REPUBLIC OF LEBANON
MINISTRY OF ENVIRONMENT

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STANDARD OPERATING PROCEDURES

FOR POST DISASTER RUBBLE MANAGEMENT 2025

IN PARTNERSHIP WITH

NATIONAL COUNCIL FOR SCIENTIFIC RESEARCH

Disaster Risk Management Unit
supported by the United Nations Development Programme

LEBANON-UN DEBRIS TASK FORCE

Volume 1

Debris Pre-Processing Measures: addresses safety, site inspection, and the identification of potential risks such as unexploded ordnance and hazardous materials.

Funded by
European Union (EU)

Prepared by
Lebanese Mine Action Center (LMAC) and United Nations Development Programme (UNDP), Lebanon

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Volume 2

Debris Processing: outlines operational standards for segregation, transportation, storage, and recycling of debris, prioritizing resource efficiency and environmental safeguards.

Funded by
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Prepared by
Ministry of Environment (MoE) and United Nations Development Programme (UNDP), Lebanon

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Volume 3

Quarry Rehabilitation: offers a structured framework for the safe and ecologically sound reuse of selected quarry sites for final debris disposal, aligning with principles of land restoration and long-term sustainability.

Funded by
Global Environment Facility (GEF)

Prepared by
Ministry of Environment (MoE) and United Nations Development Programme (UNDP), Lebanon

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FOREWORD

Lebanon continues to face the multifaceted consequences of wars, natural disasters, and environmental degradation—often resulting in the accumulation of vast volumes of debris and rubble across impacted regions. These materials, if not managed properly, pose serious risks to public health, safety, and the environment. Yet, with foresight, coordination, and sound technical guidance, they can also become a valuable resource for recovery and ecological restoration.

In response to this urgent need, and in collaboration with our national and international partners, the Ministry of Environment and its partners are publishing **Standard Operating Procedures (SOPs) for Post-Disaster Rubble Management.** This unified document provides a comprehensive and actionable framework to guide all stages of rubble management—from clearance and processing to final disposal and site rehabilitation—ensuring that operations are environmentally sound, socially responsive, and aligned with national legislation.

These SOPs reflect the commitment of Lebanese institutions to not only to properly manage post-disaster rubble, but also to use them as a catalyst for more sustainable land use practices. They are the result of inter-agency cooperation, field-tested methodologies, and lessons drawn from national experience and global standards.

I would like to acknowledge the valuable efforts of the United Nations Development Programme (UNDP) and all those who contributed to this document, and the technical teams of the Ministry of Environment. Their collaboration has helped ensure that this guidance is both technically robust and operationally feasible.

It is our hope that these SOPs will serve as a practical tool for authorities, operators, humanitarian actors, and all stakeholders engaged in recovery efforts across Lebanon. By adopting the approaches outlined in this document, we can protect communities, restore damaged landscapes, and reaffirm our national commitment to environmental stewardship and resilience.

Tamara Elzein, PhD
Minister of Environment

FOREWORD

Over the years, Lebanon has faced numerous challenges that have led to the sudden and large-scale generation of rubble. These challenges stem from both natural disasters and human-made crises, including the Port of Beirut explosion in 2020 and the cross-border conflict of 2024. In a country that lacks adequate infrastructure to manage daily construction and demolition waste in a fully sustainable and environmentally responsible manner, the emergence of vast, incidental quantities of rubble places an enormous strain on already limited resources.

Recognizing the urgent need for a structured, efficient, and environmentally sound approach to this issue, the United Nations Development Programme and the Ministry of Environment, in coordination with the United Nations Debris Task Force, the Lebanese Mine Action Center, and with funding from the European Union Delegation, and the Global Environment Facility, has developed the "Standard Operating Procedures for Post-Disaster Rubble Management – 2025."

This report marks a significant step toward responsible disaster recovery practices that balance environmental, social, and economic considerations. It comprises three main volumes, each addressing a distinct aspect of rubble management in post-disaster contexts, from essential site assessment procedures to health and safety protocols, managing UXOs, to waste collection, transportation, storage and rubble processing and quarry rehabilitation as final rubble disposal sites.

By promoting sustainable approaches, the SOPs aim to facilitate the recovery of recyclable materials and the rehabilitation of damaged sites, such as quarries, ultimately contributing to the restoration of ecological balance. The implementation of these SOPs is designed to address the complex challenges of post-disaster recovery in a way that builds long-term resilience, fosters sustainable development, and aligns with the United Nations Sustainable Development Goals.

At its core, this document underscores the critical importance of preparedness, collaboration, and resilience. It serves as a call to action for all stakeholders to work together in rebuilding not just infrastructure, but also hope—for the betterment of Lebanon, where the impacts of disasters can be met with constructive, sustainable solutions that prioritize the well-being of our communities and our planet.

Blerta Aliko
UNDP Resident Representative

Contents

VOLUME 1

DEBRIS PRE-PROCESSING MEASURES

Context

Since 8 October 2023, Lebanon sustaining numerous airstrikes over a period of approximately 11 months; these attacks were primarily concentrated in the Governorates of South of Lebanon and Nabatieh, with occasional strikes in the Governorate of Baalbeck and Hermel. On 23 September 2024 an escalation of the conflict occurred with the expanded attacks on the Governorates of South Lebanon and Nabatieh, the governorates of Baalbeck and Hermel, and Bekaa, and in the following days reaching the southern suburbs of Beirut, with occasional strikes on Beirut city itself.

The intensified conflict, lasting from 23 September to 27 November 2024, resulted in the displacement of approximately 1.3 million people during this period. Although, most of the displaced population returned once the attacks halted. However, the level of destruction generated significant volumes of debris. Several estimates have been released although official figures have not been published.

The debris management approach endorsed by the United Nations (UN) through the UN Debris Task Force co-led by UNDP, UN-Habitat and UNOPS, is detailed in the Debris Management Framework (DMF) which aligns with international best practice for the management of debris waste. These Standard Operating Procedures (SOPs) are an extension of the DMF, providing more details on each of the specific areas of debris management.

Scope of the SOP

This Standard Operating Procedure (SOP) is a standalone document complemented by two other volumes (Volume 2 – Debris Processing, and Volume 3 – Quarry Rehabilitation), and addresses the Debris Pre-Processing Measures. It outlines safety protocols, and regulatory compliance requirements, providing clear guidance for relevant stakeholders. This SOP through its three volumes aims to incorporate sustainability principles by prioritizing waste reduction, recycling, and reuse. Circular economy strategies will be integrated to enhance resource efficiency and environmental preservation.

This document also makes reference to SOPs guidelines on the safe and environmentally sound handling of debris taking into consideration mine action support which is managed by the Lebanese Armed Forces (LAF) in coordination with the Lebanon Mine Action Center (LMAC).

This document does not cover heritage sites (archaeological and cultural sites). These sites fall under the exclusive guidance and procedures established by the Ministry of Culture.

Phases of Implementing Debris Pre-Processing Measures

Debris pre-processing measures will have to account for the following two phases related to assessment, safety, and clearance.

Phase 1: Site Assessment for Site Safety

This phase is a preparatory phase to ensure site safety and prevent or reduce the risks of incidents during rubble removal and processing works.

1.1 Assessment of Structural Instability:

Due to the strikes endured between October 2023, and November 2024, many structures have been completely or partially destroyed, or have sustained partial damage or minor damage. These structures include buildings, bridges, roads, water towers, and various infrastructural structures.

To ensure safety during debris removal or other site activities:

Monitor for cracks: Community members and local authorities should inspect structures for cracks, which are early indicators of structural instability. Cracks should be assessed in:

- Targeted structures,
- Neighbouring structures,
- Roads and the ground in general.

Address ground and road cracks: cracks in roads and the ground may indicate deteriorated infrastructure, incapable of supporting loads associated with debris removal activities. These areas may require reinforcement or maintenance before proceeding with works.

Inspect structural cracks: Cracks in targeted and adjacent structures may signify potential instability. Vibrations caused by debris removal activities, could exacerbate instability, causing further collapses at eh work site or nearby.

Engage experts: Upon identifying cracks, consult specialized structural engineers to assess risks. Coordination with engineering departments at local authorities (e.g. municipalities, unions of municipalities, Order of Engineers and Architects, etc.) and central bodies (e.g. High Relief Commission, Council for the South, etc.) is essential.

Additionally, unstable structures must be evaluated for associated risks while ensuring compliance with safety protocols for hazardous material handling.

1.2 Assessment of Unexploded Ordinance (UXOs):

Given the extensive attacks that occurred, there are serious concerns of Unexploded Ordnance (UXOs) being present within the debris. Hence, it is essential to have the to mitigate the risks posed by UXO to as low of reasonably acceptable.

Pre-deployment:

Organisations involved in debris management undergo Explosive Hazards Risk Education (EORE) to provide an understanding of the hazards and how to recognise suspected UXOs.

This will allow for a desk assessment to be conducted as to whether there is any reason for a UXO to be present. In conjunction with mine action experts, if there is no reason to suspect that UXO might be present, then the debris management activities should proceed.

If there is reason to suspect that UXO maybe present then the LMAC should be contacted to request support from a mine action partner, the LMAC will task an organisation to support the debris management activity site. This maybe the Lebanese Armed Forces (LAF) or an NGO. These organisations will provide site specific advice on risk mitigation measures. The LMAC will conduct quality control measures on any mine action activity.

During work:

If UXOs are encountered, all activities at the designated sites should halt immediately and the incident reported to LMAC/LAF. Activities at the site may be resumed after LAF clears the site. LMAC UXO Support to Debris Management is available in Appendix 1.

In case of an accident:

All work stops immediately. All debris management staff leave the site to a safe area as will be explained in the EORE training.

The LMAC/LAF are to be contacted immediately using the emergency response procedure.

No staff are to attempt to rescue injured colleagues.

1.3 Assessment for Asbestos and other Hazardous Material:

The use of Asbestos Containing Materials (ACM) was common in construction works in Lebanon during the second half of the 20th century. Some of the common usages of ACM in the field of construction in Lebanon was corrugated sheets (mainly used as roof tiles), pipes, and insulation material. Any site where ACM is present would entail considering the entire site as a site consisting of hazardous material, and safety measures outlined in Appendix 2 (Guidelines for Asbestos) prepared by UNDP-UNEP, must be implemented.

Furthermore, other hazardous material may be encountered at targeted sites. Such material can be the result of the type of ammunition used during the attacks, chemicals stored previously in targeted buildings (paints, detergents, fuel tanks, chemicals for industrial or laboratory applications). Hazardous material can be identified using both visual assessments (e.g.,

identifying potential asbestos fibers or other visible indicators) and rapid tests using specialized equipment (e.g., portable X-ray fluorescence (XRF) analyzers for heavy metals). It is crucial that this screening is carried out by qualified professionals to ensure accurate identification and safety. If hazardous material are identified, it is essential to identify through laboratory analysis the type of hazardous material available and thus thereafter using the required type of Personal Protective Equipment (PPEs) for handling and management of such material. Appendix 3 (Health and Safety) provides detailed guidance on health and safety requirements, including appropriate PPEs.

1.4 Disconnecting Power Sources:

In Lebanon, most structures are connected to at least two power sources (the public grid and private generators). Additionally, power banks systems relying on rechargeable batteries and PhotoVoltaic (PV) solar energy systems are increasingly common. To ensure safety during debris management activities, all power sources must be properly disconnected commencing work at targeted sites. This measure is essential to prevent risks of electrocution, electrical fires, and other hazards.

Public grids:

- Contact the designated electricity authorities responsible for the geographic area to confirm disconnection of the public grid.
- Where applicable, request the initiation of repair works to stabilize the public network in the affected area.

Private generators:

- Engage with generator operators to ensure that their systems are fully disconnected from the site in question.

Solar energy systems:

- Cover all visible solar panels with opaque, non-light-transmitting sheets to prevent energy generation.
- Disconnect wiring from the rear of the panels.
- Remove the panels while keeping them covered to avoid autonomous operation at all times.

Power banks:

- Power banks may remain active and pose risks even when not visible (e.g. if buried under debris). However, disconnecting other power sources will typically allow power banks to deplete their stored energy within a few days, reducing residual risks.

All procedures must be carried out in compliance with relevant local laws and regulations to ensure safety and legal adherence during debris management activities. A comprehensive list of key applicable legislation is provided in Appendix 4 for reference.

Phase 2: Site Assessment for Recovery of Human Remains

While the priority remains the removal of debris and enabling economic and social recovery in affected areas, it is essential to consider the humanitarian aspects and emotional wellbeing of the individuals affected by the destruction.

2.1 Human Remains

There is a possibility that missing persons or human remains may be found beneath the debris. In the event that human remains, or missing persons are encountered before or during the debris removal process, all activities at the site must be halted immediately, and the Ministry of Public Health (MoPH) must be notified. Once the human remains have been recovered by the designated authorities, site activities may be resumed.

2.2 Recovery of Belongings Where Applicable

Personal items often hold significant value for individuals, both emotionally and practically. Once the site has been deemed safe, individuals may be allowed to recover belongings under a controlled and secure environment, where applicable.

2.3 Safeguarding religious and spiritually significant items

In addition to personal belongings, there may be religious or spiritually significant items within the debris that are important to the affected communities. These items should be handled with the utmost respect and care. Before commencing debris removal, any such items identified should be safeguarded and. If necessary, consulted with local religious leaders or community representatives for guidance on appropriate handling or recovery procedures. This should be done in a manner that ensures cultural sensitivity and respect for the traditions of the affected communities.

Appendix 1:
LMAC UXO Support to Debris Management

In addition to personal belongings, there may be religious or spiritually significant items within the debris that are important to the affected communities. These items should be handled with the utmost respect and care. Before commencing debris removal, any such items identified should be safeguarded and. If necessary, consulted with local religious leaders or community representatives for guidance on appropriate handling or recovery procedures. This should be done in a manner that ensures cultural sensitivity and respect for the traditions of the affected communities.

Introduction

The latest war in Lebanon lead to the destruction and damage of huge areas, hindering people's ability to return to their homes, affecting their livelihood and putting their lives at risk.

Rubble removal operations aim to clear rubble from the affected areas in a safe effective and efficient manner contributing to IDP's return, and social stability.

1. Scope

This is a summary of LMAC guidelines regarding rubble removal in explosive ordnance (EO) contaminated areas in Lebanon. All partners operating in Lebanon may profit from this content to improve safety, efficiency and effectiveness in rubble removal operations.

For the full technical note (TNMA rubble removal in EO contaminated areas) contact LMAC at info@lebmac.org

2. LMAC database

After the ceasefire, LMAC deployed non-technical survey teams within the affected villages, these teams were responsible of gathering information about:

- EO requiring immediate response.
- Rubble locations requiring rubble removal.
- Areas requiring battle area clearance from EO.

