ALTERNATIVES TO OPEN BURNING AND OPEN DETONATION:

The Disparity Between HMA and Commercial Best Practices

By Linsey Cottrell [Conflict and Environment Observatory]
and Kendra Dupuy [Norwegian People's Aid]

Munition and explosive residues have the potential to cause long-term harm when released into the environment. Common explosives, such as TNT and RDX are toxic, with both classed as possible carcinogens.[1,2] The environmental fate of explosives is complex and varied. TNT absorbs onto soil, slowly leaches, and degrades to form degradation products such as DNT, which has a higher toxicity than TNT itself.[3] RDX leaches from soil more readily, degrades slowly, and can persist in the environment. The residual soil and water contamination at military ranges caused by the firing, detonation, and disposal of munitions by open burning and open detonation (OBOD) is well documented, and there has been increased attention on finding more environmentally acceptable options.[4] This is reflected in the draft Lausanne Action Plan from the Second Review Conference for the *Convention on Cluster Munitions*, which sets out the need for stockpile survey, clearance, and destruction to be carried out with minimal environmental impacts.

Residual energetic material can accumulate and persist in soil. Contaminants may migrate to underlying groundwater or nearby surface water, leading to the risk of significant environmental impacts. This risk can be reduced by the careful positioning of OBOD sites away from any water resources. The level of risk will depend on the sensitivity of the environmental setting, nature of contaminants, and the likelihood of a viable exposure pathway. In addition to residual explosives, there are contaminants from other toxic components of munitions (for example, antimony, cadmium, chromium, lead, and mercury) and combustion of by-products such as noxious gases, dioxins, and carcinogenic polyaromatic hydrocarbons (PAHs), which are produced from incomplete combustion.

OBOD remains a primary disposal method across humanitarian mine action (HMA) programs since it is cost-effective, can be used across a diverse range of munitions, and does not require sophisticated infrastructure and equipment. It also remains in common use across the military, including in the United States.

Use of OBOD, however, is under increased pressure due to environmental regulation, better understanding of the environmental contamination risks, land remediation costs, and access to OBOD alternatives. In 2016, the United States Congress instructed the Department of Defense to arrange for the review of technologies available as alternatives to OBOD.[5] The National Academies of Sciences, Engineering, and Medicine (NASEM) review findings, published in 2019, provide a useful update and comparison of a broad range of technologies, in spite of its focus on conventional munition stockpiles for the US military.[6]

Some countries already ban the use of OBOD, unless there is no alternative and it is justified on safety grounds. NATO also prohibits the use of OBOD under the contract framework for munition disposal.[7] NATO does not prescribe specific technologies to be used in place of OBOD but does require contractors to adhere to environmental management protocols. This includes requiring contractors to provide independent test reports to demonstrate that any pollution abatement systems for closed incineration or detonation meet the appropriate environmental emission standards.

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Land and Marine Environments

The need for the wider adoption of alternative approaches is not just restricted to land-based disposals. For underwater munitions, blow-in-place detonation is regarded by International Mine Action Standard (IMAS) 09.60 as the safest option but potentially harmful to the marine environment.[8] For detonation, bubble curtains can be used to attenuate the explosive shock wave, and with monitoring put in place, operations can be delayed if marine mammals are detected. Bubble curtains however can be expensive to deploy and ineffective in deep water or strong water currents.

Capable of killing adult and juvenile sea creatures, blast detonations also risk physical trauma or permanent auditory injury to marine mammals up to 15 km away (for an explosive charge of more than 700 kilograms).[9] Although estimates of these distances do differ, the OSPAR Commission reported harbor porpoises being killed within 4 km of explosions and suffering permanent hearing damage as far as 30 km away.[10] This evidence indicates that a focus on alternatives to detonation is similarly required to reduce environmental harm in the marine environment.

Constraints to Change

Armed forces worldwide have been late and slow to adopt environmental policies and practices, playing catch-up with the commercial and private sector. This has historically been underpinned by how military activities are exempt from the regulations, including environmental legislation, which govern the civilian sector.

Humanitarian programs are also prone to late adoption of environmental practices. For the HMA sector, there are obvious financial and logistical constraints that restrict adoption of alternatives to OBOD: Funding remains a key barrier to deployment. The environmental impacts from OBOD have been known for some time, but where there are safety and cost constraints, environmental mitigation will often be regarded as a lower priority. In line with other sectors, these barriers may also be psychological and due to individual behaviors, mindsets, and attitudes toward the environment. Perceptions, old habits, and lack of awareness may prevent and slow down the take-up of alternative initiatives.

