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Paved With Good Intentions: The Realities of “Safe” Versus “Free”

Roger West
Golden West Humanitarian Foundation Humanitarian Foundation

Paved with Good Intentions: The Realities of “Safe” Versus “Free”

Government-initiated landmine and unexploded-ordnance clearance policies often dictate unrealistic standards and goals that differ from the practical reality of landmine/UXO removal. The author argues that end use of the land, as well as the variables of munitions deterioration due to aging and environment, and the level of expected risk should be considered in landmine/UXO policy-making.

by Roger Hess [Golden West Humanitarian Foundation]

From a global perspective you will find that much of Western Europe has not reached the same standards expected of those countries that have experienced wars in the last 20 years, such as Afghanistan, Angola, Bosnia and Herzegovina, Cambodia, Croatia, and Iraq. Explosive ordnance, chemical munitions and other hazardous remnants from World War I and World War II are still commonly found during construction and rebuilding in Belgium, France, Germany, Italy and the United Kingdom. Many of these items remain very active and highly dangerous, but the risk level is anticipated, managed and dealt with accordingly. For countries recovering from more recent conflicts, the significant difference is in the way the threat is managed and addressed and how clearance standards are set.

So with this in mind, why are newer post-war environments held to standards that have not been achieved in some of the most developed countries in the world? Let us consider a more realistic approach to clearance standards involving risk mitigation.

Policies versus Practicality

Compared to how we went about our tasks 15 years ago, the landmine and UXO clearance field has matured a great deal. Unfortunately, the same cannot always be said for the policies governing some landmine/UXO clearance efforts. Like many in our field, I have often been placed in situations where I was expected to meet unrealistic standards and goals because policy requirements were at odds with the level of threat. Using an example later in this article, I will explain how this situation occurred while we were working in Quang Tri province in Vietnam. In situations where policies and threat level are at odds, it is challenging to explain why unrealistic standards and goals are, in fact, a waste of time, money and resources.

I have encountered a few common unrealistic standards over the years, including: “The country must be made landmine/UXO-free” and to a lesser extent, “The entire site must be cleared of all landmine/UXO to a depth of five, 10 or even 15 meters (16–49 feet).” Such unrealistic expectations have resulted in some of the most heavily debated topics of our profession and have normally been generated from a policy established at the governmental or geopolitical levels. These policies are generally written on principles that may have seemed logical at their inception but are not always reviewed for practicality as time goes on.

Senior politicians developed and/or put in place some of these policies, thereby making the nation as a whole bound to implement them. While a few countries, such as Costa Rica and Macedonia, were fortunate enough to have conditions where landmine/UXO-free status was achievable, for most countries this goal is nearly impossible.

Landmine/UXO contamination that presents a direct threat to the public or impedes development must be cleared; this is without question. Not everyone agrees, however, that land that does not directly threaten the public or immediately stop development does not require clearance (See Tamar Gabelnick’s editorial on page 5). There are far more cost- and time-effective methods to manage the risk in these areas without compromising safety.

Without delving into the different techniques involved with clearing each type of threat, the key issue is freedom of movement. Clearing shallow-laid landmines to create free access over a contaminated area results in very little freedom of movement, because a missed signal can kill or seriously injure the operator or his/her team members, as well as anyone who subsequently uses the land. Clearing buried UXO allows far more freedom of movement but requires a search method that goes much deeper. A missed signal is unlikely to kill the clearance team, however, the people occupying and developing the land afterward may not be so lucky.

Either way, it should be acknowledged that the threat from an explosive-filled munition—a landmine, cluster munition, hand grenade, mortar, etc.—is still an explosive threat. Wars happen, and since the invention of the cannon ball, hazardous items remain. After the war ends, rebuilding must occur, and the remaining hazards must be managed.

Assessing and Managing the Risk

In Europe, a significant amount of buried munitions remain. In the case of the U.K. more deeply buried munitions are likely larger aircraft bombs dropped by the *Luftwaffe*. In much of the rest of Western Europe, smaller munitions such as landmines, artillery, mortars, grenades, cluster munitions and other aircraft bombs persist in the ground.