In LMAC database, rubble tasks are classified according to the level of risk and to their priorities.

a- Risk calculation

Risk is calculated based on the following factors:

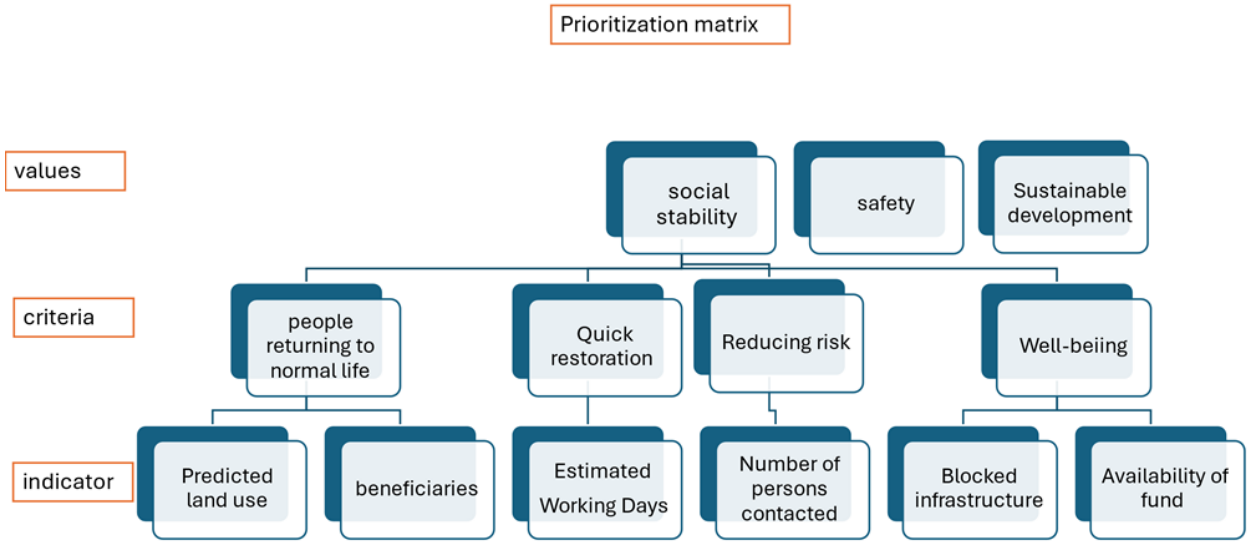
Risk from any remaining explosive ordnance

Risk from the building integrity

Other risks (WP, asbsetos)

b- Priority matrix

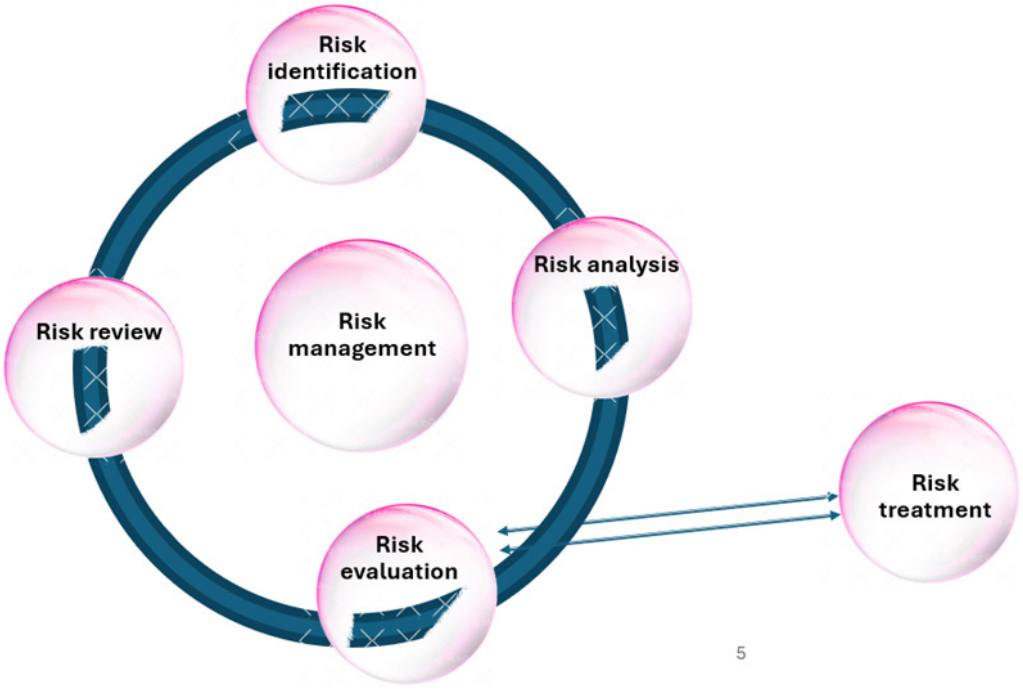
Each task is given an automated priority score based on the following matrix:



3. Risk management database

Before starting rubble removal operations, a task risk assessment shall be conducted in order to manage the safety of team members and third parties.

The task risk assessment shall be reviewed and adapted as work progresses and unanticipated hazards or environmental conditions are encountered (see below risk management cycle).



3.1 Risk identification

Risk assessments shall take into consideration:

- The types and conditions of EO hazards anticipated under the rubble.
- The stability of the building / structure.
- The environmental conditions, the terrain and weather at the worksite.
- The likelihood of unintended detonations.
- The presence of any toxic or chemical materials.

3.2 Risk identification

Risk analysis is the assessment of probable incidents based on the:

- Probability of Incident: Determine the likelihood of each identified hazard occurring.
- Severity of Impact: Assess the potential impact of each hazard, considering injury, fatality, or equipment damage.
- Exposure Levels: Consider how often workers are exposed to these hazards, based on the type of operation and the environment.
- Risk of staff or objects falling.
- Human Factors: Inexperience, fatigue, or lack of training among personnel can increase the risk of accidents.
- Risk from using heavy machines
- The security situation
- Any other risk contributing factor.

A list of risk factors and mitigation procedures shall be attached to the clearance plan, all staff shall be reminded about mitigation procedures before starting each working day.

3.3 Risk evaluation

Managers may use a risk matrix to categorize risks as low, medium, or high based on probability and severity of each hazard.

3.4 Risk treatment

Depending on the evaluation of threats, all risk factors must be treated by taking control measures.

A list of risk factors and mitigation measures shall be attached to the clearance plan.

An example of mitigation procedures could be:

- Personal Protective Equipment (PPE): Provide appropriate PPE like helmets, armor, eye-pro, and boots for workers.

- Training & Competence: Ensure all personnel are trained in EO awareness, rubble handling, and emergency procedures.
- Robust Tools & Machinery: Use equipment designed for rubble removal that minimizes human exposure to risk.
- Supervision: Deploy experienced supervisors to oversee operations, enforce safety protocols, and respond to emergencies.
- EOD support: increase presence of EOD personnel within rubble removal teams.
- Using different access lanes for machines and personnel.
- Use of remote machines and UAV if possible.

3.5 Risk review

- Continuous Monitoring is essential to ensure that risk stays at a tolerable level, regularly check for signs of structure instability or potential EO exposure during operations should reduce the risk of incident happening.
- Incident and near-misses reporting: organizations should Implement a system for reporting accidents or near-misses to improve safety measures.
- Post-Operation Review: Conduct a post-operation risk review to assess the effectiveness of safety measures and identify areas for improvement.

4. Rubble removal methodology

The following sequence of events generally occurs post conflict:

1. Immediate Response
2. Non-Technical Survey
3. Planning and Preparation
4. Clearance
5. Monitoring /quality assurance
6. Final inspection /quality control
7. Handover

4.1 Immediate response

Unexploded ordnance may exist everywhere in a post conflict situation or during a ceasefire, this will put civilians at high risk especially IDP, s hurrying to check their homes and goods.

Once LMAC or LAF are notified about any EO threat, an immediate response will be carried out by LAF units or implementing agencies working under LMAC supervision.

4.2 Non-technical survey

LMAC database is the best source to start from in the rubble removal process, this database contains all necessary information's regarding risk, priority, future use, ownership and beneficiaries.

4.3 Planning and preparation

A clearance plan shall indicate as a minimum:

- The history of the task area, its location and the task ID.
- A full threat assessment for all identified hazards and the mitigation procedures that will be taken.
- Assets to be used.
- Team composition.
- A medical evacuation plan.
- An internal Quality Management monitoring plan.
- A planned start date and an estimated working day.
- Site layout (CP, medical point, emergency assembly zone, designated zone for spreading).

4.4 Clearance

Prior to clearance taking place all persons in the working area must be fully briefed on the task safety procedures and the day's work plan. Clearance operation will be broken down into three phases.

Phase 1: Visual Search of a marked area to be cleared

- Locally trained searchers under the supervision of a supervisor with EOD experience, will conduct a visual search of the area to be cleared prior to the machine's beginning work. On finding any EO LMAC shall be notified to prepare for an EOD response based on the assessment of the EO found, this approach will reduce risk on operators.
- The clearance plan shall be amended according to the threat found every time.
- Once the area has been visually searched machines can begin work.

Phase 2: Clearance of rubble and EOD support

- Rubble will be removed by rubble removal machines.
- The machine's driver must keep a clear vision on the rubble to avoid hitting any EO, good communication must be maintained with the driver and he must stop working and notify the site supervisor anytime he doubts to find new EO.
- The site supervisor will remain a minimum of 100m away from the vehicle or behind adequate cover to give protection from Blast and Fragmentation. On suspicion of uncovering an EO all work is to stop. The site supervisor will confirm if indeed the item is an EO or not. If so, the vehicle is to be moved to a distance of 100m and the area cleared of any other staff. LMAC will be notified to determine future EOD steps.

Phase 3: visual search of spread rubble

- Rubble will be transported by wheel loaders to a designated area, where it will be spread over thin layers and visually searched by searchers.
- Any EO found in this case will be marked and reported to LMAC.

4.5 Monitoring

Quality management ensures that rubble removal operations are conducted in a systematic, efficient, and safe manner, contributing to the overall success of mine action efforts.

4.6 Final inspection

Once the rubble has been removed and searched and all EO found were disposed, a final check must be done to the final product to make sure no hazard has been left.

4.7 Handover

Completed tasks will be handed over to landowners or municipalities.

Landowners/municipalities shall be notified about the process that has been followed and any EO found and about any residual risk that may arise after the application of all reasonable efforts.

5. Explosive ordnance reconnaissance

LMAC involves a regional school for humanitarian demining where many “first responders” have been trained against EO threats (LRC, ICRC, Civil defense…).

LMAC prefers that all operators working in rubble removal follow a quick course at this school in order to raise their awareness about the EO and their threats.

Appendix 2: Guidelines for Asbestos

ASBESTOS HEALTH AND SAFETY REQUIREMENTS

UN environment programme

UNDP

A. KEY POINTS FOR THE SAFE HANDLING OF ASBESTOS

SAFE HANDLING OF ASBESTOS

1. PROVIDE PROTECTIVE EQUIPMENT AND TRAINING

- As a minimum, provide workers with gloves, goggles, disposable clothing or replacement clothing, adequate footwear and disposable masks (see Appendix C for specifications).
- Dispose of contaminated clothing and protective equipment in the same way as other asbestos-containing materials (ACMs).
- Provide washing facilities for workers and training to all involved if possible, or work supervisors as a minimum

2. IF POSSIBLE, DO NOT DISTURB IT, BREAK IT OR CUT IT

This can release asbestos dust which contains hazardous fibres

3. DO NOT BURN IT

Never burn suspected ACMs as this releases dangerous fibres into the air

4. WET IT

- If it is necessary to move, saw or break up the materials, keep them thoroughly wet to reduce the amount of airborne fibres
- Work only in well-ventilated areas
- Take particular care with friable materials
- Clean any contaminated surfaces by wetting the area or using damps cloths. Never dust or sweep as this propels fibres into the air

5. COVER IT

- When disposing of it, keep piles of ACMs covered with plastic sheets until they can be disposed of
- Always wet the materials before moving

6. WRAP IT UP

- Store asbestos-containing waste in sealable containers until it can be disposed of safely
- Use metal or plastic drums or strong polyethylene bags
- If using bags put one bag inside another and seal with strong tape
- Label the containers in the local language(s) and include a hazard warning before disposal

ASBESTOS HEALTH AND SAFETY REQUIREMENTS

B. DEDICATED ASBESTOS DISPOSAL SITE SELECTION AND DEVELOPMENT

ASBESTOS SITE SELECTION AND DEVELOPMENT

1. Site

In collaboration with the local government, locate a site where adequate cover material is available, access is good and controllable and where the waste cannot be exposed by water or wind erosion, slope failure, further disasters or re-excavation

2. VEHICLES

Clearly label vehicles transporting asbestos waste and ensure they are operated by trained personnel

3. EMISSION PROTECTION

During and after the disposal of asbestos waste, make sure no visible emissions occur and cover waste with at least 15cm of compacted non-asbestos-containing material within 24 hours of disposal

4. BARRIERS

If no natural barriers exist around the site to deter access, install fencing, trenches or other barriers to prevent unauthorised access to the designated area

5. WARNING SIGNS

Post warning signs at the entrance of the site and around the perimeter

6. CLOSURE

Final closure of an area containing asbestos waste requires at least an additional 75cm of compacted non-asbestos material to provide a 1m final cover. This must be done within 90 days of the last deposition

ASBESTOS HEALTH AND SAFETY REQUIREMENTS

MINIMUM STANDARDS
for working with debris waste in Beirut

C. PPE REQUIREMENTS WHEN COMING INTO CONTACT WITH ASBESTOS CONTAINING MATERIALS

Personal protective clothing and equipment is an essential line of defence for minimising the risks presented by contact with asbestos when elimination and isolation of the hazard is not practicable. It is essential that workers receive prior training on the use of personal protective equipment.

WHAT IS PERSONAL PROTECTIVE EQUIPMENT (PPE)?

PPE is clothing or equipment which provides protection to the user from a potential hazard.

WHAT PPE MUST BE WORN WHEN ASBESTOS IS OR MAY BE PRESENT?

If asbestos or asbestos containing materials are present, or there is a possibility of presence, the following should be worn:

- **Respiratory Protective Equipment** (RPE) should be used by those designated to handle asbestos whenever practicable – to avoid inhaling asbestos fibres
- **Overalls** disposable, to avoid the risk of carrying asbestos fibres away from the worksite on clothing
- **Footwear** – appropriate for the work being undertaken (see next page for details).

WHAT PPE IS REQUIRED

Although controls must be in place to prevent or reduce exposure to asbestos fibres when working with ACMs (see Appendix A), when exposure cannot be avoided the last line of defence against dangerous exposure is the use of appropriate PPE. The following details the levels of PPE recommended for work with asbestos materials, from that which provides the best protection to the minimum standard required.