It is also a challenge to increase or promote environmental protection measures when munition disposal is taking place in an area already regarded as contaminated or environmentally degraded. HMA implementers may similarly not be fully aware, or understand the complexities and ecological sensitivity of the area in which munition disposal is taking place. Areas may still have high ecological value, even if they are not designated or regionally recognized as important habitats (see Figure 1).

Existing environmental governance and legislation in the region may already be weak or loosely enforced, in which case there will be limited accountability or incentive to improve environmental performance. The International Ammunition Technical Guideline (IATG) 10.10 notes that national environmental legislation "shall dictate the emission levels to be met which will in turn dictate the type of technology required to meet these emission levels" and that donors may insist on higher standards if national legislation is less than the international norms.[11] For the HMA sector, there appears to be little evidence that this is regularly being required or monitored by donors.

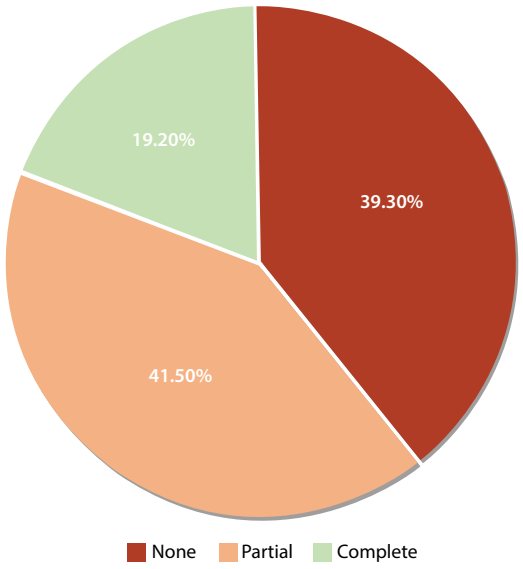

Figure 1. Percentage of key biodiversity areas (KBAs) that are protected. Large areas of KBAs remain unprotected, at-risk, and are not legally recognized as ecologically important. Globally, approximately 20 million square kilometers of KBAs have been identified by the International Union for Conservation of Nature. Less than 20 percent of these critically important KBAs are covered by complete 'protected status'.[11]
All figures courtesy of the authors.

All of these constraints, together with conflicting priorities and goals, play a role in preventing changes to disposal practices. There is the risk that the HMA community will continue with "business as usual" by comparing itself to others within the sector (such as the military and other contractors) and a belief that changes will make little impact in the wider context. Collective action will be needed to see real change.

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Momentum for Change?

If militaries move away from using OBOD, there is the potential for increased availability and use of alternative technologies within the HMA sector, provided that momentum continues and the military does not revert to its historical reliance on exemptions to circumvent environmental regulation. Increased uptake of alternative technolgies by militaries should play a key role in driving down cost, demonstrating reliability and fitness-for-purpose, increasing technical capacity, and addressing any capability gaps.

This is similar to some militaries' ambitions to transfer to low-carbon technology and renewable energy, which could mean access to cheaper and greener technology options for civilian society. Given countries' considerable spending on their militaries, there is the opportunity for economies of scale and investment that would create more efficient technological alternatives while lowering costs, incentivizing wider adoption and increased partnerships. Both advances in military technology and potentially lower costs could support and incentivize the transfer of technology to the HMA sector.

As the viability of alternate technologies within HMA evolves, technologies improve and unit costs fall. However, given shifting attitudes and understanding of the environmental implications of OBOD, it is important that these alternatives (discussed in the following section) are evaluated on a regular basis.

The current IATG 10.10 suggests that, for less than 1,000 tons, alternative disposal methods to OBOD are not cost-effective. The basis for this assessment should be challenged and reviewed, because alternative technologies become more cost-efficient as they improve. It is also important to understand what has been considered under any option benefit analysis, especially whether it takes into consideration any environmental remediation that could be required in the future to address residual contamination at sites where munition disposal has taken place.

Alternative Technologies

Safety, cost, and environmental performance must all be considered in parallel to assess the viability of alternatives. There are no disposal procedures that will have zero environmental impacts, but steps can be taken to minimize the impacts to soil, water, and air. This means following the same "as low as reasonably practicable" approach, which is adopted for the management of other non-environmental risks.

As well as good environmental performance, munition disposal options must be practical and economically viable. The type and state of the munition, the amount to be disposed of, local staff training and competencies, consistency with international agreements, and alignment with applicable national safety, security, and environmental regulations are all factors to consider. When selecting an alternative to OBOD, basic considerations will include

- Is the technology safe, reliable, and affordable?
- Does the technology irreversibly destroy the munition and its energetic materials?
- Does the technology guarantee environmental benefits compared to OBOD?
- Are there opportunities to safely recover and recycle munition components to reach near net-zero waste?
- Can its environmental performance be monitored?
- Will the public and local community have confidence in the technology?

