Environmental Cleanup Technical Seminar

Potential Technical Problems Pertaining to Cleanups of Overseas U.S. Military Bases

By Jorge Emmanuel, U.S. Working Group for Philippine Bases Cleanup

While much of the International Grassroots Summit on Military Base Cleanup is focused on important political, legal, and financial questions, there are many technical issues that need to be resolved with regards to cleanup of overseas bases. (The UXO problem will be discussed by others and will not be covered here.) The purpose of this paper is to outline some of the major technical issues that need to be addressed in the coming years. Although this paper centers on technical matters, it is obvious that they cannot be separated from policy and economic considerations. This paper is not intended to be a comprehensive presentation but an attempt to initiate discussion and technical exchanges in the hope of facilitating the cleanup process at overseas bases.

I. General issues

(a) Need to Build Technical Capacity

A lack of experience in environmental investigations and cleanup in many developing countries may mean that their available technical capacity in this specific environmental field may be inadequate. If so, the U. S. should provide training, technology transfer, and technical support to build that capacity and develop self-sufficiency.

(b) Differences in Overall Approach to Environmental Investigations and Cleanup

Differences in overall approach need to be resolved beforehand. In one country, for example, an environmental baseline survey (using a process intended for the identification of clean parcels for economic conversion) was used instead of a comprehensive environmental assessment to draw conclusions about the extent of contamination, thus understating the problem. In general, the overall approach to environmental restoration must be systematic, thorough, and comprehensive with a rational sequence of steps and adequate opportunity for independent review, oversight, and public comment throughout.

II. Possible technical issues during the investigation phase:

(a) Lack of Standards or Guidelines on Environmental Sampling:

In 1994 and 1996, EPA released guidances for the Data Quality Objectives (DQO) process (EPA/600/R-96/055) and Data Quality Assessment (EPA/600/R-96/084) which were attempts to get investigators to prepare careful sampling plans in relation to the types of decisions that needed to be made. Unfortunately, in the U. S., many investigators follow the DQO process pro forma, using general equations and templates to determine their sampling procedure without carefully considering compositional and distributional heterogeneity, sources of sampling error,

15 Sites Types Associated With Base Contamination	
Site	Total Number
Storage Areas	3,479
Underground Storage Tanks	2,689
Landfills	2,016
Spill Areas	1,904
Surface Disposal Areas	1,475
Disposal Pits/Dry Wells	849
Contaminated Buildings	709
Oil/Water Separators	573
Surface Impoundments/Lagoons	557
Fire-Fighting/Crash Training Areas	532
Waste Treatment Plants	410
Aboveground Storage Tanks	356
Burn Areas	325
Explosive Disposal Areas	268
Unexploded Ordnance Areas	220

etc. This could result in inappropriate use of random and/or non-probabilistic sampling, inadequate number of samples or sample mass, or improper selection and use of sampling tools.

Samples obtained following an inadequate sampling plan may not be representative of the environmental medium being analyzed resulting in inadequately characterized sites. Sometimes, when judgmental (non-probabilistic) sampling is used, contamination in other parts of the site are missed. Similarly, when a coarse random grid is used for systematic random sampling, hot spots may be missed entirely. If a trowel is used to collect soil samples to test for volatile organic compounds (VOCS) as was done at one overseas base, the soil sample could underestimate the VOC concentrations by several orders of magnitude. Samples that are not properly preserved at the time of collection (e. g. , some types of samples must be acidified and cooled to 4 C) or samples that are stored for too long (e. g. , a water sample being tested for VOCs stored for more than two weeks) may give erroneous results. These examples illustrate the need for standards or guidelines on environmental sampling.

General Cleanup Process

- **preliminary investigation**
- **site characterization**
- **studies to determine remedies**
- **design of cleanup system**
- **cleanup**
- **monitoring**
- **(immediate actions)**

The field of environmental sampling is developing and many controversies remain. Some countries may not have standards or guidelines for sampling which could call into question the ability of investigators to properly characterize the extent and levels of contamination at a site, or to evaluate the effectiveness of cleanup technologies or the lack thereof.

(b) Lack of Standardized Methods of Analysis, Inadequate Laboratory Capabilities, and/or Lack of Quality Assurance/Quality Control:

In the United States, standardized methods of chemical analysis are explicitly defined so much so that when an investigator wishes to analyze, for instance, VOCs in a groundwater sample, he or she needs only to specify EPA Method 8240 and a qualified environmental laboratory would know immediately what is required. Countries that have no standardized analytical methods may decide to adopt standard methods of another country or develop equivalent methods. In the latter case, they should validate the method by determining the method detection level (the concentration of a sample, processed through the analytical method, that produces a detection signal sufficiently large such that 99% of tests of samples at that concentration results in a detectable signal). In addition, the method should be tested for stability ("method ruggedness") and equivalency with a standard method by conducting statistical analyses on the results of five or more sets of tests at different concentrations (see for example, EPA's 1983 guidelines for establishing equivalent methods, EPA 600/X-83-037).

In countries with much experience in environmental remediation, one finds numerous environmental laboratories with complete sets of analytical instruments, subsampling tools, extraction devices, and calibration standards -- all of which are expensive assets. Environmental labs are also equipped for sample storage and disposal, sample control, sample preparation, and computerized reporting of analytical results. In the United States, environmental laboratories are accredited under various national and state programs such as EPA's Contract Lab Program and California's Environmental Lab Accreditation Program, or independent organizations such as the American Association of Laboratory Accreditation. Laboratories issue Statements of Qualification which indicate which EPA Method of analysis they are capable of conducting. Some countries may not have sufficiently developed laboratory capabilities to meet specific needs of environmental testing. Technology transfer, information exchange, training, and funding may be needed to develop full capabilities.