Figure 1: Full face covering

Respiratory Protective Equipment

For long periods of continuous use in demolition related works, effort must be made to use the highest level of mask available and practical in the circumstances. Figure 1 shows the type of mask, covering the whole face, which should be used by those working significant amounts of time with or in close proximity to ACMs. Full face masks should conform to BS EN 136 standard with P3 filter and should be used by licensed operators.

Figure 2: Reusable face covering

If a full-face mask is not available to those needing to clear debris containing or potentially containing ACM, then a face mask covering nose and mouth should be used. Figure 2 shows a reusable mask (applicable standard EN140 with P3 filter), covering nose and mouth, which would be suitable for those working for regular periods in debris clearance.

Figure 3: Basic disposable face covering

Figure 3 shows the minimum standard face mask that must be used by anyone working with or near ACMs if higher level masks are not available. This equipment should be suitable for most short-duration non-licensed work, especially for open-air debris removal and disposal activities.

The mask used should be of FFP3 or FMP3 standard and should be used at all times when in close proximity to ACMs. When using FFP3 (applicable standard BS EN 1827) or FMP3 (applicable standard BS EN 149) masks, these should be properly disposed of at the end of each day and a new mask worn the following working day.

Figure 4: Safety goggles

Safety Goggles

Should one of the masks shown in Figure 3 or Figure 6 be used, then it is recommended that safety goggles are used, meeting BS EN 166 standard) as shown in Figure 4.

Figure 5: Wellington boots

Footwear

Appropriate footwear is an important part of the PPE required when working with asbestos contaminated debris. It is recommended that Wellington Boots designed specifically for this purpose be worn by everyone involved in this work. Wellingtons should be EN ISO 20345:2011 compliant, to provide solid sole protection from penetration and steel toecaps. An example of this footwear is shown in Figure 5.

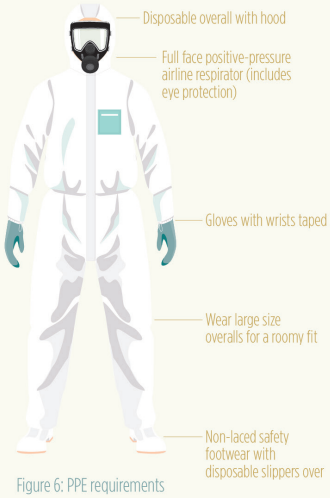


Figure 6: PPE requirements when working with asbestos

Full RPE for High Risk Work

Figure 6 shows the necessary full PPE required when working to clear ACMs. This is the level of PPE necessary for trained people spending significant amounts of time working to separate and dispose of ACMs who will therefore have a high level of exposure to asbestos over a sustained period. Disposable overalls should be Type 5/6 (relevant standard BS EN ISO 13982+A1). Gloves should be Type 5/6 single use and be appropriately disposed of at the end of each day. Footwear should be solid sole, ankle high wherever possible. Wellington boots (see Figure 5) or non-laced pull-on footwear is preferable as these are easier to clean. Disposable overshoes should be used if non-laced footwear is not available. Disposable overalls, gloves and overshoes should be treated as hazardous and disposed of with other asbestos waste.

ASBESTOS HEALTH AND SAFETY REQUIREMENTS

D. PERSONAL DECONTAMINATION

It is important that everyone working with or near asbestos materials ensures they are fully decontaminated before leaving the workplace. This will help alleviate the possibility of taking asbestos fibres home on clothing and exposing family and friends.

The following procedure should be followed by each person working at on debris clearance involving asbestos materials.

PROCEDURE

Damp Rag

Asbestos Waste Bag

- Clean boots with damp rags
- Use damp rags in a gentle 'patting' action on overalls (rubbing can disturb fibres)
- Where there are two workers, they can help to clean each other
- Peel off disposable overalls. They should be inside-out when they have been removed. Put the overalls in a suitable asbestos waste bag (UN-approved Class 9 plastic bag)
- Remove RPE last. If using disposable face covering, place these in the asbestos waste bag. For non-disposable RPE, clean after use and store in safe place away from contamination
- Tape the waste bag securely closed and dispose of with hazardous waste

متطلبات الصحة والسلامة المتعلقة بالتعامل مع الأسبستوس

برنامج الأمم المتحدة للبيئة

UNDP

أ- النقاط الرئيسية المرتبطة بالتعامل الآمن مع الأسبستوس

التعامل الآمن مع الأسبستوس

١. تأمين معدات الوقاية/الحماية والتدريب

- تزويد العمال، كحد أدنى، بالقفازات والنظارات الواقية والملابس التي يمكن التخلص منها/تستعمل لمرة واحدة أو الملابس البديلة والأحذية المناسبة والأقنعة التي يمكن التخلص منها/تستعمل لمرة واحدة (النظر إلى الملحق ج للاطلاع على المواصفات)
- التخلص من الملابس الملوثة ومعدات الوقاية/الحماية بنفس طريقة التخلص من المواد الأخرى التي تحتوي على الأسبستوس
- تأمين مرافق الاغتسال للعمال وتدريب جميع المعنيين، إذا كان ذلك ممكناً، أو تدريب المشرفين على العمل كحد أدنى

٢. إذا كان ذلك ممكناً، عدم بعثرة أو تكسير أو تقطيع المواد

يمكن أن يؤدي ذلك إلى إطلاق غبار الأسبستوس الذي يحتوي على ألياف خطرة

٣. عدم حرق المواد

عدم حرق المواد التي يشتبه باحتوائها على الأسبستوس بتاتاً لأن ذلك يطلق أليافاً خطرة في الهواء

٤. تبليل المواد

- إذا كان من الضروري تحريك أو نشر أو تفتيت المواد، يجب إبقاؤها رطبة بشكل كامل لتقليل كمية الألياف المتطايرة في الهواء
- حصر العمل ضمن مناطق مجهزة بتهوية جيدة
- توخي الحذر عند استخدام المواد الهشة
- تنظيف جميع الأسطح الملوثة عن طريق ترطيب المكان أو استخدام قطعة قماش مبللة. عدم تنظيف الغبار أو مسحها أبداً لأن هذا يدفع الألياف في الهواء

٥. تغطية المواد

- عند التخلص من المواد، المحافظة على تغطية أكوام المواد التي تحتوي على الأسبستوس بأغطية بلاستيكية ريثما يمكن التخلص منها
- ترطيب المواد باستمرار قبل نقلها

٦. تغليف المواد

- تخزين النفايات التي تحتوي على الأسبستوس في حاويات محكمة الإغلاق ريثما يمكن التخلص منها بشكلٍ آمن
- استخدام براميل معدنية أو بلاستيكية أو أكياس بولي إيثيلين متينة
- في حال استخدام الأكياس، يجب وضع كيس داخل كيس آخر وإغلاقه بشريط لاصق متين ووضع علامات/تسميات على الحاويات باللغة (اللغات) المحلية وتضمين تحذير بالمخاطر قبل التخلص منها

برنامج الأمم المتحدة للبيئة

متطلبات الصحة والسلامة المتعلقة بالتعامل مع الأسبستوس

ب- اختيار موقع مخصص للتخلص من الأسبستوس وتطويره

اختيار موقع للتخلص من الأسبستوس وتطويره

١. الموقع

بالتعاون مع السلطة المحلية يتم تحديد موقع تتوفر فيه مواد ملائمة للتغطية، ويكون الوصول إليه سهلاً وخاضع للضبط، كما لا تصبح النفايات فيه مكشوفة بسبب الإنجراف بفعل المياه أو الرياح أو انهيار المنحدرات أو حدوث المزيد من الكوارث أو إعادة الحفر

٢. المركبات

وضع علامات/تسميات واضحة على المركبات التي تنقل نفايات الأسبستوس والتأكد من تشغيلها بواسطة موظفين مدربين

٣. الحماية من الانبعاثات

أثناء وبعد التخلص من نفايات الأسبستوس، التأكد من عدم حدوث انبعاثات مرئية ومن تغطية النفايات بما لا يقل عن ١٥ سم من المواد المضغوطة التي لا تحتوي على الأسبستوس، في غضون ٢٤ ساعة من التخلص منها

٤. الحواجز

في حال عدم وجود حواجز طبيعية حول الموقع لمنع الدخول إليه، تركيب سياج أو خنادق أو حواجز أخرى لمنع الدخول دون إذن إلى المنطقة المحددة

٥. اللافتات التحذيرية

وضع لافتات تحذيرية عند مدخل الموقع وفي محيطه

٦. الإغلاق

يتطلب الإغلاق النهائي للمنطقة التي تحتوي على نفايات الأسبستوس ٧٥ سم على الأقل من المواد الإضافية المضغوطة من غير الأسبستوس لتوفير غطاء نهائي يبلغ متراً واحداً. يجب أن يتم ذلك في غضون ٩٠ يوماً من آخر ترسّب للأسبستوس

برنامج الأمم المتحدة للبيئة

متطلبات الصحة والسلامة المتعلقة بالتعامل مع الأسبستوس

المعايير الدنيا للتعامل مع مخلفات النفايات في بيروت

ج. المتطلبات المتعلقة بمعدات الوقاية الشخصية عند التعامل مع مواد تحتوي على الأسبستوس

تعتبر ملابس ومعدات الوقاية الشخصية خط دفاع أساسي لتقليل المخاطر الناتجة عن التعرض للأسبستوس عندما يكون التخلص من الخطر وعزله أمراً غير ممكن عملياً. ولا بد أن يتلقى العمال تدريباً مسبقاً على استخدام معدات الوقاية الشخصية.

ما هي معدات الوقاية الشخصية؟

معدات الوقاية الشخصية هي ملابس أو معدات توفر الحماية للمستخدم من المخاطر المحتملة.

ما هي معدات الوقاية الشخصية التي يجب استخدامها عند وجود الأسبستوس بالفعل أو عند احتمال وجوده؟

في حال وجود الأسبستوس أو المواد التي تحتوي على الأسبستوس، أو في حال كان هناك احتمال لوجودهما يجب ارتداء ما يلي:

- **معدات حماية الجهاز التنفسي** يجب استخدامها من الأشخاص المعينين بالتعامل مع الأسبستوس كلما أمكن ذلك، لتجنب استنشاق ألياف الأسبستوس.
- **بدلات العمل** الأحادية الاستخدام، لتجنب مخاطر حمل ألياف الأسبستوس بعيداً عن موقع العمل على الملابس.
- **الأحذية** يجب أن تكون مناسبة للعمل الذي يجري القيام به (انظر الصفحة التالية للحصول على التفاصيل).

معدات الوقاية الشخصية المطلوبة

على الرغم من أنه يجب توفر الضوابط لمنع أو تقليل التعرض لألياف الأسبستوس عند التعامل مع المواد التي تحتوي على الأسبستوس (انظر الملحق أ)، عندما لا يمكن تجنب التعرض لها، يتمثل خط الدفاع الأخير في استخدام معدات الوقاية الشخصية المناسبة عند مواجهة التعرض الخطير. توضح التفاصيل التالية مستويات معدات الوقاية الشخصية الموصى بها عند التعامل مع مواد الأسبستوس، بدءاً من تلك التي توفر أفضل حماية إلى الحد أدنى من المعايير المطلوبة.

معدات حماية الجهاز التنفسي

يجب بذل الجهود لاستخدام أفضل نوعية من القناع المتوفر والعملي خلال فترات طويلة من الأعمال المتعلقة بالهدم. يبيّن الشكل 1 نوع القناع الذي يغطي الوجه بالكامل والذي يجب أن يستخدمه الأشخاص الذين يتعاملون مع المواد التي تحتوي على الأسبستوس أو يتواجدون بالقرب منها لفترات طويلة. يجب أن تتطابق أقنعة الوجه الكاملة مع معيار (BS EN 136) مع فيلتر P3 ويجب استخدامها من قبل المشغلين الحاصلين على ترخيص.

الشكل1: غطاء كامل للوجه

إذا لم يكن قناع الوجه الكامل متوفراً للأشخاص الذين يتعيّن عليهم إزالة المخلفات التي تحتوي أو يمكن أن تضم مواد تحتوي على الأسبستوس، يجب استخدام قناع الوجه الذي يغطي الأنف والفم. يبيّن الشكل 2 قناعاً قابلاً لإعادة الاستخدام (المعيار المطبق EN140 مع فيلتر P3)، يغطي الأنف والفم فيكون مناسباً للأشخاص الذين يعملون لفترات منتظمة في إزالة المخلفات.

الشكل 2: غطاء الوجه القابل لإعادة الاستخدام

يبيّن الشكل 3 قناع الوجه القياسي الذي يتطابق مع الحد الأدنى من المعايير والذي يجب أن يستخدمه أي شخص يتعامل مع المواد التي تحتوي على الأسبستوس أو يتواجد بالقرب منها في حال عدم توفر أقنعة ذات نوعية أفضل. يجب أن يكون هذا الجهاز مناسباً لمعظم الأعمال القصيرة المدة غير الحاصلة على ترخيص، لا سيما أنشطة إزالة المخلفات والتخلص من المواد التي تحتوي على الأسبستوس في الهواء الطلق.

يجب أن يتطابق القناع المستخدم مع أحد معياري FMP3 أو FFP3 ويجب استخدامه في جميع الأوقات عند التواجد بالقرب من المواد التي تحتوي على الأسبستوس. عند استخدام أحد قناعي FFP3 (المعيار المطبق BS EN 1827) أو FMP3 (المعيار المطبق BS EN 149)، يجب التخلص منهما بشكل صحيح في نهاية كل يوم وارتداء قناع جديد في يوم العمل التالي.

الشكل 3: غطاء الوجه الأساسي الذي يمكن التخلص منه/يستعمل لمرة واحدة

النظارات الواقية

في حال استخدام أحد الأقنعة المبيّنة في الشكل 3 أو الشكل 6، من المستحسن استخدام النظارات الواقية التي تتطابق مع معيار (BS EN 1666) كما هو مبيّن في الشكل 4.

الشكل 4: النظارات الواقية

الأحذية

تشكل الأحذية المناسبة جزءاً مهماً من معدات الوقاية الشخصية المطلوبة عند التعامل مع المخلفات الملوثة بالأسبستوس. من المستحسن أن يرتدي جميع المشاركين في هذا العمل جزمة من نوع ويلينغتون المصممة خصيصاً لهذا الغرض. يجب أن تكون الأحذية مطابقة لمعيار EN ISO 20345:2011 لتوفير حماية قوية للنعل من الاختراق ويجب أن تكون مقدمة الحذاء فولاذية. يتضمن الشكل 5 نموذجاً من هذه الأحذية.

الشكل 5: جزمة من نوع ويلينغتون

معدات حماية الجهاز التنفسي الكاملة للأعمال الشديدة المخاطر

يبيّن الشكل 6 معدات الوقاية الشخصية الكاملة اللازمة المطلوبة عند إزالة المواد التي تحتوي على الأسبستوس. هذا هو مستوى معدات الوقاية الشخصية اللازمة للأشخاص المدربين الذين يمضون وقتاً طويلاً في العمل على فصل المواد التي تحتوي على الأسبستوس والتخلص منها، ونتيجة لذلك يتعرضون لمستويات عالية من الأسبستوس لفترة طويلة. يجب أن تكون بدلات العمل التي يمكن التخلص منها/تستعمل لمرة واحدة من نوع 5/6 (BS EN ISO 13982+A1).