The good news is that since many smaller UXO in Europe are deeply buried, it is feasible for pedestrians and vehicles to pass over them without causing detonation. If this UXO you drove over **had** detonated, you probably would not even have known it unless you had seismic instruments already in position. The detonation of a high-explosive compound creates a shock wave and rapidly expanding gases. However, this power is finite, and any surrounding matter, such as compacted earth, directly affect the explosion impact.

How Deep is Deep Enough?

Calculating the factors required to nullify the effects of an underground detonation requires consideration of several variables such as the quantity and depth of the explosive and soil type. These calculations can be done using specialized software programs. The best program I have seen to date is the Conventional Weapons Effects Program (CONWEP); the current Windows®-based version (2.1.0.8) is restricted due to its new features, but many people still have access to the older DOS-based program.

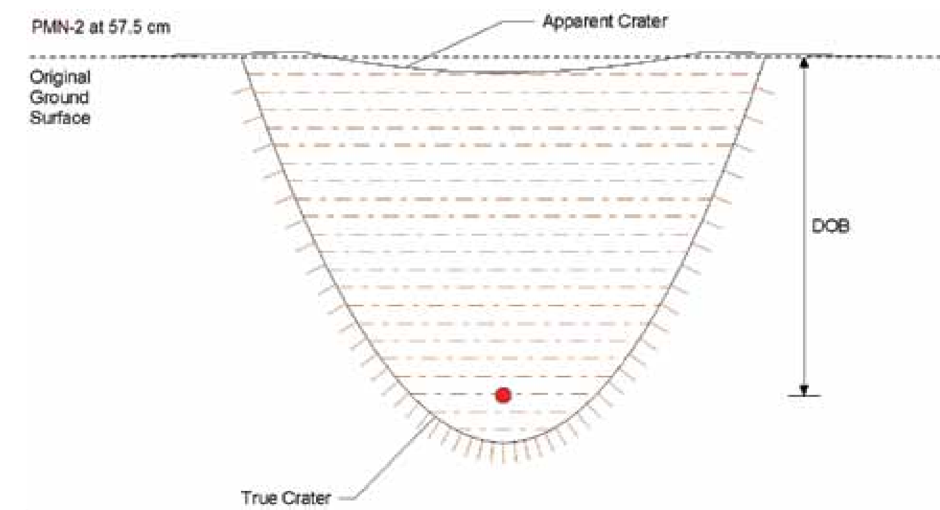

Figure 1. Extract from CONWEP showing depth and the soil type required to nullify a detonation’s effects.
All graphics courtesy of the author.

The Russian PMN-2 anti-personnel mine is one of the most common AP mines worldwide and is provided as an example. It contains a 108-gram main charge of a compound named TG-40, which is fairly close to U.S.-made Composition B explosives. Using the unclassified CONWEP cratering profiles with a dry, sandy clay environment at 0 centimeters, the apparent crater will be 15 cm. (6 inches) deep, and window breakage can be expected at nearly 25 meters (82 feet).

When buried to 58 cm. (23 in.) in the same environment, the blast goes to null and has no noticeable effects. If it is buried 57.5 cm. (22.6 in.), the apparent crater is only 2.6 millimeters (0.10 in.) deep, and window breakage is down to 23 cm. (9 in.) away (see Figure 1 above). Essentially, if you wear a decent set of shoes when walking over a PMN-2 at this depth and it does detonate, you might need to touch up your shoe polish. The more we tested the CONWEP predictions against various situations, the more accurate we found the predictions.