In order to have a high degree of confidence in laboratory results and to minimize the possibility of error or fraud, laboratories in the U. S. and elsewhere have well-established and standardized quality assurance/quality control (QA/QC) programs. QA/QC is the program specifying the measures needed to produce defensible data of known precision and accuracy. These measures

U.S. Department of Defense (DoD) Cleanup Program

- **Defense Environmental Restoration Program (DEPR)**
  - established in 1984
  - funded by the Defense Environmental Restoration Accounts
  - managed by the Deputy Under Secretary of Defense (Environmental Security)
  - three major programs:
    * Installation Restoration Program
    * Other Hazardous Waste Operations
    * Building Demolition/Debris Removal

- **Installation Restoration Program (IRP)**
  - deals with investigations and cleanup of contaminated sites at all DoD installations

- **Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)**
  - created Superfund, a national fund for cleanup
  - National Priorities List
    * listing of the most contaminated sites (NPL sites or Superfund sites) with the greatest danger to public health and the environment.
    * Hazard Ranking System
      » scoring to reflect the potential hazard to public health and the environment
      » score takes into account the amount and toxicity of contaminants, potential mobility, availability of pathways for human exposure, proximity of populations, etc.
      » score of 28.5 or higher on NPL

- **Two basic cleanup actions:**
  - removal actions – short term actions to remove imminent threats
  - remedial actions – part of a long-term remedial process

include periodic demonstration of laboratory capabilities using laboratory control samples or standards, determining the method detection limits for specific pollutants being tested, testing of blanks or so-called matrix spike duplicates, regular calibration, preventive maintenance, etc. Also important is a chain of custody procedure to document sample control and ensure sample integrity from the time of collection to the final report. The need for reliable, high quality, defensible data makes it necessary for all environmental labs to incorporate good QA/QC programs. Some countries may not require such programs and this could cause serious problems.

Proper environmental sampling and laboratory analysis are important capabilities that need to be in place throughout the entire environmental restoration process, from preliminary investigation to maintenance and long-term monitoring.

(c) Inappropriate Use of Quantitative Health Risk Assessments

Health risk assessments are used throughout much of the investigation and cleanup process in the United States. They are used in hazard ranking to determine if a site should be cleaned up or included in the Superfund list, in guiding the selection of remedies, in defining the cleanup levels, and in evaluating remedial actions. At times, results of health risk assessments are inappropriately used. In applying the standard risk assessment methodology in the U.S., differences between the U.S. and host nation must be considered. The average body weight, general level of health or nutrition, degree of exposure to other risks, weather conditions, eating patterns, average intake of water, etc. could differ significantly from standard assumptions used in the U.S.

It is also important to recognize that quantitative health risk assessments are based on many assumptions, including assumptions about exposure pathways, exposure concentrations, estimation of chemical intakes, absorption efficiency, toxicology data extrapolated from animal studies, toxicity values, etc., all of which introduce significant uncertainty. The National Research Council pointed out in 1982 that there were about 50 opportunities for discretionary judgment in developing a risk assessment. Thus, in practice, risk assessment is not an objective process but a very subjective one. For all these reasons, health risk assessments should be used judiciously.

III. Possible technical issues during the intermediate phase between site investigations and actual cleanup; this phase involves investigations to determine possible cleanup actions and feasibility studies:

(a) Lack of or Conflicting Cleanup Standards: How Clean is Clean?

This is among the more pressing issues relative to overseas cleanup. In the U. S. , health risk assessments and "applicable or relevant and appropriate requirements" (ARARS) are used to guide cleanup decisions. Examples of ARARs would be the maximum contaminant levels under the U. S. Clean Water Act for cleaning groundwater. The decision is formalized in a Record of Decision which is reviewed every five years.

If a host country does not have cleanup standards, the ARARs used in the U. S. should serve as a minimum standard for cleanup. In the event of conflict in cleanup standards, the more stringent standard should be used.

Nine very general criteria are used in the U. S. for selecting a cleanup remedy under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). In addition to ARARs and protecting health and the environment, the criteria include whether the solution is permanent; long-term and short-term effectiveness; reduction of toxicity, mobility, and volume of contaminants; implementability; cost; and acceptance by state and community. In developing countries or in poor communities, other

Community Environmental Response Facilitation Act of 1992 (CERFA)

- **Process to determine and document "uncontaminated" properties** (clean parcels) within closing bases to accelerate the availability of these properties for reuse
- **Environmental Baseline Survey**
  - review of DoD records
  - review of other government records analysis of aerial photographs
  - interviews of current and former employees
  - visual inspections
  - identification of contamination at adjacent parcels
  - review of ongoing response actions
  - sampling and analysis where appropriate
- **Classification of parcels**: 7 categories
- **Finding of Suitability to Lease** (FOSL)
- **Finding of Suitability to Transfer** (FOST)
- **Liability**
  - Covenant in transfer deed: DoD will be responsible for any additional RA; DoD will indemnify persons who acquire the property
  - Covenant in deed to transfer by lease: DoD

factors should be considered, such as energy conservation, occupational safety and health, potential for job creation, minimum toxic byproducts and residues, etc.

> **CERCLA (Superfund) Process**
>
> **1) Preliminary Assessment (PA)**
> Limited investigation to distinguish sites that pose little or no threat to public health and the environment and those sites that require more investigation; a PA includes
> - review of historical records
> - site visit (visual inspection)
> - interviews with current and former employees
>
> **2) Site Inspection (SI)**
> Limited sampling and analysis to determine if hazardous substances are present and are being released to the environment.
> - data from the PA/SI is used to obtain a Hazard Ranking System (HRS) score.
>
> **3) Remedial Investigation (RI)**
> Extensive field investigation involving site investigations, environmental sampling and analysis to determine the nature and extent of contamination, and to assess the risks to public health and the environment
>
> **4) Feasibility Study (FS)**
> Studies, done in conjunction with an RI, to determine options for cleanup and to evaluate those options
> - initial screening of cleanup activities
> - detailed analysis of alternatives
>
> **5) Remedial Design (RD)**
> Development of actual engineering design of the selected cleanup remedy
>
> **6) Remedial Action (RA)**
> Construction, operation, and implementation of cleanup remedy

(b) Issues Regarding Cleanup Technologies

Some technologies, such as the commonly used pump-and-treat with activated carbon adsorption, concentrate pollutants and transfer them to another medium, such as a carbon bed. The new medium with the concentrated contaminants need to be disposed of. Some countries may not have the proper facilities to do so. Other technologies may produce toxic emissions or byproducts, such as an incinerator with little or no pollution control devices. In the U.S., there are stringent federal and state regulations limiting air emissions and wastewater discharges or restrictions on land disposal of hazardous wastes, but other countries may not have similar regulations. Under those circumstances, cleanup may simply become a matter of transferring contaminants from one environmental medium to another. A high priority should be placed on permanent removal and destruction of contaminants with minimum impact on the environment.

There has been a long-standing controversy in the U. S. regarding intrinsic remediation or natural attenuation. Proponents have argued that allowing natural biological processes to get rid of contaminants is a cost-effective alternative. Intrinsic remediation may entail institutional controls to limit exposures and the use of some technologies, such as caps and slurry walls, which contain the contaminants. Clear and strict guidances are needed to ensure that intrinsic remediation is indeed the most effective and appropriate option to meet the cleanup objectives for a particular site, that extensive and long-term monitoring is conducted to show that it works, and that contingencies are available should it fail. Without enforceable guidelines, the danger exists that intrinsic remediation will become a commonly used excuse for doing nothing.