ويجب أن تكون القفازات من نوع 6/5 التي تستخدم مرة واحدة ويتم التخلص منها بشكل مناسب في نهاية كل يوم. يجب أن تكون الجزمات من نوع ويلينغتون ذات نعل متين، وأن تكون أعلى من الكاحل قدر الإمكان. يفضل استخدام جزمات من نوع ويلينغتون (انظر الشكل 5) أو الأحذية دون رباط والتي يتم ارتداؤها عن طريق السحب لأن تنظيفها أسهل. يجب استخدام الحذاء الفوقي المطاطي الذي يمكن التخلص منه/يستعمل لمرة واحدة في حال عدم توفر أحذية دون رباط. يجب التعامل مع بدلات العمل والقفازات والأحذية التي يمكن التخلص منها/تستعمل لمرة واحدة على أنها خطرة ويجب التخلص منها مع نفايات الأسبستوس الأخرى.

الشكل 6: متطلبات معدات الوقاية الشخصية عند التعامل مع الأسبستوس

برنامج الأمم المتحدة للبيئة

متطلبات الصحة والسلامة المتعلقة بالتعامل مع الأسبستوس

د- تطهير الأشخاص

من المهم أن يتأكد كل شخص يتعامل مع المواد التي تحتوي على الأسبستوس أو يتواجد بالقرب منها، من خضوعهم للتطهير بشكل كامل قبل مغادرة مكان العمل. من شأن ذلك أن يساعد في التخفيف من احتمال نقل ألياف الأسبستوس على الملابس إلى المنزل وتعريض الأسرة والأصدقاء للمخاطر.

يجب أن يقوم كل شخص يعمل على إزالة مخلفات المواد التي تحتوي على الأسبستوس باتباع الإجراءات التالية.

الإجراءات

- تنظيف الأحذية بواسطة قطع قماش مبللة
- استخدام قطع قماش مبللة للتربيت على بدلات العمل في حركات خفيفة (يمكن أن يؤدي الفرك إلى بعثرة الألياف)
- في حال وجود عاملَين، يمكنهما المساعدة في تنظيف بعضهما البعض
- خلع بدلات العمل التي يمكن التخلص منها/تستعمل لمرة واحدة. يجب أن تكون مقلوبة من الداخل إلى الخارج عند خلعها، ويجب وضعها في كيس مناسب لنفايات الأسبستوس (كيس بلاستيكي من الفئة ٩ معتمد من الأمم المتحدة)
- إزالة معدات حماية الجهاز التنفسي في النهاية. في حال استخدام غطاء الوجه الذي يمكن التخلص منه/يستعمل لمرة واحدة، يجب وضعه في كيس نفايات الأسبستوس. بالنسبة لمعدات حماية الجهاز التنفسي التي لا يمكن التخلص منها/لا تستعمل لمرة واحدة، يجب تنظيفها بعد الاستخدام وحفظها في مكان آمن بعيداً عن التلوث
- إغلاق كيس النفايات بإحكام بواسطة شريط لاصق والتخلص منه مع النفايات الخطرة

قطعة قماش مبللة

كيس نفايات الأسبستوس

Appendix 3: Health and Safety

1. Training

All workers must receive comprehensive training on the identification and handling of hazardous materials, proper use of PPE, and emergency response protocols. Training should comply with international best practices, such as those outlined by the Health and Safety Executive (HSE) and the World Health Organization (WHO).

2. Personal Protective Equipment

2.1. Criteria for Adequate Protective Clothing

Protective clothing must be suitable and effective for the specific conditions, ensuring the following:

- **Proper Fit:** Clothing should be available in different sizes to ensure a good fit for each user.
- **Durability:** It should be strong enough to avoid stretching or tearing seams during use.
- **Comfort:** The clothing should allow for ease of movement, especially in cases where physical effort is required.
- **Temperature Adaptation:** It should be suitable for working in low ambient temperatures.
- **Elastic Closures:** Should include elasticated cuffs, ankles, and a snug-fitting hood to ensure a secure seal around wrists, ankles, neck, and face.
- **No Dust-Trapping Features:** Clothing should be free of pockets or any other features that could collect hazardous dust.
- **Ease of Decontamination:** It should be easy to clean or safely dispose of after use.

2.2. Types of Personal Protective Equipment

General Protective Clothing

- **Full-Body Protective Suits:** Workers must wear full-body suits made of durable, impermeable materials that can protect against radioactive and chemical contaminants. The suits should meet the following standards:
- **Uranium contamination:** Select suits rated for protection against radioactive suspended particulates (alpha, beta, and gamma radiation). Note that while these suits cannot block beta or gamma radiation, they effectively prevent contamination from radioactive dust; Category III, Type 5/6 disposable coveralls are recommended (EN 14126 certified).
- **Phosphorus contamination:** Use flame-resistant suits (meeting EN ISO 11612 standards) to protect against potential exposure to phosphorus, which can ignite upon contact with air.
- **High-Visibility Suits:** For work near machinery or in low-light areas, suits with high-visibility strips should be used (EN ISO 20471 standard).

- **Highly Contaminated Zones:** In zones with high contamination levels, workers should wear hazmat suits equipped with appropriate respiratory protection, such as self-contained breathing apparatus (SCBA). Suits should comply with EN 943 standards for protection against hazardous substances.

Respiratory Protection

Respirators: Depending on the level of contamination, use appropriate respirators:

- **Uranium Contamination:** A P3 filter respirator should be used to protect against inhalation of radioactive dust particles (EN 143 standard).
- **Phosphorus or Chemical Contamination:** A full-face respirator with combined filters for gas, vapor, and particles should be used (EN 136 and EN 141 standards).
- **Extreme Contamination Zones:** In areas with severe contamination, a self-contained breathing apparatus (SCBA) is recommended to ensure maximum respiratory protection.
- **Escape Hoods:** Emergency escape hoods should be available for quick evacuation in case of respirator failure or sudden exposure.

Eye Protection

- **Safety Goggles:** Workers must wear safety goggles with indirect ventilation to protect their eyes from airborne particles, chemical splashes, and potential exposure to hazardous dust (EN 166 standard).
- **Phosphorus Contamination:** Flame-resistant goggles should be worn in environments where phosphorus is present to mitigate the risk of fire-related injuries.

Hand Protection

- **Chemical-Resistant Gloves:** Workers should wear heavy-duty gloves that provide protection against chemicals, such as butyl or nitrile gloves (EN 374 standard). Double gloving is recommended in high-risk areas.
- **Uranium Contamination:** Use gloves that provide protection against both radioactive particulates and chemical exposure (EN 388 for mechanical risks and EN 421 for radiation protection).
- **Phosphorus Contamination:** Flame-resistant gloves are required to mitigate the risk of burns or fire-related injuries (EN 407 standard).
- **Puncture-Proof Gloves:** Workers should wear gloves with puncture-resistant layers (EN 388 standard) to protect against sharp objects such as nails, glass, or metal shards commonly encountered in rubble.
- **Extended Cuffs:** Gloves with extended cuffs should be used to provide full coverage and prevent rubble or contaminants from contacting the skin.

Foot Protection

- **Safety Boots:** Boots should be chemical-resistant, slip-resistant, and provide protection against sharp objects. They must also meet the following criteria:
- **Uranium contamination:** Use radiation-protective footwear that prevents contact with contaminated surfaces (EN ISO 20345 for safety footwear and EN 421 for radiation protection).
- **Phosphorus contamination:** Boots should be flame-resistant or at least provide some protection against heat and flames (EN ISO 20345).

Hearing Protection

- **Ear Protection:** Depending on the environment, particularly where heavy machinery is used, whenever noise levels are suspected to exceed 85 decibels (dBA), hearing protection such as earplugs or earmuffs should be worn to protect workers from noise pollution (EN 352 standard).

Additional PPE for Hazardous Material Handling

- **Radiation Dosimeters:** Workers handling uranium-contaminated rubble should wear personal dosimeters to monitor radiation exposure (aligned with IAEA standards for radiation protection).
- **Flame-Resistant Outerwear:** When working in areas where phosphorus is present, all outer layers should be fire-retardant to protect against potential ignition.

Decontamination Procedures

- **Disposable PPE:** When possible, use disposable PPE that can be safely discarded
- **Decontamination Stations:** Ensure that all workers pass through decontamination stations upon exiting contaminated zones to remove any potential hazardous materials from their suits, boots, and gloves.
- **Waste Segregation:** Implement waste segregation protocols for contaminated PPE to ensure proper hazardous waste disposal.
- **Closure of decontamination station:** ensure the proper closure of the decontamination station when it is no longer needed, which also would include managing the secondary resulting contamination (wastewater).

Training and Fit Testing

- **Training:** All personnel must be trained in the correct use of PPE and the specific risks associated with handling contaminated rubble.
- **Fit testing:** Fit testing is required for respiratory equipment to ensure a proper seal and adequate protection, particularly for respirators (EN 529 standard).

Table 1: Corresponding PPE items per type of contamination

PPE ITEM	Uranium Contamination	Phosphorus Contamination	Other Chemical Contamination
Protective suit	Category III, Type 6/5, EN 14126 (for radiation)	Flame-resistant suit (EN ISO 11612)	Chemical-resistant suit (EN 13034)
Respirators	P3 Filter (EN 143)	Full-face respirator with gas/vapor filters (EN 136)	Full-face respirator with combined filters (EN 136/141)
Eye Protection	Safety goggles (EN 166)	Flame-resistant goggles	Chemical splash goggles (EN 166)
Hand Protection	Radiation-protective gloves (EN 421, EN 388)	Flame-resistant gloves (EN 407)	Chemical-resistant gloves (EN 374)
Foot Protection	Safety boots (EN 20345, EN 421)	Flame-resistant boots	Chemical-resistant safety boots (EN 20345)
Hearing Protection	Earplugs/Earmuffs (EN 352)	Earplugs/Earmuffs (EN 352)	Earplugs/Earmuffs (EN 352)
Radiation Dosimeters	Required	Not applicable	Not applicable
High-Visibility PPE	Not applicable	Recommended for low-light environments (EN ISO 20471)	Recommended for low-light environments (EN ISO 20471)
Escape Hoods	Not applicable	Emergency escape hood (EN 403)	Emergency escape hood (EN 403)

Appendix 4: Relevant Local Legislation

There are several local legislations that govern directly or indirectly debris management. Below is a list of some of the main Legislations.

Table 2: Relevant local legistlations

Legislation Reference	Brief Description
Laws	
Law 444/2002	Assigns the ministry of Environment the responsibility of planning, monitoring and setting standards for treatment to reduce quantities of waste sent for disposal.
Law 80/2018	Sets principles for integrated solid waste management. provides framework for waste management (Hazardous and Non-Hazardous). Provides responsibilities for both central and local authorities in waste management.
Decrees	
Decree 118/1977	Assigns the responsibility of waste transportation to municipalities while the responsibility of waste disposal is assigned to Governorates. Assigns municipalities authority in establishing solid waste disposal facilities.
Decree 5605/2019	Related to sorting at source, furthermore, when it comes to CDW it requests from union of municipalities to establish CDW collection centers to serve the caza in which the union is located.
Decree 5606/2019	Governs management of hazardous waste/material.
Circulars	
MoE Circular 6/1 (5/12/2024)	Requests from Municipalities and Union of Municipalities, to assign locations that are environmentally damaged (quarry sites) as reception areas for debris and notify the Ministry of Environment.

VOLUME 2

DEBRIS PROCESSING

Context

Since 8 October 2023, Lebanon sustaining numerous airstrikes over a period of approximately 11 months; these attacks were primarily concentrated in the Governorates of South of Lebanon and Nabatieh, with occasional strikes in the Governorate of Baalbeck and Hermel. On 23 September 2024 an escalation of the conflict occurred with the expanded attacks on the Governorates of South Lebanon and Nabatieh, the governorates of Baalbeck and Hermel, and Bekaa, and in the following days reaching the southern suburbs of Beirut, with occasional strikes on Beirut city itself.

The intensified conflict, lasting from 23 September to 27 November 2024, resulted in the displacement of approximately 1.3 million people during this period. Although, most of the displaced population returned once the attacks halted. However, the level of destruction generated significant volumes of debris. Several estimates have been released although official figures have not been published.

The debris management approach endorsed by the United Nations (UN) through the UN Debris Task Force co-led by UNDP, UN-Habitat and UNOPS, is detailed in the Debris Management Framework (DMF) which aligns with international best practice for the management of debris waste. These Standard Operating Procedures (SOPs) are an extension of the DMF, providing more details on each of the specific areas of debris management.

Scope of the SOP

This Standard Operating Procedure (SOP) is a standalone document complemented by two other volumes (Volume 1 – Debris Pre-processing Measures, and Volume 3 – Quarry Rehabilitation), and addresses debris processing after ensuring site safety. This SOP in its three volumes establishes comprehensive debris management processes for the response in Lebanon, ensuring rapid, transparent, and efficient responses to the country's immediate needs. It outlines safety protocols, and regulatory compliance, providing clear guidance for relevant stakeholders. This SOP aims to incorporate sustainability principles by prioritizing waste reduction, recycling, and reuse. Circular economy strategies will be integrated to enhance resource efficiency and environmental preservation.

This document also makes reference to SOPs guidelines on the safe and environmentally sound handling of debris.

This document does not cover heritage sites (archaeological and cultural sites). These sites fall under the exclusive guidance and procedures established by the Ministry of Culture. Upon encountering artifacts or relevant heritage material, contractors must either follow relevant published guidances by the Ministry of Culture, or contact the ministry of culture for advice and guidance.

Phases of Implementing Debris Processing

Debris processing involves multiple phases from clearance, removal, processing towards reuse and recycling, and final disposal.

It is essential to ensure that all works are implemented in line with local standards and regulations, and that labour laws and employment records are accounted for and properly documents.

Phase 1: Site Clearance

This phase is accounted for in Volume 1 – Debris Pre-processing Measures, ensures site safety and soundness before commencing any work. During site clearance and subsequent phases, the following guidelines should be accounted for:

- Ensure public and local acceptance of the intervention through engagement of local and neighbouring communities.
- If asbestos is identified on site, the guidelines provided in Appendix 1 (Guidelines for Asbestos) must be followed.
- Health and Safety measures should be accounted for at all times inline with Appendix 2 (Health and Safety).
- Local legislations should be accounted for at all time, Appendix 3 (relevant local legislations), provides some of the relevant local legislations as reference.

Phase 2: Demolition and Debris Removal

Once site clearance is completed, the debris removal stages may be initiated. It is recommended that such works be implemented based on engineered plans, especially when unstable or damaged structures are present. The engineering plans will determine whether the structures should be demolished or rehabilitated.