The CONWEP program was useful, for example, when we worked a 27-hectare (67 acres) clearance program for a development project in Vietnam at Vung Ha, which is south of Dong Ha in Quang Tri province. We were fortunate enough to have an overview of the development plans that called for no excavation around the site once it was cleared and indicated that between 1.4 and 4.0 m. (4.59–13.12 ft.) of soil would be deposited on top of the area when handed over. However, the national policy directed: “All landmine/UXO would be cleared to a depth of -5.0 m. [-16 ft.],” which is what we were asked to accomplish. This included cluster munitions or any other item that might be at this depth.

As part of the research and development program linked with this clearance (funded by the U.S. Department of Defense’s Humanitarian Demining R&D Program), we conducted numerous tests with the detection equipment and established a quality-control lane with identical free-from-explosive munitions buried at the maximum depths

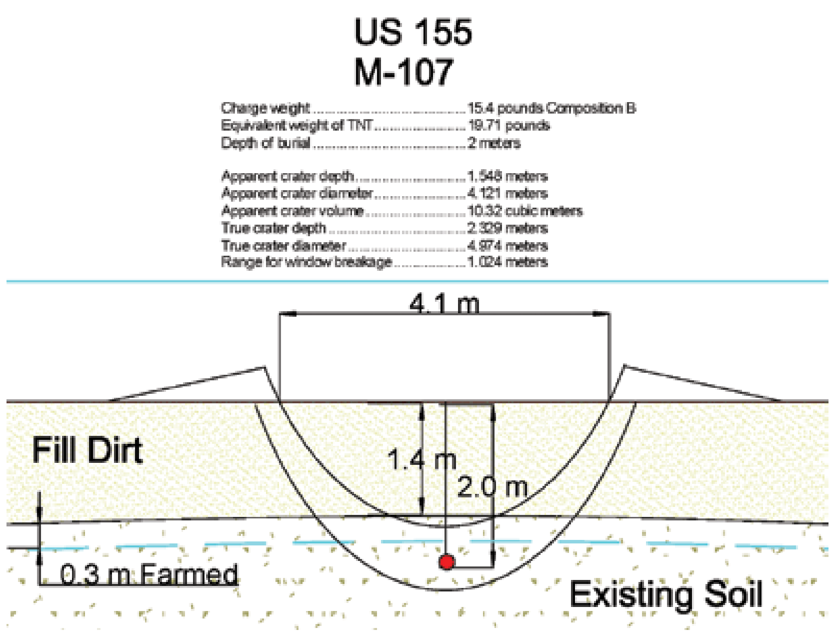

Figure 2. Extract from CONWEP overlaid onto CAD diagrams of Vung Ha clearance site showing requirements for a detonation breaking the surface of the topsoil following filling for development.

where they could be reliably located. The QC lane was used to test the detectors on a daily basis and the provincial authorities assessed it with their own detection equipment, agreeing that it was very realistic.

Using the development plan, we plotted what size munition could break the surface after the site was backfilled. The smallest item that would create a surface threat after the topsoil was added would be a 155-mm. projectile buried 60 cm. (24 in.) under the existing surface (see Figure 2 above). This munition weighs 42 kilograms (93 pounds) and contains almost 7.0 kg. (15 lb.) of explosive that equates to about 35 kg. (77 lb.) of steel.

When de-tuning our detection instruments to locate the 155-mm shell at this depth we could still reliably find larger items such as 250-lb. (113-kg.) bombs while tuning out the smaller items that would not pose a threat once the site was developed. The authorities agreed to this in principle but were bound to adhere to the national policy.

If the team could have used the adjusted parameters, it would have allowed the handover within a matter of 45–60 days. However, the national policy was followed, and the parameters expanded for smaller munitions. The clearance began 4 June 2008, and the land was handed over eight months later on 30 January 2009.

Figure 3 below shows only the south side of the project; the black dots show all of the targets investigated in accordance with the national standards. The blue dots are the large munitions that would have posed a hazard once the site was developed as specified in the plans.

The potential time and money that could have been saved on this site without any risk to the end user is obvious. Had proper planning and risk-management methods been allowed taking into consideration the land's end, the savings in money, manpower and effort could have been applied to other high-risk priority sites.