There is interest on the part of some Host Nations to try experimental or developing cleanup technologies as a way of addressing the environmental problems. It could be mutually beneficial if an innovative technology proves to be an effective, economical, and appropriate technology for a particular site: the technology vendor gets to demonstrate a technology while obtaining field data on its performance, and the site gets cleaned up. But there are some possible pitfalls. For example, if the technology produces toxic residues, how will they be disposed of? Will there be independent and impartial testing to determine its efficacy? Are there adequate laboratory and other technical resources to evaluate the technology? Who determines the criteria for success or failure of the technology? Will there be government and community oversight? Will the technology be used to treat a small portion of contaminated sites while leaving the rest untreated?

Will lax or nonexistent environmental laws in some Host Countries mean that the technology will be allowed to create other pollution problems? Will technology vendors exploit the lax or nonexistent occupational health and safety laws in some Host Countries? Who decides which technologies are appropriate? Will the community have a say about the technology? Importantly, what happens if the technology fails?

IV. Possible technical issues during the cleanup phase:

(a) Lack of Occupational Safety and Health Laws:

In the U. S. , workers at hazardous waste sites are required under the U. S. Occupational Safety and Health Administration to take 40 hours of classroom and hands-on training dealing with occupational safety. This includes training in the use of personal protective equipment, site control, decontamination, periodic medical examinations, emergency response, etc. Programs such as these are vital for the protection of workers involved in cleanup. Some Host Nations may have weak occupational safety and health regulations or no specific programs to protect hazardous waste workers.

(b) Need to Clean Up Beyond the Borders of the Base:

Many contaminants are highly mobile and migrate off-site due to natural processes such as rain, runoff, the movement of groundwater, air, bioaccumulation by plants or animals, etc. Cleanup programs should address contamination that has migrated beyond the borders of the military base.

(c) Lack of Treatment, Storage, and Disposal Facilities (TSDFs):

Many cleanup plans involve disposing of hazardous waste drums, spent solvents, filters and carbon absorbers, contaminated equipment, etc. in TSDFS. In the U. S., TSDFs must obtain permits to operate and must meet various standards related to land treatment, incineration and other thermal treatment systems, chemical or biological treatment technologies, landfills, etc. Landfills, for example, are required to have two or more liners, a leak-tight collection system, and groundwater monitoring to ensure that the toxic waste is contained. Many developing countries do not have TSDFs and the landfills are generally uncontrolled which could lead to leaching and migration of contaminants and subsequent human exposures.

(d) Lack of Funds for Contingencies:

It often happens that during the cleanup process, more contaminated soil or groundwater is discovered and the base is forced to deal with a much larger volume or in some cases, more toxic contaminants than previously anticipated. In an overseas cleanup, contingency funds should be available to prepare for this potential problem.

V. Possible technical issues during operation and maintenance:

Regarding long-term monitoring and periodic review, some sites, such as large aquifers that are heavily contaminated, may require treatment and monitoring for several decades. In general, periodic reviews (every five years in the U. S.) are necessary to make sure that cleanup objectives are met. Some Host Nations may not have the infrastructure to conduct long-term monitoring and review.

Risk Assessment Presentation Summary

By Theodore J. Henry, Director Chapp Center, Baltimore, Maryland

Overhead 1 (see p. 41)

This overhead shows the long, stepwise process through which a contaminated site is addressed in the United States. While this graphic refers specifically to the identification and remedial process for Superfund sites (contaminated sites listed on the National Priorities List), the step by step process from site identification through the implementation of a remedy helps a person understand the overall clean up process used in addressing environmental contamination.

During a remedial investigation (site characterization), a specific clean up may be conducted to address an immediate risk or defined source of contamination, such as a small dump. Such a *Removal Action* is suppose to cost less than 2 million dollars and take less than two years to complete, while larger and/or longer projects are suppose to move through the more complete *Remedial Investigation - Record of Decision* process. Too often, the quicker *Removal Action* approach is used inappropriately to reduce public input, retain control by the responsible party, etc.

Overhead 2

This definition of *Risk Assessment* provides the basic understanding of what it is suppose to accomplish - using science to determine risk to a specific receptor (human, fish, etc.) in a specific contamination scenario. As discussed in the paragraphs to follow, *Risk Assessment* is only as strong as the available scientific data and is very vulnerable to misuse or manipulation.

> **Overhead 2**
>
> **Risk Assessment is a scientifically based procedure to estimate the probability of adverse health effects from a specific exposure to a toxic agent**

Overhead 3

More specifically, *Risk Assessment* is a critical part of the remedial process used to establish clean up priorities to address health risks to the surrounding community and/or environment.

> **Overhead 3**
>
> **Health risk assessments help to determine**
> 1) **the pathway by which people are exposed to the chemicals**
> 2) **the dose at which people are being exposed**
>
> **Results of risk assessment determinations help authorities:**
> 1) **determine whether immediate steps would be taken to protect people from chemicals being released from the site, and**
> 2) **set priorities with respect to which parts of the sites should be cleaned up most rapidly.**

Overheads 4 & 5 (see p. 44)

These overheads provide the basic pieces of the *Risk Assessment* paradigm or process. The initial step is known as *Hazard Identification (Descriptive Activities)* where the investigators:

1) gain a better understanding of the site
   - For example, are we dealing with a wetland or stream?

2) try to assess the contamination source
   - Is the concern the outfall from a factory smokestack or buried drums?

3) select endpoints of concern
    - Is the endpoint the local people breathing in contamination or fish reproduction in a nearby stream?

The next phase is *Hazard Assessment*, where the risk assessor uses the information collected during the *Hazard identification* phase and research data to conduct the following assessments.

1) *Exposure Assessment* is where existing or potential exposure pathways are identified.
    - This is critical because if a person or animal is not exposed to contamination then there cannot be an adverse effect (see Overhead 7 p.46).
    - If there is a potential exposure pathway then an effort is made to calculate the concentration of the contamination to which the receptor might be exposed.

