailed search reports on formerly used defense sites. Those reports, prepared by St. Louis and Rock Island districts, are the basis for making critical decisions on ordnance cleanup strategies. Pike's QASAS background ensures that even the smallest detail, such as how typical ammo production lines worked during World War II, is given full consideration in the final analysis of the data. Once the review of the reports is finished, a recommendation on cleanup strategy goes to the Huntsville Center Technical Advisory Group, of which Pike is also a member.

As an OE project manager for the cleanup of formerly used defense sites during 1994-1996, one of Pike's projects was the Toussaint River Dredging Demonstration on Lake Erie. That project was a demonstration to determine if it was feasible to dredge a channel that was contaminated with unexploded ordnance. The equipment and procedures used were such a new innovative technology that Pike wrote a paper on the project and presented it at the 1996 Global Demilitarization Symposium and Exhibition in Reno, NV; the AMEREM '96 International Conference in Albuquerque, NM, and the DOD Explosives Safety Seminar at Las Vegas, NV.

Sikes plays a much different role at Huntsville Center. He is developing an ISO 9000-equivalent Quality Operating System that documents the processes currently used within the OE Center of Expertise and Design Center. ISO 9000 is an internationally recognized set of quality standards. As Sikes puts it, "a way to do good business." He explained that through the



John Sikes (left) and Richard Pike (right), Quality Assurance Specialists (Ammunition Surveillance) assigned to Huntsville Center, review archives search reports and oversee the center's ISO 9000-based Quality Operating System. QASAS (pronounced KWA-SUS) personnel are highly trained munitions experts.

process, you "document what you do; do what you document; and then evaluate and improve the process." According to Sikes, the documentation of OE quality processes will provide the mechanism for continuous improvement by defining a corrective action process, a preventive action process, and the sharing of lessons learned.

Both Sikes and Pike agree that one thing they both bring to Huntsville Center is an impressive access to resources throughout the services. "We personally know people in almost every relevant area who we could call and get answers or information in a matter of minutes," said Pike.

The Defense Ammunition Center in Savanna, IL, is home to the career program manager's office for all QASAS. DAC rotates QASAS employees in and out of assigned slots throughout the Army. Pike and Sikes came to Huntsville as "loaned" QASAS in 1994. Sikes' job in quality assurance in the Center of Expertise is a permanent QASAS slot. Pike is still considered "on loan;" however, the position should be made permanent soon. ☐

Tools *continued from page 1*

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For answers to technical questions concerning these tools, contact Mr. Arkie Fanning, PE, at Huntsville Center, 205-895-1762 or e-mail fanninga@smtp.hnd.usace.army.mil. To order these tools, contact Jim Manthey at mantheyj@smtp.hnd.usace.army.mil or 205-895-1588. □

Risk method *continued from page 1*

The current version of R3M is a three-tiered method that includes both qualitative and quantitative components to evaluate the safety, human health, and environmental risks posed by UXO hazards:

- Tier 1: Qualitative Risk Evaluation (QRE)
- Tier 2: Streamlined Risk Evaluation (SRE)
- Tier 3: Detailed Risk Evaluation (DRE)

Tier 1

The purpose of a QRE is to help identify ranges, or range sectors, that pose little or no explosives safety risk and ranges posing a risk and, therefore, requiring further evaluation. The outcome of a QRE would be the numerical categorization of sectors representing a level of explosives safety risk. Based on the results of a QRE, several risk management options could be recommended: (1) further evaluation using the second tier of R3M (2) further evaluation using the third tier of R3M, or (3) range close-out.

Tier 2

The SRE takes a screening-level approach and estimates the maximum degree of UXO risk to which receptors may be exposed. A most-exposed individual (MEI) receptor is identified, and risks to the MEI are evaluated deterministically, using worst-case assumptions and data. Considering the SRE results, the risk manager may decide one of the following is required: (1) an accelerated response or site-specific removal action, (2) a DRE, (3) no further action. Range sampling activities are considered a component of the SRE; the data gathered for the SRE helps delineate the range and describe UXO present on the range.

Tier 3

The DRE is a comprehensive assessment that incorporates range sampling results and characterization from range sampling activities that must be conducted before the SRE or DRE are completed. The DRE quantifies deterministic and probabilistic risk from UXO, and it assists the risk manager in determining the adequacy of accelerated responses or determining the necessity of site-specific response actions.

USAEC is currently revising R3M in preparation for expanding the development effort. USAEC plans to make the new version available to the Range Rule partnering states, tribes, and other agencies for their review and comment. Additionally, it is planned that the public will be invited to review R3M at the same time through the Internet or by individual request.

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