2.1 Planning

Prior to the initiation of debris removal several interventions should be considered and planned for, including the following:

a. Identification of destination of collected debris:

A clear plan should be developed to identify the destination of various debris components (e.g. hazardous materials, non-hazardous materials, exceptional objects, etc.). These destinations must be identified/approved by government and/or relevant authorities. All sites will undergo detailed debris segregation, categorizing debris into hazardous and non-hazardous materials. This process ensures compliance with environmental and safety regulations enables effective management of recyclable and reusable components.

b. Type of machinery:

All machinery must be spark free to prevent ignition of potential hazardous materials. Separate trucks shall be used for hazardous material and for non-hazardous material. For hazardous material the trucks shall have a closed/sealed trunk or shall have the capacity to carry sealed containers hosting hazardous material. As for non-hazardous debris conventional tipping trucks may be used.

c. Type of Personal Protection Equipment (PPE)s:

PPEs must be used at all sites. The type of PPEs will depend on the site's characteristics and the type of hazardous material present. Basic PPE should include, hard hats, eye protection goggles, visibility vests, face masks, hard-toe safety shoes, and puncture resistant gloves. Additional layers of PPEs may be needed depending on the type of hazardous material encountered, in line with their respective safety measures (refer to material safety data sheets (MSDS) of identified materials where applicable). Additional information of Health and Safety are provided in Appendix 2.

d. Smoking Free Zone:

Smoking, and other fire sources must be prohibited at all sites to prevent potential fire hazards, especially when flammable fumes may be present during excavation works.

e. Approved comprehensive work and transportation plan:

Prepares and obtain approval for the work and transportation plan where applicable, ensuring that proposed works are in line with the local legislations and best practices.

f. Dust and emission control measures:

Ensure that all machinery used are well maintained to control emission levels. Furthermore, where applicable used dust screens around sites to limit emission of dust to protect its neighbouring areas. Ensure means of monitoring air quality and and noise levels in line with MoE decisions 16/1 dated 2022, and MoE decision 52/1 dated 1996.

g. Reduce labour engagement

Work activities should be planned to minimize human exposure to debris, reducing the risk of accidents, particularly given the potential presence of hazardous materials.

h. Buffer Zones

Ensure establishing buffer zones near water bodies and/or sensitive areas.

2.2 Excavation and Segregation:

Excavation and segregation are critical components of effective debris management, focusing on excavation, loading, and transportation to assigned temporary storage locations. These operations must be carried out with utmost caution and continuous monitoring to assess and manage the various types of debris present at the site. The following considerations are essential:

a. Identification of potential UXOs:

Continuous monitoring is required to identify any unexploded ordnances (UXOs) that might not have been detected during the pre-work site assessment. If UXOs are found, all activities must be halted immediately, and the Lebanese Mine Action Center (LMAC) should be contacted.

b. Identification of human remains:

Excavation works shall be continuously monitored to enable the identification of any potential human remains under the debris. If human remains are encountered works should be put on hold and Ministry of Public Health (MoPH) must be informed.

c. Identification of fuel containers:

Excavation works shall be continuously monitored to enable the identification of any fuel containers (gas canisters for household cooking, diesel tanks for household heating, and others based on the type of damaged industry), and enabling their recovery with minimal damage to reduce risk of leakages and causing additional pollution or fire risks.

d. Identification of valuable or recoverable material:

Excavation works shall be continuously monitored to enable the identification of any valuable or recoverable material buried under debris. If such material is encountered Interior Security Forces (ISF) should be informed.

e. Identification of reusable and recyclable material:

Excavation works shall be continuously monitored to enable the identification of any reusable or recyclable material buried under debris. If such material is encountered, it should be sorted out to preserve their recyclable/reuse value**.**

f. Identification of potential hazardous material:

Excavation works shall be continuously monitored to enable the identification of potential hazardous material buried under debris. If such material is encountered, compatible safety measures shall be enforced at the site to ensure the safety of all personnel. Where and if possible encountered hazardous material shall be processed separately from the remaining debris.

g. Dust Control

Cautious excavation techniques help minimize dust emissions. Spraying water at regular intervals is recommended to suppress dust, particularly in controlled demolitions or areas with hazardous materials. This measure protects workers and nearby communities from exposure to airborne particulates.

2.3 Hazardous material handling:

The handling of hazardous material including asbestos containing materials (ACM), must be handled under special procedures compatible with the type of hazardous material encountered to minimise impacts hazards to human health and the environment.

a. Containment:

In addition to following dedicated procedures per each type of hazardous material, it is essential to contain each type of hazardous material separately, in a dedicated package that would prevent exposure of human to it while it is in storage mode and prevents leakage of liquids or dust emissions in ambient air. The containment shall be implemented in-situ and prior transportation.

b. Personal Protective Equipment (PPE):

Appropriate PPE must be used based on the specific hazardous materials encountered at the site. This ensures worker safety and reduces the risk of exposure to hazardous substances.

c. Reporting:

The Ministry of Environment must be promptly notified if hazardous materials are discovered. Reports should include details of the containment measures employed and the designated temporary storage locations for the materials.

2.4 Control Measures:

Effective control measures must be implemented as part of Quality Assurance and Quality Control. These measures include.

a. Quantification and tracking:

Ensure quantification of debris either by weight or by mass, along with documenting its source, Type (Hazardous, non-hazardous) and transportation destination.

b. Spot Checks:

Perform regular spot checks and verifications to ensure adherence to the established procedures and compliance with relevant local legislation. These checks provide ongoing oversight and help mitigate potential risks.

2.5 Handing over of sites:

After debris has been removed from targeted sites, ensure safety measures are in place before the handover. Key steps include:

a. Ensure all debris has been removed,

b. Address any holes or cavities to prevent accidents or injuries. Warning signs and barriers shall be placed within the site at areas where risks may arise.

Phase 3: Transportation and Temporary Storage Sites

3.1 Transportation:

a. Trucks must be well maintained to ensure operational safety and reliability.

b. No-hazardous material transport: Tipping trucks transporting non-hazardous material must have their trippers covered with impermeable liners while in transport.

c. Hazardous material transport: Closed trunk trucks, in compliance with international standards, must be used for hazardous material. These truck should have clear hazard signage and be laded securely to prevent leakage or release of materials during transportation.

d. Waste tracking systems: Transportation vehicles must be equipped with Global Positioning System (GPS) enabled waste tracking systems, particularly for hazardous waste, to ensure monitoring and traceability.

e. Chain of custody: Implement chain of custody procedures for all shipments, documenting the source, quantity, destination, transporter, and date/ time of transport.

3.2 Temporary Storage Sites:

Temporary storage sites play a critical role in managing debris between collection and final processing or disposal. Guidelines include:

a. Site identification: Storage sites must be identified and approved by local authorities and government agencies. Such sites should be preferably public domains, and should be subject to permitting procedures set by Lebanese authorities and legislations.

b. Hazardous material containment: Use impermeable liners in storage areas dedicated to hazardous materials to prevent leaks and contamination.

c. Transfer stations: Temporary storage sites act as transfer stations. Hazardous material remains stored until final disposal arrangements are established, including international shipping under the Basel Convention. Non-hazardous materials may undergo preliminary processing, such as the recovery of recyclables.

d. Storage optimization: Organize materials to optimize storage capacity and enable easy access to various debris categories.

e. Material traceability: Maintain records of received materials, including type, source, transporter, quantity, and date/time of arrival.

f. Systematic transport: Once non-hazardous processing locations are identified, materials at temporary sites must be transported systematically, adhering to non-hazardous material transport guidelines.

3.3 Debris Assessment at Temporary Storage Sites:

Assessment of debris at storage sites is essential to determine its suitability for reuse or disposal:

a. **Sampling and testing:** Non-hazardous debris batches must be assessed using representative sampling and laboratory testing to determine structural integrity and composition.
b. **Hazardous or unsuitable material:** Batches identified as hazardous or structurally weak through expert inspection or testing must be labelled for final disposal.
c. **Reuse and valorisation:** Batches identified as suitable for reuse, such as aggregates, should be labelled and transported to material processing facilities.
d. **Logs:** Incident logs should be established to document material rejection, spills, or batch contamination.

Phase 4: Material Processing Towards Recycling and Reuse

Based on international references debris always comprises of a component that is recyclables or reusable, except if it is contaminated with other (hazardous) material accordingly. It is essential to capitalize on recycling and reusing material within the debris wherever and whenever possible in light of scarce raw material in Lebanon, and lack of sufficient areas for final disposal.

4.1 Material processing sites:

Sites for processing non-hazardous debris material towards recycling are to be identified by the government, and should be subject to permitting procedures set by Lebanese authorities and legislations. These sites can be either selected based on existing operational quarry sites, where required infrastructure is already available or partially available, or can be a completely new site to be set up as needed. These sites should be spacious, enabling establishing various zones within the site. Minimum area required for such sites is 8,000m^2. The main zones needed are as follows:

a. **Reception zone:** should comprise of an access gate and (preferably) of a weighbridge to monitor entering quantities, and of a control room to monitor and control quantities and volumes of material entering and leaving the site. The reception zone should have a storage capacity of approximately 5 working days (based on the processing capacity of the available or installed crusher). The reception area along with processing area and final product storage area shall all have water source for dust control measures. Ideally dust containment shall be done using mist cannons. Furthermore, the reception area shall comprise of site offices.
b. **Processing zone:** the processing area shall be equipped with at least the following basic logistics. (1) a loader and an excavator, to collect and feed material, (2) a jackhammer, to separate where needed the reinforced concrete, (3) crushers, to reduce and optimize the size of stones, rocks, concrete, hollow blocks, etc., (4) conveyors, to convey material, (5) screens, to separate material by size.

c. **Final product storage zone:** this zone shall comprise of a spacious area with a capacity to accommodate the storage of recovered material for at least 7 consecutive days. This zone shall be divided into several sub-zones as follows, (1) Sub-zone for storage of recyclables, (2) Sub-zone for processing of crushed material (for reuse), (3) Sub-zone for storage of rejects (material that are neither recyclable nor reusable).

4.2 Material Processing Site Safety:

Ensuring safety at material processing sites is of paramount importance to protect workers and maintain operation efficiency. The following measures must be implemented:

a. **Fencing and monitoring:** The entire site should be securely fenced and equipped with monitoring systems to control access and ensure safety.
b. **Safety signage:** Clearly visible signs must be installed throughout the site, providing safety instructions, operational guidelines, and directional information for both workers and visitors.
c. **Basic Traffic Management Plan:** includes vehicle routling within the site, pedestrian separation.
d. **PPE enforcement:** All personnel on-site must always wear appropriate PPEs. The mandatory PPE includes hard hats, eye protection goggles, high visibility vests, face masks, hard-toe safety shoes, and puncture resistant gloves.
e. **Air Quality:** Ensure air quality and noise level monitoring inline with national standards (MoE decision 16/1 dated 2022, and MoE decision 52/1 dated 1996).
f. **Run-off protection:** Ensure Run-off protection: ensure run-off protection and erosion control with the site, of both natural material and established stockpiles.
g. **Buffer zones:** where needed ensure the creation of buffer zones near water bodies and/or sensitive areas. These buffer zones should be in line with national requirements and advice of MoE.
h. **Fuel storage:** ensure the availability of containment trays at fuel storage areas within the site and the availability spill response kits.
i. **Weather monitoring system:** ensure the installation of a basic weather monitoring station to anticipate risks. Key required monitoring parameter include:
   - Wind speed and direction
   - Precipitation level measurement
   - Temperature level

4.3 Processing of Debris:

Non-hazardous debris processing will have to undergo several stages to obtain recyclable and reusable end products. As indicated previously, it may be more cost effective to capitalize on existing infrastructure (i.e. existing quarry sites) if and were possible. These stages are described here after.

a. Reception area:

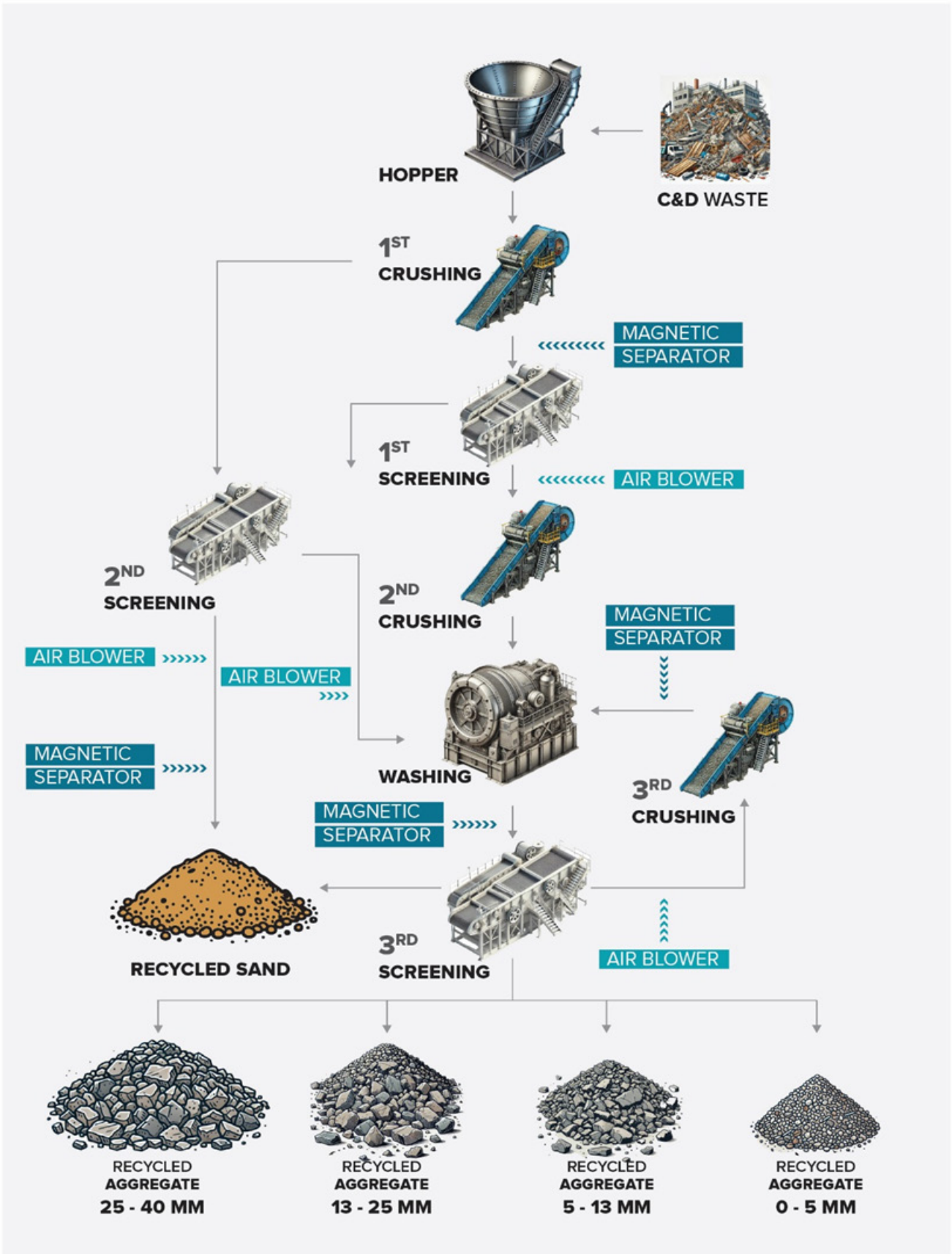
Material arriving at the processing site is first directed to the reception area. The quantity of debris is measured using a weighbridge, and the number and volume of shipments are recorded meticulously. These records are crucial for tracking the movement of materials and ensuring proper documentation throughout the processing lifecycle.

b. Preliminary sorting and separation:

Preliminary sorting of material shall be performed by labourers, to remove and extract notable and bulky material that are not crushable, recyclable, and/or reusable. Manual or through the aid of machinery (i.e. Jackhammers or others) different material shall be separated from each other (i.e. separating concrete from steel reinforcement).

c. Mechanical sorting and processing:

There are several potential processing systems for debris to obtain debris with practical size for later re-use. A potential processing system in displayed in Figure 1. Independently of the type of processing system to be used, it is essential to ensure that in addition to crushers and screens, if and when needed, the system should be equipped with magnetic separators to recover ferrous material, wind blowers and water tanks, to separate light fractions, and clean the debris. Once may consider using eddy current based devices as well to recover non-ferrous metals, that can be linked to some kitchenware, rails, window frames, among others.