In November 2009, I gave a presentation in Vietnam outlining the relevant issues for planning a project which would substantially accelerate the clearance rates. It was attended by members from the country's Ministry of Finance, Ministry of Planning and Investment, along with the People's Committee and Ministry of Defense. The briefing included a video of a 155-gram (4-ounce) charge buried 80 cm. (32 in.) deep and then detonated as I stood a few meters from it. If this charge was on the surface, I would likely have been seriously injured or killed, but I barely had a layer of dust on my shoulders. While this entertained the audience, unfortunately the individuals in positions to change the policies (Finance and Planning Ministries) did not understand the point I tried to make.

This raises two questions about some of the policies governing our actions:

- If a hazard is in a position or location unlikely to hurt anyone, why is time and money spent trying to remove it when other more pressing, life-threatening hazards are present?
- If a buried munition detonates undetected, what makes it a risk?

The popular stance of "Because it is there and could kill someone if the conditions are just right" is not a justifiable answer. The question should be: "Is it presenting a clear threat to the population, or is it in a position likely to present a valid threat?"

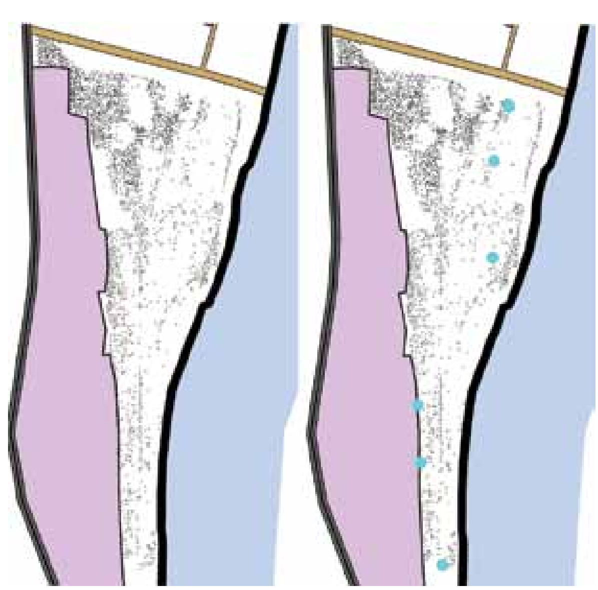

Figure 3. Contamination overview, Vung Ha clearance site, south portion.