2) *Effects (dose-response) Assessment* is where the available scientific data are used to determine the potential impact on the receptor.
    - An effort is made to calculate the *dose* of the chemical contaminant that a person or animal actually receives, which is calculated using various factors including contaminant concentration, duration of exposure, route of exposure (see Overhead 8 p.47) and body weight.
    - Any available research data regarding the contaminant are evaluated to determine what types of effects are possible and the probability of such adverse effects occurring. This part of the process is heavily dependent of the quality of scientific data available. For chemicals that have been researched there are sometimes comparison criteria to compare the site data with to determine if the concentrations present at the site pose significant risk (one example in the United States is Maximum Contaminant Levels (MCLs) for drinking water)

Overhead 4

Risk Assessment Paradigm

- **Hazard Identification**
  – site assessment
  – source description
  – choosing endpoints
- **Hazard Assessment**
  – exposure assessment
  – effects (dose-response) assessment
- **Integration/Risk Characterization**

The last phase of the *Risk Assessment* process is *Integration/Risk Characterization* where the data collected and the assessments conducted are evaluated to determination what exposure or dose is "acceptable".

Overhead 6

The *Risk Assessment* process is only one-half of the larger process of *Risk Analysis*. Once a *Risk Assessment* is completed, the *Risk Management* phase is where influencing factors such as costs, politics and other non-scientific influences are considered before final decisions are made regarding "acceptable" risks and clean up possibilities.

Overhead 6

Risk Analysis encompasses both risk assessment and risk management.

Risk Assessment provides the scientific basis for public policy and action.

Risk Management involves evaluating risks relative to potential benefits and defining an acceptable risk level. Socioeconomic, legislative, technical and political factors are considered.

Overhead 7 (see p. 46)

This is a useful graphic in many ways. For instance, it shows how a release of contamination can travel in the aquifer underground and move toward a well and thus impact those drinking that water. A *Completed Exposure Pathway* is where there are the following:

1) Source (the barrel of chemical)
2) Release (the leaking of its contents)
3) Contaminated medium and point of exposure (the groundwater and well in this case)
4) Potentially exposed population (a community using the well)
5) Route of exposure (ingestion of the contaminated drinking water)

Equally important, it shows how one must have a solid understanding of the subsurface to accurately determine risks to groundwater. If there is a connection between the upper and lower aquifers (something easy to miss in the site characterization process), a deep well can become contaminated over time and those drinking the well water can become ill. Without long-term monitoring of the deep well, people may be unknowingly exposed to the contamination years or decades later.

Overhead 8

This overhead lists the different routes of exposure through which a person might be exposed to contamination or physical risks. UXO stands for unexploded ordnance and represents an explosive hazard **and** a toxicological hazard from the chemicals that make up the munition item.

Overhead 8

Potential Exposure Pathways at APG-Edgewood

Routes of Exposure	Results
Ingestion	Contaminated fish and wildlife
Accidental Ingestion	Groundwater, surface water, soil, sediments
Dermal Absorption	Groundwater, surface water, soil, sediments
Inhalation	Lower atmosphere during testing; areas surrounding old dumpsites; dispersed soil particles near contaminated areas.
Physical Hazards	UXOs and white phosphorous in all testing areas

Overhead 9

Once contamination is found, the site characterization and risk assessment process will result in 1 of 3 possible determinations or approaches (or a combination of the 3).

1) A risk assessment may be completed in a manner that no "unacceptable risks" are found. Thus, no action is taken at the site.

2) Contamination may be left in place with risks being addressed by interrupting/cutting off the exposure pathway.
   - Institutional controls are becoming a popular mechanism to avoid more costly clean up.
   - For example, the responsible party may interrupt exposure to contaminated soil by placing a fence around the site to restrict access.

3) Lastly, contamination may actually be cleaned up.
   - Different regulatory agencies have different perspectives on this approach.

- With regards to groundwater, many states require the clean up of groundwater even if it is not expected to be used as drinking water in the future. This approach is based on the belief that all groundwater is a *natural resource* to protect because it may be needed in the future in some fashion.
- The U.S. Environmental Protection Agency (EPA) more often makes decisions about the treatment of groundwater *based on risk* from current or future use. In other words, if no current or future-use exposure pathway is identified, then there is no risk and no need to address the contamination.

> **Overhead 9**
>
> **Strategies for Risk Reduction**
>
> - Produce assessment with no “unacceptable” risks
>   – use of inadequate comparison criteria
> - Interrupt exposure pathway
>   – provide alternative water source
>   – land use and institutional controls
> - Cleanup of contamination
>   – resource protection
>   -- state view on groundwater
>   – risk-based cleanup
>   -- EPA view on groundwater

Overheads 10 & 11

This list of uncertainties associated with the *Risk Assessment* process reflects a few of the many ways that risk assessments can be flawed or inadequate.

A lack of knowledge regarding the source of contamination greatly weakens a person's ability to accurately assess risk. For instance, the explosive chemical RDX (a possible carcinogen) is being found in groundwater at military sites. At Aberdeen Proving Ground, it is not known whether these detections are the result of:

1) munition testing and training at ground surface,
2) old buried munitions scattered throughout the site that are leaking, or
3) a buried munition dump that has not been located.

The size and type of the RDX source will dictate whether the current concentrations are reflective of the highest levels that will ever be found, or if the current groundwater concentrations are only the beginning and that 10 years from now the concentrations will be ten times greater.

Another example of a weak risk assessment process involves the selection of chemicals of concern. In a San Diego Bay study regarding old outfalls (discharge pipes) at the North Island Naval Air Station, reference samples were taken from other contaminated areas of the Bay. As a result, specific chemicals were dropped from the risk assessment because contaminant concentrations in the sediments from the outfall areas were not significantly higher than the concentrations found in the reference samples. By reducing the number of chemicals fully assessed in the risk calculations, the final characterization underreported the true risks resulting from the historical outfall discharges.

Overhead 10

Uncertainties

- **Source Terms**
  – RDX in APG groundwater
- **Site characterization**
  – well location
- **Migration assessment**
  – aquifer destination
  – technology limitations
- **Selection of chemicals of concern**
  – reference samples in San Diego Bay

Overhead 11

More uncertainties

- Receptor models
  – sensitive populations local exposure parameters
- Contamination interactions
  – lead and p-450 systems
- Lack of research
  – DNT isomers
- Lack of risk assessment
  – environmental RAD contamination
- Predicting and controlling future use

Chemical interactions are another area where risk assessments can under estimate risk. Scientific knowledge about the toxicity of specific chemicals lags far behind the man's ability to generate new chemicals and place them in the environment (80,000 chemicals are used in industry and there is a decent amount of research information on less than 1,000 of these chemicals). Science is even weaker at knowing how the different chemicals interact with each other to affect a person or ecological receptor. For instance, lead impacts the effectiveness of the P-450 system within a person's liver. The P-450 system allows the body to modify and then excrete chemicals that enter the body. If this system is impacted by lead exposure then the body may be less capable of addressing other contaminants to which the individual is expose (increasing the potential impact of those other chemicals).