HOPPER
C&D WASTE
1ST CRUSHING
MAGNETIC SEPARATOR
1ST SCREENING
AIR BLOWER
2ND SCREENING
2ND CRUSHING
MAGNETIC SEPARATOR
AIR BLOWER
AIR BLOWER
MAGNETIC SEPARATOR
WASHING
3RD CRUSHING
MAGNETIC SEPARATOR
RECYCLED SAND
3RD SCREENING
AIR BLOWER
RECYCLED AGGREGATE 25 - 40 MM
RECYCLED AGGREGATE 13 - 25 MM
RECYCLED AGGREGATE 5 - 13 MM
RECYCLED AGGREGATE 0 - 5 MM

Incident logs should be established to document material rejection, spills, or batch contamination.

d. Obtained end products and their potentials

It is anticipated to obtain various categories of material from the debris processing system. The main category is aggregates, which based on their quality and size can be used in various applications (mortar, partial aggregate substitution in concrete mixes, sub-base, fill material, etc.). In addition to aggregates, recyclable material is recovered. Recyclable material, may contain metal (ferrous and non-ferrous, such as metallic doors, aluminium windows, steel rails, cutlery, etc.), wood (from doors, tables, house furniture), glass (windows, house appliances, etc.), plastics, etc. Recyclable material can be sent to industries that can process this material or use it as a primary product, or to intermediary entities that can send material for proper recycling entities. List of potential entities that can receive and process non-aggregate products are published by the Ministry of Environment, under circular 7/1 dated November 2017, by ALI (Association of Lebanese Industries), and other reliable sources. As for Aggregates various contractors that are involved in the construction field, cement plants, quarry site owners can be considered as potential entities to receive and process them. The third main category within debris is rejects (gypsum, films, textile, etc.). Rejects in principle should be sent for final disposal sites that are designated by the government.

Phase 5: Final Disposal

A structured and practical approach is required to ensure the safe and environmentally responsible final disposal of debris. This phase outlines the necessary steps for handling, treating, and disposing of both non-hazardous and hazardous materials, all in alignment with environmental standards and best practices.

5.1 Disposal of Non-Hazardous Material:

a. Quarry Rehabilitation: Non-hazardous material that is neither recyclable nor reusable can be utilized for quarry rehabilitation, providing an environmentally beneficial use for these materials. SOPs for Quarry rehabilitation are available in Volume 3 – Quarry Rehabilitation.

b. Designated Disposal Sites: Non-hazardous materials unsuitable for reuse or recycling should be disposed of in pre-identified locations that meet regulatory standards for containment and monitoring.

c. Disposal sites should be equipped with dust control systems, controlled and monitored access to track, trace and quantify received material.

5.2 Disposal of Hazardous Material:

Hazardous material set for disposal must abide by local and international standards and shall account for export or local disposal.

a. Export under Basel Convention:

- Hazardous materials can be exported in compliance with the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.
- Ensure proper documentation, prior notification, and consent for transboundary movements.
- Collaborate with certified international facilities and transporters for safe and compliant disposal.

b. Local Disposal:

- Hazardous materials can also be disposed of locally in certified hazardous waste landfill cells. These landfill cells must comply with Lebanese Ministry of Environment Decision 30/1 dated 18 March 2024, which sets standards for such facilities.
- Disposal sites should be secured with controlled access and a monitoring system to track, trace and quantify received material.

Appendix 1: Guidelines for Asbestos

ASBESTOS HEALTH AND SAFETY REQUIREMENTS

A. KEY POINTS FOR THE SAFE HANDLING OF ASBESTOS

SAFE HANDLING OF ASBESTOS

1. PROVIDE PROTECTIVE EQUIPMENT AND TRAINING

- As a minimum, provide workers with gloves, goggles, disposable clothing or replacement clothing, adequate footwear and disposable masks (see Appendix C for specifications).
- Dispose of contaminated clothing and protective equipment in the same way as other asbestos-containing materials (ACMs).
- Provide washing facilities for workers and training to all involved if possible, or work supervisors as a minimum

2. IF POSSIBLE, DO NOT DISTURB IT, BREAK IT OR CUT IT

This can release asbestos dust which contains hazardous fibres

3. DO NOT BURN IT

Never burn suspected ACMs as this releases dangerous fibres into the air

4. WET IT

- If it is necessary to move, saw or break up the materials, keep them thoroughly wet to reduce the amount of airborne fibres
- Work only in well-ventilated areas
- Take particular care with friable materials
- Clean any contaminated surfaces by wetting the area or using damps cloths. Never dust or sweep as this propels fibres into the air

5. COVER IT

- When disposing of it, keep piles of ACMs covered with plastic sheets until they can be disposed of
- Always wet the materials before moving

6. WRAP IT UP

- Store asbestos-containing waste in sealable containers until it can be disposed of safely
- Use metal or plastic drums or strong polyethylene bags
- If using bags put one bag inside another and seal with strong tape
- Label the containers in the local language(s) and include a hazard warning before disposal

ASBESTOS HEALTH AND SAFETY REQUIREMENTS

B. DEDICATED ASBESTOS DISPOSAL SITE SELECTION AND DEVELOPMENT

ASBESTOS SITE SELECTION AND DEVELOPMENT

1. Site

In collaboration with the local government, locate a site where adequate cover material is available, access is good and controllable and where the waste cannot be exposed by water or wind erosion, slope failure, further disasters or re-excavation

2. VEHICLES

Clearly label vehicles transporting asbestos waste and ensure they are operated by trained personnel

3. EMISSION PROTECTION

During and after the disposal of asbestos waste, make sure no visible emissions occur and cover waste with at least 15cm of compacted non-asbestos-containing material within 24 hours of disposal

4. BARRIERS

If no natural barriers exist around the site to deter access, install fencing, trenches or other barriers to prevent unauthorised access to the designated area

5. WARNING SIGNS

Post warning signs at the entrance of the site and around the perimeter

6. CLOSURE

Final closure of an area containing asbestos waste requires at least an additional 75cm of compacted non-asbestos material to provide a 1m final cover. This must be done within 90 days of the last deposition

ASBESTOS HEALTH AND SAFETY REQUIREMENTS

MINIMUM STANDARDS
for working with debris waste in Beirut

C. PPE REQUIREMENTS WHEN COMING INTO CONTACT WITH ASBESTOS CONTAINING MATERIALS

Personal protective clothing and equipment is an essential line of defence for minimising the risks presented by contact with asbestos when elimination and isolation of the hazard is not practicable. It is essential that workers receive prior training on the use of personal protective equipment.

WHAT IS PERSONAL PROTECTIVE EQUIPMENT (PPE)?

PPE is clothing or equipment which provides protection to the user from a potential hazard.

WHAT PPE MUST BE WORN WHEN ASBESTOS IS OR MAY BE PRESENT?

If asbestos or asbestos containing materials are present, or there is a possibility of presence, the following should be worn:

- **Respiratory Protective Equipment** (RPE) should be used by those designated to handle asbestos whenever practicable – to avoid inhaling asbestos fibres
- **Overalls** disposable, to avoid the risk of carrying asbestos fibres away from the worksite on clothing
- **Footwear** – appropriate for the work being undertaken (see next page for details).

WHAT PPE IS REQUIRED

Although controls must be in place to prevent or reduce exposure to asbestos fibres when working with ACMs (see Appendix A), when exposure cannot be avoided the last line of defence against dangerous exposure is the use of appropriate PPE. The following details the levels of PPE recommended for work with asbestos materials, from that which provides the best protection to the minimum standard required.

Figure 1: Full face covering

Respiratory Protective Equipment

For long periods of continuous use in demolition related works, effort must be made to use the highest level of mask available and practical in the circumstances. Figure 1 shows the type of mask, covering the whole face, which should be used by those working significant amounts of time with or in close proximity to ACMs. Full face masks should conform to BS EN 136 standard with P3 filter and should be used by licensed operators.

Figure 2: Reusable face covering

If a full-face mask is not available to those needing to clear debris containing or potentially containing ACM, then a face mask covering nose and mouth should be used. Figure 2 shows a reusable mask (applicable standard EN140 with P3 filter), covering nose and mouth, which would be suitable for those working for regular periods in debris clearance.

Figure 3: Basic disposable face covering

Figure 3 shows the minimum standard face mask that must be used by anyone working with or near ACMs if higher level masks are not available. This equipment should be suitable for most short-duration non-licensed work, especially for open-air debris removal and disposal activities.

The mask used should be of FFP3 or FMP3 standard and should be used at all times when in close proximity to ACMs. When using FFP3 (applicable standard BS EN 1827) or FMP3 (applicable standard BS EN 149) masks, these should be properly disposed of at the end of each day and a new mask worn the following working day.

Figure 4: Safety goggles

Safety Goggles

Should one of the masks shown in Figure 3 or Figure 6 be used, then it is recommended that safety goggles are used, meeting BS EN 166 standard) as shown in Figure 4.

Figure 5: Wellington boots

Footwear

Appropriate footwear is an important part of the PPE required when working with asbestos contaminated debris. It is recommended that Wellington Boots designed specifically for this purpose be worn by everyone involved in this work. Wellingtons should be EN ISO 20345:2011 compliant, to provide solid sole protection from penetration and steel toecaps. An example of this footwear is shown in Figure 5.

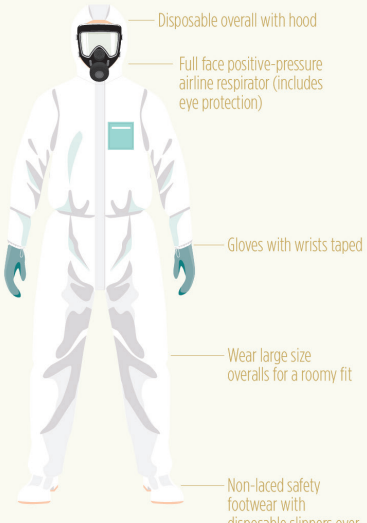


Figure 6: PPE requirements when working with asbestos

Full RPE for High Risk Work

Figure 6 shows the necessary full PPE required when working to clear ACMs. This is the level of PPE necessary for trained people spending significant amounts of time working to separate and dispose of ACMs who will therefore have a high level of exposure to asbestos over a sustained period. Disposable overalls should be Type 5/6 (relevant standard BS EN ISO 13982+A1). Gloves should be Type 5/6 single use and be appropriately disposed of at the end of each day. Footwear should be solid sole, ankle high wherever possible. Wellington boots (see Figure 5) or non-laced pull-on footwear is preferable as these are easier to clean. Disposable overshoes should be used if non-laced footwear is not available. Disposable overalls, gloves and overshoes should be treated as hazardous and disposed of with other asbestos waste.

ASBESTOS HEALTH AND SAFETY REQUIREMENTS

D. PERSONAL DECONTAMINATION

It is important that everyone working with or near asbestos materials ensures they are fully decontaminated before leaving the workplace. This will help alleviate the possibility of taking asbestos fibres home on clothing and exposing family and friends.

The following procedure should be followed by each person working at on debris clearance involving asbestos materials.