An options appraisal process can be used to evaluate and determine the most feasible and appropriate technology (see Figure 2).

As noted in IATG 10.10, alternatives to OBOD can also create revenue-generating opportunities such as recycling recovered materials (e.g., steel, aluminum, and copper). Scrap metal prices have steadily increased in recent years, and the revenue from recovered material could support operational costs.[12] This is provided that ownership of any scrap is not contested, and that suitable infrastructure and management controls are in place, with control measures that certify items are safe and free from explosives.

The United States Environmental Protection Agency's (USEPA) report on alternative disposal methods gave a perspective from environmental considerations and concluded that a wide range of alternative treatment technologies have been successfully used instead of OBOD techniques.[13] The criteria used to compare technologies included the scale at which the technology has been developed (i.e., to what degree the technology has been successfully piloted or used full-scale); portability of the technology; and the emissions/outputs of the process—all of which are relevant for the HMA sector.

Some technologies have yet to reach full-scale development, including some chemical treatment and chemical neutralization processes that have applicability in the HMA sector given their portability but, at the time of the USEPA report, have not yet proven to successfully treat bulk energetic material for extended periods. Any process requiring the use of chemicals will need the supply, storage, handling, and disposal of all chemicals or waste by-products managed appropriately. Suitable disposal facilities may not be available in countries where the HMA sector operates. The throughput capacity and rate at which munitions and energetic material can be processed by the technology is also a factor. Some chemical treatments can be slow and take several hours to fully react, require treatment tanks, and must be able to treat wastewater. Treatments that convert explosives into non-energetic by-products, such as fertilizers, could also be sold to generate revenue. This would be subject to quality assurance checks, such as checking residual heavy metal content.

Norwegian People's Aid (NPA) already utilizes techniques including mechanical breakdown (e.g., band saw), the extraction of explosives as developed by Golden West Humanitarian Foundation,[14] and deflagration for programs (e.g., Palau), where there are environmental and logistical constraints. Explosive harvesting can be used to recover and re-purpose high explosives but is not suitable for all explosives. Harvesting can yield small donor charges for disposal efforts or for commercial use as quarry charges. For HMA, this eliminates the need to purchase explosives to use as donor charges, but any extraction must be strictly managed to prevent soil or water contamination from process discharges. Although harvested explosives remain available for use and the demand for purchasable explosives is reduced, their production and use still impacts the environment.

A combination of alternatives to OBOD may prove viable, but their feasibility and adaptability within the HMA sector need to be fully evaluated. Many successful partnerships already operate across the HMA sector and, for technologies to be viable, this may mean extending local partnerships to share expertise and pool resources where possible.