Figure 4

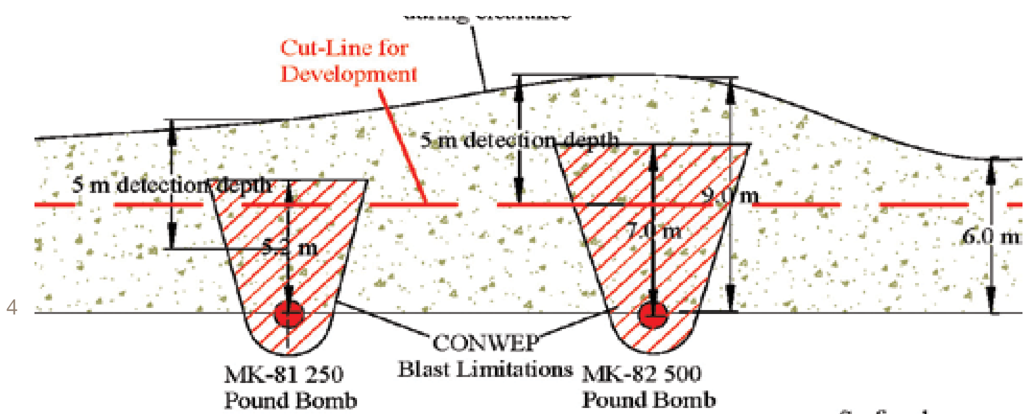

Figure 5

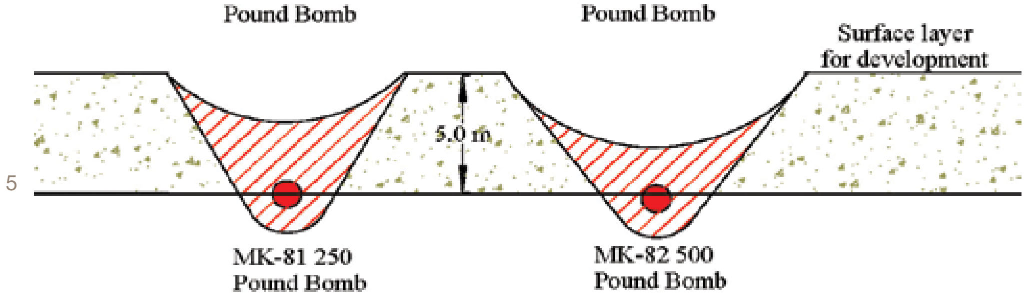

Figure 4. (top) Extract from CONWEP overlaid onto CAD diagrams of Ai Tu clearance site (partial). Depicts blast limitation of MK-81 250 and MK-82 500-pound bombs under surface layer of a hill. **Figure 5.** (bottom) Extract from CONWEP overlaid onto CAD diagrams of Ai Tu clearance site (partial). Depicts blast limitation following construction clearance for redevelopment of land, making munitions a much greater threat.

It is true, however, that previously cleared land may not always stay clear due to environmental factors. Flood waters can redistribute landmines and UXO the same way rocks and other debris are moved. Erosion can expose deeply buried items that were beyond the reach of detector systems used at the time of clearance, so what may have been considered "cleared to standards" at one time, may reveal hazardous items when the topsoil shifts. In addition, construction can expose buried UXO if the construction project's scope of work is not known at the time of clearance. Often, clearance is requested for an area with rolling hills and valleys that upon completion will be used for development. The clearance team can only work from the surface that is present at the time and search as deep as the capability of their detectors. So without knowing the detailed development plan, time and money is wasted, and safety is not always assured for those who follow (see Figures 4 and 5 above).

When turned over to construction crews, the hills are often leveled out to backfill the valleys and make a flat surface for building. The clearance effort has now been wasted in two ways:

- The time spent searching for small, subsurface munitions in the valley was pointless. It is now under a soil level in which only very large munitions would be able to create a hazard.
- Larger munitions located beyond the detectors' limitations posed no surface threat at the time of clearance. Once construction crews level out the hills, however, the previous clearance depth is exceeded, and items may now be at a position where they present a substantial surface hazard.

Flood conditions can also place landmines/UXO at a depth that is no longer hazardous, which was the case during the clearance of Vung Ha. This area typically floods on an annual basis with 5–30 cm. (1.97–11.81 in.) of silt deposited each year, depending on how high the flood waters rise. The battles ended at this site more than 30 years ago. This gives a perspective on how deep the munitions are now.

From an R&D perspective, Vung Ha received an unexpected benefit as it effectively proved how deep the detection systems being tested could search and locate. The provincial military quality-assurance teams also scanned the area with their own instruments and could find nothing remaining, so it was deemed as "meeting or exceeding the national standards." Fortunately, the project included mechanical-assistance support to excavate the signals located at these nationally-specified depths, as this would have been manually impossible. Almost 400 items were located with an average depth of 1.25 m. (4 ft.).