Overheads 12 & 13 (see pp. 51-52)

These overheads show a specific example where data were presented to a community inaccurately to avoid revealing that contamination was migrating off the installation toward the community.

Overhead 12 is a groundwater contour map. The numbers represent groundwater in feet above mean sea level. Like water above ground, water under ground flows from areas of higher elevation to areas of lower elevation. So, groundwater flow direction on the map is from areas of higher groundwater elevation to areas of lower elevation (higher numbers to lower numbers, perpendicular to the contour lines drawn).

This overhead was shown to the public as evidence that groundwater flowed from off-post to on-post, keeping the groundwater plume of trichloroethene on-post and away from the community. However, there are problems with this groundwater contour map. First, the presenter placed arrows off-post making conclusions about groundwater flow where there were no wells (data) to allow such decisions. Additionally, the presenter ignored the area underneath the word "boundary" where the groundwater elevation data indicated water was flowing toward off-post communities. Specifically, data points including 7.83, 5.17 and 3.44 reveal an area of groundwater flow heading directly off-post.

Overhead 13 shows the extent of the plume after off-post samples were taken, indicating the contamination had migrated toward housing through the area specifically ignored by the presenter in overhead 12. It took the community 6 months of discussions with the U.S. Army and the EPA to get this off-post sampling conducted.

A closing note to Summit Participants

I have been working with community groups for almost six years in their efforts to get the United States Department of Defense to take responsibility for the safe and adequate clean up of environmental contamination resulting from past military activities. This is no easy task and it is largely through the commitment of concerned individuals across the United States that the Department of Defense has made some improvements nationally.

Internationally, I am aware of the complete lack of support and response by the U.S. Military. It is terribly unfortunate how politics and financial considerations can so easily outweigh science, human health and the environment. This is why I established the CHAPP Center and work with community groups on military contamination issues. I hope this information is helpful in some way in your efforts to get your local community and environmental needs addressed.

As a toxicologist, I am aware of the limitations of science and how individuals will manipulate risk assessment to reach conclusions that most benefits their company and the party responsible for the contamination. While a scientific risk assessment can be complicated, it is possible to present scientific data and the logic behind the assessment and decision-making process in a clear fashion. If you are presented or given information and it is not clear, never hesitate to push

for additional information and clarification. Have faith in your own logic and capabilities. Never let a military or technical person or agency intimidate you or end your efforts to make a difference.

Hopefully the relationships established through the International Grassroots Summit and similar events will enhance everyone's abilities to improve their specific situations. It was a privilege to get to speak to you all this past fall.

If any of the information provided in this summary is confusing, please feel free to contact me and I will try to address your questions.

Environmental Technical Seminar Panel Presentation

By Rick Stauber, consultant\UXO expert, Waldorf, MD

I have twenty-five years experience in removal of unexploded ordnance, including work in Panama and Puerto Rico and right now I serve as a technical advisor to EPA on Army Corps of Engineers removal plans.

The Department of Defense (DoD) can provide information free of charge: computer disks that have over five thousand pieces of ordnance on it that you can use for identification and safety. Also there are books and publications that the DoD can provide you free of charge that deal with chemical munitions, because some places overseas and also within the U.S., the DoD has buried or disposed of chemical munitions. So this becomes a problem also. You just have to know where to get this information, and how to ask for it.

Types of Detection Technology

The first thing we're going to talk about is UXO detection technology. These are the main technology sensors used to detect buried metal objects. Magnetometry basically relies on the deviation or the change in the magnetics of the earth. The earth has a magnetic field. When you bury something, or place it under the ground, and it's made of ferrous metals, it disturbs the magnetic field. Magnetometry can detect the change in that field. So that's one of the devices that's used to detect UXO, because UXO is made out of ferrous metal, for the most part. Some pieces of ordnance--bombs, hand grenades or pieces of munitions do contain aluminum, which is non-ferrous, but there are other types of detectors that will detect non-ferrous metals.

Mag & Flag Technology

- Utilizes Simple Hand Held Sensors
- No Digital Mapping Capability
- No Post-Processing of Data
- Utilizes Human Interface for Detection

The other type of magnetometer is called a gradiometer. A gradiometer is nothing more than a magnetometer with two sensors normally placed along the shaft at two locations. And when you move the sensors across the ground, it detects the difference between the two sensors. Just another form of a magnetometer.

> **Commercial UXO Remediation Procedures**
>
> - **Both Surface and Subsurface Clearance**
> - **Contracts driven to the nature and scope of the remediation**
> - **Utilizes ex-military EOD personnel**
> - **High Ratio of trained personnel**

Another form of technology is called electromagnetic induction, often referred to as EM. It's an antenna on the ground that sends a pulse of electrical energy into the ground. When it detects something that is buried beneath the ground, the electrical energy is absorbed into that item and then it's reflected back--it's like looking into a mirror, you get your reflection. And the degree of reflection indicates how much material is buried.

Where this is very good is where you have items made out of aluminum, brass, plastic and those items. But most of the time military ordnance is made out of ferrous metals: steel, iron, something that will be very heavy and very dense.

Another type of technology is ground-penetrating radar: GPR. This is basically just like the police: they have a radar gun that detects vehicles and tells you how fast you're going. Very similar technology, except the radar points down and detects things that are buried beneath the surface of the ground.

A sensor is any one of these four items. When you combine two or three of them together-a Multi-Sensor combination- you get benefits, because some are better [at different things.] An example: EM: is good to detect aluminum. Magnetometry is good to detect ferrous iron. If you combine the two sensors together on a platform then you get the benefits of both.

> **UXO Detection Technologies**
>
> 1. Magetometery
> 2. Gradiometery
> 3. Electromagnetic Induction (EM)
> 4. Ground Penetrating Radar
> 5. Multi-Sensor Combinations

Currently there are two different types of procedures being used here in the U.S. by the Army Corps of Engineers, who have primary responsibility for all of the cleanup in the military bases in the U.S. One of the types of technology is called "Mag and Flag." All that means is Magnetometry and a person with a flag or bunch of flags, and as he walks, as he detects an item, he'll stop and put a flag in the ground. He'll walk, detect another one, and put a flag in the ground. There are very severe problems using this procedure. It uses very simple hand-held detectors that were in fact not designed to detect UXO, but rather to detect gas lines or power lines for underground utilities. The only reason this is used is it's a very inexpensive piece of equipment: about $800. It's very easy to train people to use it, also.