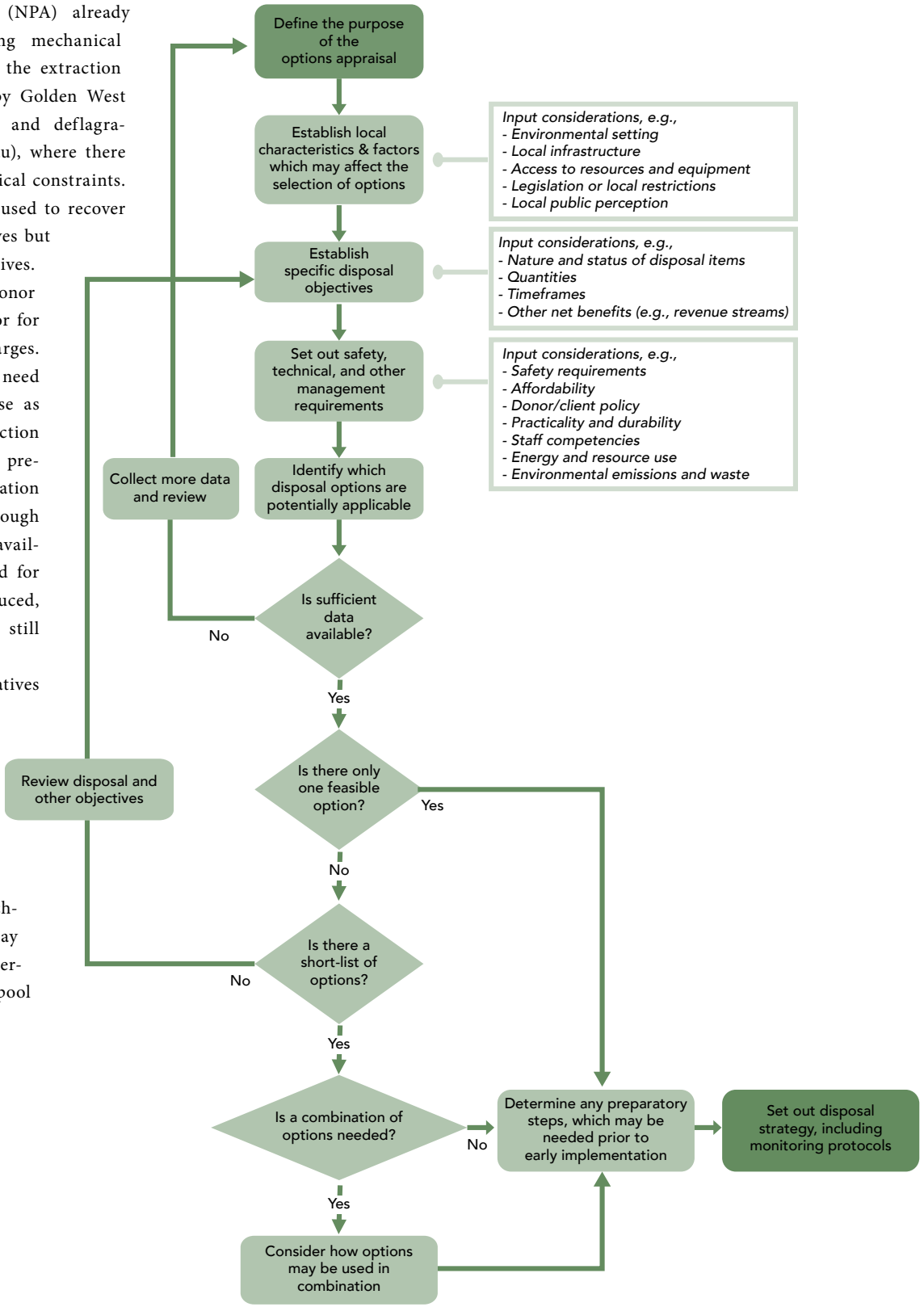

Figure 2. Example of an options appraisal process for technology selection.

So What's Next?

IMAS 07.13 and IATG 10.10

- IMAS 07.13 sets out guidance on mitigation measures needed to prevent pollution
- IATG 10.10 reiterates the need for environmentally-responsible disposal practices

NPA is not yet in a position where a single technology or combination of technologies will be adopted program-wide as an alternative to OBOD. Field trials and comparative analysis of the environmental performance of selective alternatives are still necessary to evaluate operational constraints. This will include learning from the range of techniques that have already been used and better understanding constraints by mapping regional differences in existing knowledge, levels of training, logistics, and infrastructure.

Environmental management obligations in HMA are already given in IMAS 07.13,[15] which sets out guidance on mitigation measures needed to prevent pollution, and IATG 10.10 reiterates the need for environmentally-responsible disposal practices. It is important to ensure that the environmental risks from OBOD are being communicated to EOD operatives and others to increase awareness on the link between chemical pollution and the disposal of explosives. This also means raising awareness about the potential ecological sensitivity of an area, even though the area may not be officially designated or visibly rich in biodiversity. Communicating the risks and educating donors on the need to fund alternative disposal approaches is similarly needed to overcome the financial and operational constraints.

OBOD will still be needed where technical and safety issues prevail and, until technologies advance, where OBOD remains the only option for certain energetic materials. Environmentally, OBOD is the least preferred method; however, measures can be adopted to help reduce the environmental impacts of OBOD practices. While not all listed here, measures can include the choice of location for central demolition sites; the use of platforms, burning pads or trays to limit contact with soils; and clearing other combustible material from the site. Weather conditions should also be carefully considered, including wind direction, wind speed, and rainfall. OBOD should not be carried out in heavy rainfall or high winds, as an optimum wind speed is needed to enable atmospheric mixing and dispersion of smoke plumes.

Without better access to cost-effective, safe, and reliable technologies for the HMA sector, OBOD will remain the primary means of disposal. Funding is needed to pilot a range of alternative technologies, provide staff training, and deliver the commitments to minimize environmental harm, as set out in the Lausanne Action Plan.

By seeking ways to accelerate the adoption of more environmentally acceptable munition disposal techniques, we can hopefully avoid the adage that "if the only tool you have is a hammer, everything looks like a nail."

BIOGRAPHIES

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Linsey Cottrell is the Environmental Policy Officer at the UK-based charity Conflict and Environment Observatory (CEOBS). Cottrell is a Chartered Environmentalist and registered in the UK as a Specialist in Land Condition. She is also a trustee for the Institution of Environmental Sciences. Before joining CEOBS in 2019, she worked in the environmental consultancy sector on contaminated land and environmental risk assessment.

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ENDNOTES

Alternatives to Open Burning and Open Detonation: The Disparity Between HMA and Commercial Best Practices
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