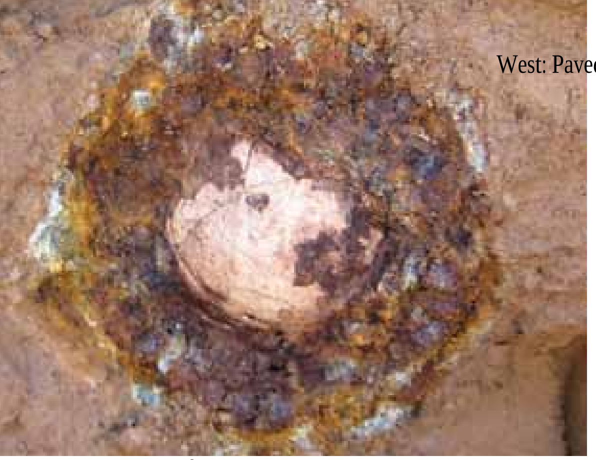

Image 1 (left). U.S. BLU-26 submunition remains found at 55 cm. during Vung Ha clearance. **Image 2** (middle). U.S. BLU-61 submunition found in deep search excavation spoils during Vung Ha clearance. **Image 3** (right). U.S. 105-mm projectile with T-227E2 variable time fuze located at 1.5 m. deep in non-oxidizing layer, at Vung Ha clearance site.

From an operational perspective, the task site could have been completed faster, less expensively and with the same degree of safety for the end user, if the correct planning approach and risk-management system was applied.

Aging of Landmines/UXO

Another factor to consider is the effects of aging on munitions. The aging effects on landmines and UXO have been studied, showing that some items will render themselves useless over time, but not all of them will follow this pattern.[1] The physical state of subsurface munitions will vary greatly depending on the design and materials used, along with the munitions' exposure to geological and weathering conditions. Items made from poor materials placed close to the surface can deteriorate to the point of becoming non-functional over the course of a few years. Some of the Chinese-made landmines and U.S.-made cluster munitions such as the BLU-26 can come apart in 10–20 years when placed in flood zones or extreme environments. However, the Yugoslavian PROM series bounding mines or the urethane-coated U.S. BLU-61 cluster munition will remain functional for much longer due to better design and materials.

Examples of the BLU-26 and BLU-61 are shown in Images 1 and 2 above. Both were dropped on Vietnam around the same period and were found in similar environments. The BLU-26 fuze was completely nonfunctional upon closer examination, but the BLU-61 was in perfect condition. Both items were found at a depth where they presented no surface hazard.

Aside from the munition design, the position in the soil has a direct effect on the functionality of the munitions. For our purposes, the soil structure can be divided into oxidizing and non-oxidizing layers. This is the amount of oxygen available to help the materials corrode or deteriorate. Items such as the BLU-26 with exposed ferrous metal components positioned in the oxidizing layer will deteriorate at a faster pace than those in a non-oxidizing layer. However, if the same item managed to penetrate into the non-oxidizing layer of the soil, it can stay fully operational for many decades.

Indisputable Facts

Post-war minefields close to the population always lead to loss of limbs and lives. Anti-tank mines buried in critical roadways can kill many people on a bus in a single blast. A surface UXO visible to a child can be mistaken for a toy, and it will kill them and their friends when they decide to see if it really does go *boom* like the mine-risk education people said.

The demining and explosive ordnance disposal teams working in these situations carry out duties that directly prevent the loss of life and improve public safety. Clearance teams working in support of economic development tasks help to save lives and create jobs that will improve the overall livelihood of those in underdeveloped areas. These tasks deserve the most focus from international humanitarian donor funding.

Worldwide donor funding is in very short supply, and it affects all of us in this profession. The policies driving national and international goals should be readdressed to ensure that they are reasonable and that the limited funds available are maximized to save lives and support the recovery of post-conflict environments.

see endnotes page 80

Roger Hess has spent more than 30 years in the demining/EOD field. He joined the U.S. Army in 1977 as a Combat Engineer, volunteered for EOD in 1978, retired as a First Sergeant 22 years later and moved directly into humanitarian demining/EOD operations afterward. His past work includes governmental, nongovernmental and commercial clearance operations in Africa, the Middle East and Southeast Asia.

Roger Hess
Director, Field Operations
Golden West Humanitarian Foundation
6355 Topanga Canyon Blvd, Suite 517
Woodland Hills, California
91367-2110 / USA
Tel: +1 818 703 0024
E-mail: roger.hess@goldenwesthf.org
Website: http://goldenwesthf.org