But these are the problems: There is no digital capability. That means there is no way to develop a map of where the areas are where you have detected UXO. Or, sometimes more importantly, where you have not detected UXO. There is no way to develop a map. And a map is part of the archives or the history of that section of land.

Another problem: No post-processing data. This means, since it's not connected to a computer, there's no way of gathering that information to put it into a map, and no way to have the computer be able to tell you if that item is a large enough metal mass, or to make the decision if it's UXO or not. This becomes very important. But if you're walking 8-10 hours a day carrying this, you get tired. It's human nature: you're not paying attention to what the sensor is detecting. So there's more room for error. The room for error when you're using this equipment, depending on who you're talking to, is somewhere between 30 and 70 percent. You may be picking up less than half of the items that could be there. So that's why this is not the preferred technology.

Also sometimes there's so much noise generated by this piece of equipment that it's hard to tell whether you have a signal generated by this piece of ordnance.

In cleaning up a lot of old military sites within the U.S., the Defense Department found that it takes a lot of money, time and effort to detect UXO. So they wanted to develop a technology that would speed up the process and make it more accurate. So they went to computers. They already had the sensors. Now they're looking at linking this sensor with the computer. And that provides a lot of benefits. The first is, the sensors can be the active (EM--actually sending a pulse of electrical energy into the earth) or passive (magnetometer--detecting changes in the earth's magnetic field). Here's the benefit: you can digitize the information that you're receiving. Instead of listening for the change with your ear, you have a computer that is taking that analog signal and digitizing it so the computer can understand the information. You can also store that information. This becomes very important because if you're working on a large-scale project--2,3,4000 acre area of land, you need some way to create a map so you know where you found and didn't find UXO.

Digital UXO Technology

- UXO Detection Sensors “Active” or “Passive”
- Digital Sensor Interface
- Digitized Storage System
- Accurate Location Device

They are now using the Global Positioning satellites--most people have seen these little devices that you hold in your hand--GPS, Ground Positioning Systems? Push a button and it'll tell you approximately where you're located. Very simple piece of equipment. There is a type of equipment called Differential GPS. A simple GPS that you could buy at a store, costing about $400, can tell you within 75 to 100 feet where you're located. For a camper or somebody like that, that's good. But for a survey, for engineers, they have what's called differential GPS. That will get you within plus-or- minus 70 feet --boom! you're right there, within a couple of centimeters. That is the type of detection and locating capability that can be provided for this type of system using the new technology. And then, they have developed close processing computer software. Once you have stored all of the information in a computer, the software will process that information, and identify the size, depth and strength of UXO that you've located. You've done away with the interface of the human person and human error.

Military vs. Commercial Clearance

At overseas installations--any place where there is an active range--the military bomb disposal people are responsible for conducting range clearance. Now you must realize something: the military is required to surface-clear only. Only on the surface. They're not required to do any sub-surface clearance. Their mission is to reduce the immediate harm to the area. They're also limited to small areas of clearance. They only do one range at a time, or very small areas, because of one reason: there are not that many EOD people in the military. Also they don't have the time for large-scale operations, because they have the military missions also. Range clearance is only one part of a military mission.

Military EOD Range Clearance Procedures

- **Surface Clearance Only**
- **Limited in Both Nature and Scope**
- **Utilizes only a small Amount of Trained EOD Personnel**

Commercial operations are different. They rely on retired bomb disposal people. That's what we do. We retire from the military and go into the commercial arena. But we work as government contractors and work to the specifications developed by the client. We clear both surface and subsurface for a commercial UXO operation. The depth of clearance is something that has to be discussed, because it has to be at the detection depth. You can't clear deeper than you can detect. So that becomes important in determining what type of sensor to use.

The contract is driven by the nature of the scope of the remediation. The only thing that matters is money. The deeper you have to clear, and the more land you clear, the more money it's going to cost. The people doing the work are all trained ex-military, which is a very small group of people. The one big difference between military and commercial clearance operations is technology. This is the type of map that high technology can generate. This is one acre by one acre plots of an old bombing range. With technology and computers we can zoom down--this is like one quarter of that map--and isolate individual items of suspected UXO very rapidly, with differential GPS. Now remember, within centimeters you can locate them. You can also detect landfills, or anything else below the surface. Remember, magnetometers, radiometers detect ferrous metals. Ground tech uses radar, and EM systems detect all metals or anything else.

Now, depths. This system is using a cesium vapor magnetometer. This type of sensor is very sensitive. This gives you an idea of the size of the object. A 20 millimeter projectile is relatively small. Basically the size of a human thumb. This is using a digitized system.

This is the biggest bomb currently in the military today. The 500 lb. bomb of about 14 feet. So this gives you an idea of the technology that is available today.

Question and Answer Period

Question: [inaudible]

Rick Stauber: The question was dealing with depleted uranium, how you detect it. One effect you have to consider with depleted uranium is ... low alpha and beta radiation. Now alpha radiation is a particle; beta is a particle. Alpha will not penetrate even a single layer of paper. So if it's covered with any substance--a layer of soil, or anything like that, you're not going to be able to detect it--at least the alpha. Beta will penetrate something very shallow...I can't remember the penetration depth. What happens with beta is you'll get a sunburn, called a beta burn. Both of them will not actually penetrate or do any harm to the body. You have to ingest it --take it into your system to basically damage your internal organs. Now for the detection of that you need a special gradate-meter or special detection device that will detect alpha and beta radiation.

If it's under the soil, you'll have to physically dig to it, or hope there's small particles or small pieces of the depleted uranium that have been broken up on impact. Normally it will break up on impact. Most people, when they hear the words "depleted uranium," associate it with depleted uranium bombs... Basically depleted uranium is a penetrator. It is surrounded with an aluminum skin that helps the loader and handler from getting contaminated. But outside of the aluminum you also have what's called a SABOP This is a plastic or aluminum cup that has not been fired. When the item is fired and it leaves the gun barrel, the SABOP falls away and the small, in some cases thin projectile--just like a dart, will strike... Kinetic energy will penetrate the metal; with penetration you'll get higher caloric action, meaning it burns. But unless you find the actual physical mass of it, in a lot of cases you're not going to be able to detect it because it does produce alpha/beta radiation at low levels, and sometimes that radiation is hard to find. And example on target plates--large metal plates, if it penetrates to the plate, if you check on the outside of the plate where it hit, you might find some small pieces and you might be able to detect it, but unless you can move the metal plate and look behind it in the ground, chances are you won't find it.

Question: Which UXO technology can be used in sandy soils?