PROCEDURE

Damp Rag

Asbestos Waste Bag

- Clean boots with damp rags
- Use damp rags in a gentle 'patting' action on overalls (rubbing can disturb fibres)
- Where there are two workers, they can help to clean each other
- Peel off disposable overalls. They should be inside-out when they have been removed. Put the overalls in a suitable asbestos waste bag (UN-approved Class 9 plastic bag)
- Remove RPE last. If using disposable face covering, place these in the asbestos waste bag. For non-disposable RPE, clean after use and store in safe place away from contamination
- Tape the waste bag securely closed and dispose of with hazardous waste

متطلبات الصحة والسلامة المتعلقة بالتعامل مع الأسبستوس

برنامج الأمم المتحدة للبيئة

UNDP

أ- النقاط الرئيسية المرتبطة بالتعامل الآمن مع الأسبستوس

التعامل الآمن مع الأسبستوس

١. تأمين معدات الوقاية/الحماية والتدريب

- تزويد العمال، كحد أدنى، بالقفازات والنظارات الواقية والملابس التي يمكن التخلص منها/تستعمل لمرة واحدة أو الملابس البديلة والأحذية المناسبة والأقنعة التي يمكن التخلص منها/تستعمل لمرة واحدة (النظر إلى الملحق ج للاطلاع على المواصفات)
- التخلص من الملابس الملوثة ومعدات الوقاية/الحماية بنفس طريقة التخلص من المواد الأخرى التي تحتوي على الأسبستوس
- تأمين مرافق الاغتسال للعمال وتدريب جميع المعنيين، إذا كان ذلك ممكناً، أو تدريب المشرفين على العمل كحد أدنى

٢. إذا كان ذلك ممكناً، عدم بعثرة أو تكسير أو تقطيع المواد

يمكن أن يؤدي ذلك إلى إطلاق غبار الأسبستوس الذي يحتوي على ألياف خطرة

٣. عدم حرق المواد

عدم حرق المواد التي يشتبه باحتوائها على الأسبستوس بتاتاً لأن ذلك يطلق أليافاً خطرة في الهواء

٤. تبليل المواد

- إذا كان من الضروري تحريك أو نشر أو تفتيت المواد، يجب إبقاؤها رطبة بشكل كامل لتقليل كمية الألياف المتطايرة في الهواء
- حصر العمل ضمن مناطق مجهزة بتهوية جيدة
- توخي الحذر عند استخدام المواد الهشة
- تنظيف جميع الأسطح الملوثة عن طريق ترطيب المكان أو استخدام قطعة قماش مبللة. عدم تنظيف الغبار أو مسحها أبداً لأن هذا يدفع الألياف في الهواء

٥. تغطية المواد

- عند التخلص من المواد، المحافظة على تغطية أكوام المواد التي تحتوي على الأسبستوس بأغطية بلاستيكية ريثما يمكن التخلص منها
- ترطيب المواد باستمرار قبل نقلها

٦. تغليف المواد

- تخزين النفايات التي تحتوي على الأسبستوس في حاويات محكمة الإغلاق ريثما يمكن التخلص منها بشكلٍ آمن
- استخدام براميل معدنية أو بلاستيكية أو أكياس بولي إيثيلين متينة
- في حال استخدام الأكياس، يجب وضع كيس داخل كيس آخر وإغلاقه بشريط لاصق متين ووضع علامات/تسميات على الحاويات باللغة (اللغات) المحلية وتضمين تحذير بالمخاطر قبل التخلص منها

برنامج الأمم المتحدة للبيئة

متطلبات الصحة والسلامة المتعلقة بالتعامل مع الأسبستوس

ب- اختيار موقع مخصص للتخلص من الأسبستوس وتطويره

اختيار موقع للتخلص من الأسبستوس وتطويره

١. الموقع

بالتعاون مع السلطة المحلية يتم تحديد موقع تتوفر فيه مواد ملائمة للتغطية، ويكون الوصول إليه سهلاً وخاضع للضبط، كما لا تصبح النفايات فيه مكشوفة بسبب الإنجراف بفعل المياه أو الرياح أو انهيار المنحدرات أو حدوث المزيد من الكوارث أو إعادة الحفر

٢. المركبات

وضع علامات/تسميات واضحة على المركبات التي تنقل نفايات الأسبستوس والتأكد من تشغيلها بواسطة موظفين مدربين

٣. الحماية من الانبعاثات

أثناء وبعد التخلص من نفايات الأسبستوس، التأكد من عدم حدوث انبعاثات مرئية ومن تغطية النفايات بما لا يقل عن ١٥ سم من المواد المضغوطة التي لا تحتوي على الأسبستوس، في غضون ٢٤ ساعة من التخلص منها

٤. الحواجز

في حال عدم وجود حواجز طبيعية حول الموقع لمنع الدخول إليه، تركيب سياج أو خنادق أو حواجز أخرى لمنع الدخول دون إذن إلى المنطقة المحددة

٥. اللافتات التحذيرية

وضع لافتات تحذيرية عند مدخل الموقع وفي محيطه

٦. الإغلاق

يتطلب الإغلاق النهائي للمنطقة التي تحتوي على نفايات الأسبستوس ٧٥ سم على الأقل من المواد الإضافية المضغوطة من غير الأسبستوس لتوفير غطاء نهائي يبلغ متراً واحداً. يجب أن يتم ذلك في غضون ٩٠ يوماً من آخر ترسّب للأسبستوس

برنامج الأمم المتحدة للبيئة

متطلبات الصحة والسلامة المتعلقة بالتعامل مع الأسبستوس

المعايير الدنيا للتعامل مع مخلفات النفايات في بيروت

ج. المتطلبات المتعلقة بمعدات الوقاية الشخصية عند التعامل مع مواد تحتوي على الأسبستوس

تعتبر ملابس ومعدات الوقاية الشخصية خط دفاع أساسي لتقليل المخاطر الناتجة عن التعرض للأسبستوس عندما يكون التخلص من الخطر وعزله أمراً غير ممكن عملياً. ولا بد أن يتلقى العمال تدريباً مسبقاً على استخدام معدات الوقاية الشخصية.

ما هي معدات الوقاية الشخصية؟

معدات الوقاية الشخصية هي ملابس أو معدات توفر الحماية للمستخدم من المخاطر المحتملة.

ما هي معدات الوقاية الشخصية التي يجب استخدامها عند وجود الأسبستوس بالفعل أو عند احتمال وجوده؟

في حال وجود الأسبستوس أو المواد التي تحتوي على الأسبستوس، أو في حال كان هناك احتمال لوجودهما يجب ارتداء ما يلي:

- **معدات حماية الجهاز التنفسي** يجب استخدامها من الأشخاص المعينين بالتعامل مع الأسبستوس كلما أمكن ذلك، لتجنب استنشاق ألياف الأسبستوس.
- **بدلات العمل** الأحادية الاستخدام، لتجنب مخاطر حمل ألياف الأسبستوس بعيداً عن موقع العمل على الملابس.
- **الأحذية** يجب أن تكون مناسبة للعمل الذي يجري القيام به (انظر الصفحة التالية للحصول على التفاصيل).

معدات الوقاية الشخصية المطلوبة

على الرغم من أنه يجب توفر الضوابط لمنع أو تقليل التعرض لألياف الأسبستوس عند التعامل مع المواد التي تحتوي على الأسبستوس (انظر الملحق أ)، عندما لا يمكن تجنب التعرض لها، يتمثل خط الدفاع الأخير في استخدام معدات الوقاية الشخصية المناسبة عند مواجهة التعرض الخطير. توضح التفاصيل التالية مستويات معدات الوقاية الشخصية الموصى بها عند التعامل مع مواد الأسبستوس، بدءاً من تلك التي توفر أفضل حماية إلى الحد أدنى من المعايير المطلوبة.

معدات حماية الجهاز التنفسي

يجب بذل الجهود لاستخدام أفضل نوعية من القناع المتوفر والعملي خلال فترات طويلة من الأعمال المتعلقة بالهدم. يبيّن الشكل 1 نوع القناع الذي يغطي الوجه بالكامل والذي يجب أن يستخدمه الأشخاص الذين يتعاملون مع المواد التي تحتوي على الأسبستوس أو يتواجدون بالقرب منها لفترات طويلة. يجب أن تتطابق أقنعة الوجه الكاملة مع معيار(BS EN 136) مع فيلتر P3 ويجب استخدامها من قبل المشغلين الحاصلين على ترخيص.

الشكل1: غطاء كامل للوجه

إذا لم يكن قناع الوجه الكامل متوفراً للأشخاص الذين يتعيّن عليهم إزالة المخلفات التي تحتوي أو يمكن أن تضم مواد تحتوي على الأسبستوس، يجب استخدام قناع الوجه الذي يغطي الأنف والفم. يبيّن الشكل 2 قناعاً قابلاً لإعادة الاستخدام (المعيار المطبق EN140 مع فيلتر P3)، يغطي الأنف والفم فيكون مناسباً للأشخاص الذين يعملون لفترات منتظمة في إزالة المخلفات.

الشكل 2: غطاء الوجه القابل لإعادة الاستخدام

يبيّن الشكل 3 قناع الوجه القياسي الذي يتطابق مع الحد الأدنى من المعايير والذي يجب أن يستخدمه أي شخص يتعامل مع المواد التي تحتوي على الأسبستوس أو يتواجد بالقرب منها في حال عدم توفر أقنعة ذات نوعية أفضل. يجب أن يكون هذا الجهاز مناسباً لمعظم الأعمال القصيرة المدة غير الحاصلة على ترخيص، لا سيما أنشطة إزالة المخلفات والتخلص من المواد التي تحتوي على الأسبستوس في الهواء الطلق.

يجب أن يتطابق القناع المستخدم مع أحد معياري FMP3 أو FFP3 ويجب استخدامه في جميع الأوقات عند التواجد بالقرب من المواد التي تحتوي على الأسبستوس. عند استخدام أحد قناعي FFP3 (المعيار المطبق BS EN 1827) أو FMP3 (المعيار المطبق BS EN 149)، يجب التخلص منهما بشكل صحيح في نهاية كل يوم وارتداء قناع جديد في يوم العمل التالي.

الشكل 3: غطاء الوجه الأساسي الذي يمكن التخلص منه/يستعمل لمرة واحدة

النظارات الواقية

في حال استخدام أحد الأقنعة المبيّنة في الشكل 3 أو الشكل 6، من المستحسن استخدام النظارات الواقية التي تتطابق مع معيار (BS EN 1666) كما هو مبيّن في الشكل 4.

الشكل 4: النظارات الواقية

الأحذية

تشكل الأحذية المناسبة جزءاً مهماً من معدات الوقاية الشخصية المطلوبة عند التعامل مع المخلفات الملوثة بالأسبستوس. من المستحسن أن يرتدي جميع المشاركين في هذا العمل جزمة من نوع ويلينغتون المصممة خصيصاً لهذا الغرض. يجب أن تكون الأحذية مطابقة لمعيار EN ISO 20345:2011 لتوفير حماية قوية للنعل من الاختراق ويجب أن تكون مقدمة الحذاء فولاذية. يتضمن الشكل 5 نموذجاً من هذه الأحذية.

الشكل 5: جزمة من نوع ويلينغتون

معدات حماية الجهاز التنفسي الكاملة للأعمال الشديدة المخاطر

يبيّن الشكل 6 معدات الوقاية الشخصية الكاملة اللازمة المطلوبة عند إزالة المواد التي تحتوي على الأسبستوس. هذا هو مستوى معدات الوقاية الشخصية اللازمة للأشخاص المدربين الذين يمضون وقتاً طويلاً في العمل على فصل المواد التي تحتوي على الأسبستوس والتخلص منها، ونتيجة لذلك يتعرضون لمستويات عالية من الأسبستوس لفترة طويلة. يجب أن تكون بدلات العمل التي يمكن التخلص منها/تستعمل لمرة واحدة من نوع 5/6 (BS EN ISO 13982+A1).

ويجب أن تكون القفازات من نوع 6/5 التي تستخدم مرة واحدة ويتم التخلص منها بشكل مناسب في نهاية كل يوم. يجب أن تكون الجزمات من نوع ويلينغتون ذات نعل متين، وأن تكون أعلى من الكاحل قدر الإمكان. يفضل استخدام جزمات من نوع ويلينغتون (انظر الشكل 5) أو الأحذية دون رباط والتي يتم ارتداؤها عن طريق السحب لأن تنظيفها أسهل. يجب استخدام الحذاء الفوقي المطاطي الذي يمكن التخلص منه/يستعمل لمرة واحدة في حال عدم توفر أحذية دون رباط. يجب التعامل مع بدلات العمل والقفازات والأحذية التي يمكن التخلص منها/تستعمل لمرة واحدة على أنها خطرة ويجب التخلص منها مع نفايات الأسبستوس الأخرى.

الشكل 6: متطلبات معدات الوقاية الشخصية عند التعامل مع الأسبستوس

برنامج الأمم المتحدة للبيئة

متطلبات الصحة والسلامة المتعلقة بالتعامل مع الأسبستوس

د- تطهير الأشخاص

من المهم أن يتأكد كل شخص يتعامل مع المواد التي تحتوي على الأسبستوس أو يتواجد بالقرب منها، من خضوعهم للتطهير بشكل كامل قبل مغادرة مكان العمل. من شأن ذلك أن يساعد في التخفيف من احتمال نقل ألياف الأسبستوس على الملابس إلى المنزل وتعريض الأسرة والأصدقاء للمخاطر.

يجب أن يقوم كل شخص يعمل على إزالة مخلفات المواد التي تحتوي على الأسبستوس باتباع الإجراءات التالية.

الإجراءات

- تنظيف الأحذية بواسطة قطع قماش مبللة
- استخدام قطع قماش مبللة للتربيت على بدلات العمل في حركات خفيفة (يمكن أن يؤدي الفرك إلى بعثرة الألياف)
- في حال وجود عاملَين، يمكنهما المساعدة في تنظيف بعضهما البعض
- خلع بدلات العمل التي يمكن التخلص منها/تستعمل لمرة واحدة. يجب أن تكون مقلوبة من الداخل إلى الخارج عند خلعها، ويجب وضعها في كيس مناسب لنفايات الأسبستوس (كيس بلاستيكي من الفئة ٩ معتمد من الأمم المتحدة)
- إزالة معدات حماية الجهاز التنفسي في النهاية. في حال استخدام غطاء الوجه الذي يمكن التخلص منه/يستعمل لمرة واحدة، يجب وضعه في كيس نفايات الأسبستوس. بالنسبة لمعدات حماية الجهاز التنفسي التي لا يمكن التخلص منها/لا تستعمل لمرة واحدة، يجب تنظيفها بعد الاستخدام وحفظها في مكان آمن بعيداً عن التلوث
- إغلاق كيس النفايات بإحكام بواسطة شريط لاصق والتخلص منه مع النفايات الخطرة

قطعة قماش مبللة

كيس نفايات الأسبستوس

Appendix 2: Health and Safety

1. Training

All workers must receive comprehensive training on the identification and handling of hazardous materials, proper use of PPE, and emergency response protocols. Training should comply with international best practices, such as those outlined by the Health and Safety Executive (HSE) and the World Health Organization (WHO).

2. Personal Protective Equipment

2.1. Criteria for Adequate Protective Clothing

Protective clothing must be suitable and effective for the specific conditions, ensuring the following:

- **Proper Fit:** Clothing should be available in different sizes to ensure a good fit for each user.
- **Durability:** It should be strong enough to avoid stretching or tearing of seams during use.
- **Comfort:** The clothing should allow for ease of movement, especially in cases where physical effort is required.
- **Temperature Adaptation:** It should be suitable for working in low ambient temperatures.
- **Elastic Closures:** Should include elasticated cuffs, ankles, and a snug-fitting hood to ensure a secure seal around wrists, ankles, neck, and face.
- **No Dust-Trapping Features:** Clothing should be free of pockets or any other features that could collect hazardous dust.
- **Ease of Decontamination:** It should be easy to clean or safely dispose of after use.

2.2. Types of Personal Protective Equipment

General Protective Clothing

- **Full-Body Protective Suits:** Workers must wear full-body suits made of durable, impermeable materials that can protect against radioactive and chemical contaminants. The suits should meet the following standards:
- **Uranium contamination:** Select suits rated for protection against radioactive suspended particulates (alpha, beta, and gamma radiation). Note that while these suits cannot block beta or gamma radiation, they effectively prevent contamination from radioactive dust; Category III, Type 5/6 disposable coveralls are recommended (EN 14126 certified).

- **Phosphorus contamination:** Use flame-resistant suits (meeting EN ISO 11612 standards) to protect against potential exposure to phosphorus, which can ignite upon contact with air.
- **High-Visibility Suits:** For work near machinery or in low-light areas, suits with high-visibility strips should be used (EN ISO 20471 standard).
- **Highly Contaminated Zones:** In zones with high contamination levels, workers should wear hazmat suits equipped with appropriate respiratory protection, such as self-contained breathing apparatus (SCBA). Suits should comply with EN 943 standards for protection against hazardous substances.