Rick Stauber: Usually magnetometer or radiometer systems ... the most sensitive is the cesium vapor magnetometer. That will depend on the metal mass of the target you are trying to detect. The larger the mass, the deeper the penetration detectability you can arrange. The actual soil composition doesn't really matter that much in the case of magnetometer. Now if you're using ground-penetrating radar and EM systems, sometimes the soil composition do affect the penetration and extend of detectability. With radar, if the soil is moist, the signal will attenuate, or spread, and you won't get a good signal. Sometimes with your EM systems you'll have that problem too. That's more a factor of moisture, not with the actual geology of the soil.

Question: In your experience, what percentage of bombs do not go off in target ranges.

Rick Stauber: In the military DoD field, for planning purposes they normally associate 10 % of all ordnance that are fired. So for example, 100 items have been fired, you might anticipate 10 items that have not detonated. Because of imperfections, or something that happened in the firing. I've seen cases where people have fired projectiles with the safety pins still on.

Question: If risk assessment is a double-edged sword, we should be looking at other tools. I mean, the way you described it, it sort of sounds like it's pretty comprehensive, and so my question is, is there some other tool that you're saying should be used in order to figure out what kind of cleanup to do, what not to do?

Ted Henry: With regard to the risk assessment, I know there's quite a push out there to get rid of risk assessment in its entirety from a lot of people that are very tired of the cleanup process. I don't think there's a way to do it without risk assessment in some form. I think you have to use it, but you have to demand the data, and the logic behind the decisions. And if they can't express themselves while doing that, then that's where the risk assessment starts to suffer. If you acknowledge the limitations of science, of which there are many, you can still do a decent risk assessment. But the part that gets thrown out too often, and it's partly our own fault, because the court systems demanded a quantitative way, a numbered way, to show the decision process. We can't throw out the qualitative way, and that's what we refer to as the logic, and being clear with what do you do about the contamination that you don't have a lot of supporting data for. So you have to use risk assessment, but you have to give the qualitative side appropriate respect.

I can give you one very simple 30 second example: I know the DoD has been trying to develop a risk model for UXO. One of the things that the states sent them back to the drawing board on was that they were trying to quantify risk for certain things that they [the States] decided weren't quantifiable and that it could only be done in a qualitative, clear judgment-type sense. So you have to use it, but you can't rely just on numbers.

Question: As you know that DoD is saying in Panama that they can't clean up the ranges without destroying the forests. If you are able to detect things below low-lying brush using current technology and also if you burn off the brush or cut brush without destroying trees, can you detect UXO without destroying trees?

Rick Stauber: On the question on vegetation, one of the things brought out by Ted was, if you give them (DoD) information they don't want, they'll take the information out. That's what they did on my report [on Panama?] But: one of the things we found and added to the report was ... in the tropics in Panama. And we came up with a checkerboard method of clearing alternate black and red over a period of time, allowing the jungle to regenerate itself during that interim period. Now the question is, clearing under the brush. You would normally try to cut away the brush, not touching the heavy trees--the large hardwoods. That can be easily done. Because if anybody's been in the tropics, they know that the jungle regenerates itself very rapidly--the vines, the grass, sometimes you can almost see it grow, it's that quick. So by simply using a checkerboard pattern of taking and clearing alternate areas across in a sequence, you can clear the land and not damage the large trees which do take time to regenerate.

The question about detecting UXO potentially under the tree, yes, cesium vapor magnetometers are that sensitive that they can detect under the tree. What you would not want to do is an EM system, because what you'd be detecting is the root. You wouldn't be able to tell the difference between the root of the tree and the ordnance. Now at the same time, don't be looking just under the tree; look in the tree. Ordnance will stick in the tree.

Ted Henry: I'd just like to add one thing. That statement about--they have to do risk assessment, there's always multiple levels to this thing. If you're going to go with scientific data, you know, soil samples from a site, and go the scientific way, then obviously that's when risk assessment is an unfortunate tool that must be used to some degree. Of course there's always the political route; there's always other ways to reach your goal that gets around some of that scientific stuff. Roberto (Rabin's) work down in Vieques really impressed me with just how much you can do with organizing and the political system more than relying on science.

International Meetings Impact PCBs Issues
By Larry Yates, Center for Health Environment and Justice

(Editors note: This piece was submitted to the Summit as a report on cleanup activites in the U.S.)

In May of 1999, at the invitation of the Center for Health, Environment and Justice in Virginia in the USA, and responding to growing understanding of the global threat of PCBs, activists and experts from around the world met to develop an International Initiative for the Elimination of PCBs. The countries represented included Australia, Canada, Mexico, the Philippine Republic, Russia, South Africa, and the United States of America, and several indigenous nations and tribes in North America and Russia. Activists were present from more than fifteen local communities directly impacted by PCBs, as well as from international organizations of indigenous people harmed by PCBs, especially Arctic peoples. Technical assistance for the meeting was provided by the Great Lakes Center for Occupational and Environmental Safety and Health at the University of Illinois at Chicago School of Public Health (GLCOESH), and the Toronto Environmental Alliance was the local host.

PCBs are one of the twelve POPs (persistent organic pollutants) now under consideration by the United Nations for elimination in a treaty process that is expected to be completed in the year 2000. Several participants in the Toronto meeting were leaders in the International POPs Elimination Network (IPEN), a global network of public interest non-governmental organizations united in support of a common POPs Elimination Platform. (For more on IPEN and its platform, see their Website at www.ipen.org.) The Toronto meeting participants agreed to work within the structure of IPEN, as part of its Dioxin and PCB Working Group, as they carry out the action steps agreed on there.

The gathering reflected a growing awareness that most solutions proposed by governments and industry for treating PCB contamination lag far behind the existing technology. Many communities with a long-standing toxic legacy of PCBs have been immobilized, not just by industry resistance to cleanup, but by the conventional wisdom that incineration and landfilling are the only choices for PCB treatment. Yet in Australia and in Warren County, North Carolina, USA, among other places, effective treatments of PCBs are being put into place.

The Toronto meeting began a process that could not be completed during a brief four day meeting. One concern, stated by the representatives of developing countries present, was that there were not enough "opportunities for discussing the specific problems of developing and marginalized countries." Still, the meeting showed real results.

At the initial Technical Workshop, internationally recognized experts guided a vigorous, frank, and well informed discussion on the relevant technical, community and policy issues. The group united on issues faced by affected communities, on key health effects of PCBs, on inventorying PCBs in the environment, on regulatory and community structures that would support PCB elimination, and on technical criteria for treatment technologies. Then the Activists' Roundtable developed appropriate action steps, including: developing a Web-based information source on PCB elimination, documenting PCB exposure in communities, joint action on Military Issues, especially sites formerly used by the U.S. military, initiating campaigns on contamination of breast milk and of food sources by PCBs, preparing case studies of the failure of burning and burial of PCBs, and counteracting corporate lies about PCBs. Results of the meeting are detailed on the World Wide Web at http://www.ipen.org/pcb_technicalworkshop.htm and http://www.ipen.org/pcb_activists'roundtable.htm

On Sept. 6-11, the International Negotiating Committee (INC), the United Nations body that is implementing the POPs treaty process, met in Geneva. Before the INC, IPEN hosted a conference on POPs Elimination & Alternatives in Europe which was attended by NGOs from around the globe who were in Geneva to attend the INC meetings. Workshops and plenary sessions focused on issues including POPS stockpiles, pesticide alternatives, PCBs and dioxin, and the particular impacts of POPS on women and children and indigenous communities.

Among these meetings was a meeting on PCB-related Military Issues, which built on work done at Toronto. The meeting developed a statement which was presented to the INC, asking that the POPs treaty hold military institutions accountable for characterization and cleanup of POPs contamination, including PCBs and pesticides, caused by military testing, use, storage, and disposal. The group also called for communities near military sites to have full information as to POPs threats, noted that "Minority, Indigenous, and economically disadvantaged communities" are disproportionately affected, and asked for the application of the precautionary principle to any remediation action for military POPs contamination. The statement made to the INC is available on the Web at http://www.ipen.org/militinterv.html.

In Geneva, the PCB Working Group agreed to do joint work in Central and Eastern Europe with Otvoreny Kruh (Opened Circle) from the Slovak Republic, and with the Netherlands-based organization, Women in Europe for a Common Future, which sponsored the participation of several women from Central and Eastern Europe, and the Russian Federation, in Geneva.

The PCB Working Group is providing information through the IPEN World Wide Web site. Additional links and information are available at that site, including a paper on PCB health effects by Stephen Lester, Science Director of CHEJ, at http://www.ipen.org/pcb_workinggroup.htm Communities and organizations that were not represented in Toronto or Geneva, but are committed to the same goals, are invited to join in the ongoing process of building towards elimination of PCBs.

Contact: Larry Yates at CHEJ (703 237 2249), <lyates@essential.org>
Lin Kaatz Chary at GLCOESH (312-996-09151), <lchary@uic.edu>

Summary of scope and activities of the Chemical Weapons Working Group and the Non-Stockpile Chemical Weapons Citizens Coalition

By Elizabeth Crowe, Chemical Weapons Working Group

(Editors note: This piece was submitted to the Summit as a report on cleanup activites in the U.S.)

This is to provide a brief summary of the issue of chemical weapons disposal in the U.S. and overseas, and to share my organizational goals in attending the International Grassroots Summit on Military Base Clean-Up.

Who We Are

The **Chemical Weapons Working Group** (CWWG) is an international coalition of grassroots organizations working for safe disposal of stockpiled chemical weapons in the U.S., Pacific and Russia. The CWWG was founded in 1991 by citizens from the nine U.S. chemical weapons stockpile sites (in Alabama, Arkansas, Colorado, Indiana, Kentucky, Maryland, Oregon, Utah and on Kalama Island in the Pacific) and several Russian communities near chemical weapons stockpile sites, in response to the U.S. Army's plan to burn chemical weapons in massive incinerators in the communities where weapons are stored. While the Russian government had

The Army first proposed its chemical weapons incinerator plan in 1984. Opposition to the incinerators grew quickly; citizens didn't believe the Army's assurances that incinerators could either safely destroy lethal nerve and mustard agents or prevent the release of other toxic compounds into the environment. With the founding of the CWWG came the development of an international strategy to promote the safe, non-incineration disposal of chemical agents, and to involve affected citizens in making decisions on how these weapons are destroyed.

The grassroots Non-Stockpile Chemical Weapons Citizens Coalition was founded in 1998 as a sister coalition to the CWWG, to address the retrieval, storage and disposal of abandoned “non-stockpile” chemical weapons. Non-stockpile weapons can be found at hundreds of sites in over 30 U.S. states, on military bases and private lands. Like the CWWG, the Coalition supports the destruction of chemical weapons by non-incineration methods which protect public health and the environment, and citizen involvement in decision-making processes.

What We Do

Both the CWWG and the non-stockpile Coalition actively campaign for environmental justice in chemical weapons disposal program and other military clean-up programs. We have successfully promoted the demonstration of three advanced non-incineration chemical weapons disposal technologies, and are working to ensure that more technology demonstrations are accomplished. Already two U.S. stockpile sites are moving ahead with such advanced disposal technologies, which do not produce dioxins and which can safely contain hazardous by-products rather than releasing toxics through a smokestack as incineration does. Other chemical weapons sites are moving closer to accepting safer disposal methods.

Technologies which have been, or will soon be, tested for treatment of chemical weapons may be applicable to a wide range of other warfare materiel and toxic compounds. Some technologies have already proven useful in safely destroying PCBs and other industrial chemicals. Others have the capability to destroy explosives and energetics. Deployment of such advanced technologies may one day make open burning/open detonation, improper landfilling and other inappropriate disposal processes obsolete.

International Activities

International collaboration within the CWWG has been concentrated on working with grassroots organizations in the Pacific and, to a much greater extent, Russia. Since 1991 we have organized numerous 'exchange' visits between citizens living near chemical weapons stockpile sites in the two countries, the most recent exchange having taken place in March 1999. Member organizations have sponsored and participated in numerous international hearings on chemical weapons disposal and other military toxics clean-up issues. More information on specific activities is available on request.

The non-stockpile Coalition is just beginning to develop an international focus and strategy, and I hope that this Summit will help us to do just that. The U.S. Army document listening the international scope of non-stockpile weapons is highly classified, but we do know where some of the U.S. chemical weapons stockpile were dumped at sea, and know that U.S. chemical weapons still exist in numerous countries all over the world.

Goals for the Summit

Of course, we expect that the U.S. government will neither release information on non-stockpile chemical weapons site, nor act in a responsible, accountable manner to ensure safe clean-up. Rather, as you all know, it will take international grassroots and political pressure to make the U.S. military accountable for its actions.

I am hoping to work cooperatively with Summit participants to 1) share information on the chemical weapons issue and background on the U.S. movement for safe disposal of these weapons; 2) solicit information on possible chemical weapons sites in other countries; and, 3) work cooperatively with interested Summit participants to develop the criteria for a successful international campaign toward the retrieval and disposal of U.S. non-stockpile chemical weapons overseas.