Respiratory Protection

Respirators: Depending on the level of contamination, use appropriate respirators:

- **Uranium Contamination:** A P3 filter respirator should be used to protect against inhalation of radioactive dust particles (EN 143 standard).
- **Phosphorus or Chemical Contamination:** A full-face respirator with combined filters for gas, vapor, and particles should be used (EN 136 and EN 141 standards).
- **Extreme Contamination Zones:** In areas with severe contamination, a self-contained breathing apparatus (SCBA) is recommended to ensure maximum respiratory protection.
- **Escape Hoods:** Emergency escape hoods should be available for quick evacuation in case of respirator failure or sudden exposure.

Eye Protection

- **Safety Goggles:** Workers must wear safety goggles with indirect ventilation to protect eyes from airborne particles, chemical splashes, and potential exposure to hazardous dust (EN 166 standard).
- **Phosphorus Contamination:** Flame-resistant goggles should be worn in environments where phosphorus is present to mitigate the risk of fire-related injuries.

Hand Protection

- **Chemical-Resistant Gloves:** Workers should wear heavy-duty gloves that provide protection against chemicals, such as butyl or nitrile gloves (EN 374 standard). Double-gloving is recommended in high-risk areas.
- **Uranium Contamination:** Use gloves that provide protection against both radioactive particulates and chemical exposure (EN 388 for mechanical risks and EN 421 for radiation protection).
- **Phosphorus Contamination:** Flame-resistant gloves are required to mitigate the risk of burns or fire-related injuries (EN 407 standard).
- **Puncture-Proof Gloves:** Workers should wear gloves with puncture-resistant layers (EN 388 standard) to protect against sharp objects such as nails, glass, or metal shards commonly encountered in rubbles.
- **Extended Cuffs:** Gloves with extended cuffs should be used to provide full coverage and prevent rubble or contaminants from contacting the skin.

Foot Protection

Safety Boots: Boots should be chemical-resistant, slip-resistant, and provide protection against sharp objects. They must also meet the following criteria:

- **Uranium contamination:** Use radiation-protective footwear that prevents contact with contaminated surfaces (EN ISO 20345 for safety footwear and EN 421 for radiation protection).
- **Phosphorus contamination:** Boots should be flame-resistant or at least provide some protection against heat and flames (EN ISO 20345).

Hearing Protection

- **Ear Protection:** Depending on the environment, particularly where heavy machinery is used, whenever noise levels are suspected to exceed 85 decibels (dBA), hearing protection such as earplugs or earmuffs should be worn to protect workers from noise pollution (EN 352 standard).

Additional PPE for Hazardous Material Handling

- **Radiation Dosimeters:** Workers handling uranium-contaminated rubble should wear personal dosimeters to monitor radiation exposure (aligned with IAEA standards for radiation protection).
- **Flame-Resistant Outerwear:** When working in areas where phosphorus is present, all outer layers should be fire-retardant to protect against potential ignition.

Decontamination Procedures

- **Disposable PPE:** When possible, use disposable PPE that can be safely discarded after use in contaminated areas.
- **Decontamination Stations:** Ensure that all workers pass through decontamination stations upon exiting contaminated zones to remove any potential hazardous materials from their suits, boots, and gloves.
- **Waste Segregation:** Implement waste segregation protocols for contaminated PPE to ensure proper hazardous waste disposal.
- **Closure of decontamination station:** ensure the proper closure of the decontamination station when it is no longer needed, which also would include managing the secondary resulting contamination (wastewater).

Training and Fit Testing

- **Training:** All personnel must be trained in the correct use of PPE and the specific risks associated with handling contaminated rubble.
- **Fit Testing:** Fit testing is required for respiratory equipment to ensure a proper seal and adequate protection, particularly for respirators (EN 529 standard).

Table 1: Corresponding PPE items per type of contamination

PPE ITEM	Uranium Contamination	Phosphorus Contamination	Other Chemical Contamination
Protective suit	Category III, Type 6/5, EN 14126 (for radiation)	Flame-resistant suit (EN ISO 11612)	Chemical-resistant suit (EN 13034)
Respirators	P3 Filter (EN 143)	Full-face respirator with gas/vapor filters (EN 136)	Full-face respirator with combined filters (EN 136/141)
Eye Protection	Safety goggles (EN 166)	Flame-resistant goggles	Chemical splash goggles (EN 166)
Hand Protection	Radiation-protective gloves (EN 421, EN 388)	Flame-resistant gloves (EN 407)	Chemical-resistant gloves (EN 374)
Foot Protection	Safety boots (EN 20345, EN 421)	Flame-resistant boots	Chemical-resistant safety boots (EN 20345)
Hearing Protection	Earplugs/Earmuffs (EN 352)	Earplugs/Earmuffs (EN 352)	Earplugs/Earmuffs (EN 352)
Radiation Dosimeters	Required	Not applicable	Not applicable
High-Visibility PPE	Not applicable	Recommended for low-light environments (EN ISO 20471)	Recommended for low-light environments (EN ISO 20471)
Escape Hoods	Not applicable	Emergency escape hood (EN 403)	Emergency escape hood (EN 403)

Appendix 3: Relevant Local Legislation

There are several local legislations that govern directly or indirectly debris management. Below is a list of some of the main Legislations.

Table 2: Relevant local legistlations

Legislation Reference	Brief Description
Laws	
Law 444/2002	Assigns the ministry of Environment the responsibility of planning, monitoring and setting standards for treatment to reduce quantities of waste sent for disposal.
Law 80/2018	Sets principles for integrated solid waste management. provides framework for waste management (Hazardous and Non-Hazardous). Provides responsibilities for both central and local authorities in waste management.
Decrees	
Decree 118/1977	Assigns the responsibility of waste transportation to municipalities while the responsibility of waste disposal is assigned to Governorates. Assigns municipalities authority in establishing solid waste disposal facilities.
Decree 5605/2019	Related to sorting at source, furthermore, when it comes to CDW it requests from union of municipalities to establish CDW collection centers to serve the caza in which the union is located.
Decree 5606/2019	Governs management of hazardous waste/material.
Circulars	
MoE Circular 6/1 (5/12/2024)	Requests from Municipalities and Union of Municipalities, to assign locations that are environmentally damaged (quarry sites) as reception areas for debris and notify the Ministry of Environment.

VOLUME 3

QUARRY REHABILITATION

Context

Since 8 October 2023, Lebanon sustaining numerous airstrikes over a period of approximately 11 months; these attacks were primarily concentrated in the Governorates of South of Lebanon and Nabatieh, with occasional strikes in the Governorate of Baalbeck and Hermel. On 23 September 2024 an escalation of the conflict occurred with the expanded attacks on the Governorates of South Lebanon and Nabatieh, the governorates of Baalbeck and Hermel, and Bekaa, and in the following days reaching the southern suburbs of Beirut, with occasional strikes on Beirut city itself.

The intensified conflict, lasting from 23 September to 27 November 2024, resulted in the displacement of approximately 1.3 million people during this period. Although, most of the displaced population returned once the attacks halted. However, the level of destruction generated significant volumes of debris. Several estimates have been released although official figures have not been published.

The debris management approach endorsed by the United Nations (UN) through the UN Debris Task Force co-led by UNDP, UN-Habitat and UNOPS, is detailed in the Debris Management Framework (DMF) which aligns with international best practice for the management of debris waste. These Standard Operating Procedures (SOPs) are an extension of the DMF, providing more details on each of the specific areas of debris management.

Scope of the SOP

This Standard Operating Procedure (SOP) is a standalone document that complements two previous volumes (Volume 1 – Debris Pre-Processing Measures, and Volume 2 – Debris Processing), and addresses the debris final disposal as part of quarry rehabilitation. This SOP, through its three volumes, aims to incorporate sustainability principles by prioritizing waste reduction, recycling, reuse, and sustainable disposal. Circular economy strategies will be integrated to enhance resource efficiency and environmental preservation.

This document also refers to SOPs guidelines for Quarry Rehabilitation as part of the final disposal of generated debris, by the armed hostilities in Lebanon 2024. The SOPs are based on piloted interventions carried out prior to the escalation of the conflict.

These pilot projects were implemented in Akkar, Lebanon, as part of the Land Degradation Neutrality of Mountain Landscapes in Lebanon (LDN) project, which is funded by the Global Environment Facility (GEF) and is implemented in partnership with the Ministry of Environment (MoE) in Lebanon. The LDN project aims to achieve land degradation neutrality in Lebanon's mountain landscapes by rehabilitating degraded land and preventing further degradation. The LDN project began with pilot interventions to gain the necessary expertise and confidence, with the intention of scaling up these efforts after the project's completion.

This document summarizes the methodology used in the rehabilitation of the 2 quarry sites, from site selection to implementation, that can be used in a similar manner for the final disposal of debris generated from the conflict, throughout Lebanon.

This document also builds on previously piloted experiences and technical methodologies for quarry rehabilitation, developed to support the final disposal of debris through sustainable land rehabilitation practices.

The approaches outlined are informed by field-test ed interventions aimed at stabilizing abandoned quarries, promoting ecological recovery through native species replanting, and reducing environmental risks such as erosion, dust emissions, and surface water runoff. These interventions also highlight the potential for rehabilitated sites to deliver social and ecological benefits, including improved landscape integration and opportunities for recreational and educational use.

The rehabilitation methodology presented in this SOP provides a structured framework covering all phases from site selection to implementation, and is intended to guide debris-related rehabilitation activities in a variety of contexts, ensuring adaptability and scalability based on site-specific conditions

Methodology

Using debris as part of quarry rehabilitation should follow the principles of ecological rehabilitation. This is the process of assisting the recovery of ecosystems that have been degraded, damaged, or destroyed. An ecosystem is considered recovered and restored when it has sufficient biotic and abiotic resources to sustain its structural and functional integrity without continued external inputs.

The rehabilitation process should follow seven structured phases:

- Initial phase: Quarry suitability check and site selection.
- Phase 1: Baseline surveys.
- Phase 2: Objective definition and preliminary design.
- Phase 3: Environmental Impact Assessment (EIA).
- Phase 4: Rehabilitation permits.
- Phase 5: Implementation.
- Phase 6: Monitoring.

Phase 1: Baseline Surveys

The first phase involves the comprehensive collection of data to establish the physical, ecological, and social baseline of the site. This phase is foundational, shaping all subsequent steps. The timeline typically spans three to nine months, with biodiversity assessments requiring a minimum of three months, depending on site complexity and seasonality. A quarry suitability check is recommended before launching the full baseline, along with a topographic survey (including 3D mapping) to guide volume estimation and inform design.

1.1 Biodiversity Assessment:

This involves the collection of fauna and flora inventories to identify conservation priorities, critical habitats, and suitable species for rehabilitation. In accordance with IUCN guidance, this assessment should include:

- Fauna and flora composition, abundance, percent cover, diversity, and resilience of plant communities (including grazing impacts).
- Functional ecology and ecological connectivity.
- Habitat mapping and corridor identification.
- Bio-geographical and bio-climatic characteristics.
- Recommendations for native species selection (based on adaptability and availability).
- Preliminary species database for the site.
- Identification and potential rehabilitation of biological corridors and reservoirs.

In Mediterranean climates, biodiversity assessments are ideally conducted in Spring (February–April) and/or Fall (September–November) to cover species life cycles. Duration may be shortened if valid existing data is available.

1.2 Geology and Hydrology Assessments

These should include analysis of slope types and stability, erosion risk, surface and groundwater flows, and the potential impact on underground water. They must be supported by:

- Topographic survey.
- Soil geotechnical assessments (boreholes, sampling, and lab testing).

1.3 Social Assessment:

This assessment identifies key stakeholders, their roles, concerns, and potential benefits. Community input is critical in aligning the rehabilitation plan with local environmental, recreational, educational, and socio-economic needs.

1.4 Environmental Pressures Assessment

This includes identification of external threats such as fire risk, illegal dumping, invasive species, and urban encroachment. Mitigation measures should be proposed for each pressure identified.

Phase 2: Objective Definition and Preliminary Design

2.1 Rehabilitation Objective:

Objectives must be developed through a participatory process and should reflect baseline results. They may include:

- Landscape integration.
- Native vegetation restoration.
- Erosion control.
- Biodiversity enhancement.
- Biomass increase.
- Educational or research value.
- Long-term environmental, social, and economic risk reduction.
- Productive or recreational post-quarry land use.
- Long-term stability and safety of the site.

2.2 Preliminary design:

The design should address:

- Season of implementation.
- Ecological functionality.
- Site topography and context.
- Water availability.
- Plant and substrate selection.
- Cost and timeline considerations.
- Site shaping and regrading (to address erosion, slope failure, and water table contact).

Two main scenarios are possible:

Scenario 1: Backfilling using on-site excavation material (if suitable).

Scenario 2: Partial backfilling using debris or demolition waste (subject to quality and availability within a reasonable distance).

Phase 3: Environmental Impact Assessment (EIA)

In accordance with Decree 8633 (2012), the EIA should address pollution risks, long-term environmental effects, and cumulative impacts.

The EIA process includes:

- Review of relevant legal/policy frameworks.
- Public participation and consultation with stakeholders.
- Development of a Scoping Report identifying key issues, alternatives, methods, and mitigation measures.

The Scoping Report must be approved by MoE before proceeding to the full EIA report.

Once the EIA is approved and comments integrated, the detailed design and bill of quantities should be finalized.

Phase 4. Rehabilitation permits

Permits must be obtained through the National Council for Quarries and Crushers, following applicable procedures. The application file should include:

- Detailed design.
- Approved EIA.
- Ownership documents (e.g., ifedi 3iqariet).
- Implementation plan.

Permitting should not proceed in the absence of clear legal ownership to avoid delays or disputes.

Phase 5: Implementation

Rehabilitation must follow the approved design, EIA, and permits.

Activities may include:

- Reforestation.
- Regrading and slope stabilization.
- Drainage or erosion control.

The implementation period should remain flexible, based on design complexity and seasonality.

Phase 6: Monitoring

Monitoring is guided by a Monitoring & Evaluation (M&E) Plan developed during the design phase. It should assess:

- Landscape evolution.
- Ecosystem functionality.
- Species establishment.
- Slope stability.
- Community feedback.

The M&E Plan should cover a 2–3 year period post-rehabilitation and includes:

- Indicators (vegetation cover, species richness, erosion, slope integrity).
- Tools (drone surveys, photographs, field checklists).
- Clear assignment of responsibilities.
- Opportunities for community involvement.
- Alignment with national restoration or Land Degradation Neutrality (LDN) frameworks Conclusion.

Conclusion

This Standard Operating Procedure (SOP) offers a comprehensive framework for the rehabilitation of exhausted or abandoned quarries using debris, in line with principles of ecological restoration, risk mitigation, and land use sustainability. Through a structured sequence of phases—from site selection and baseline surveys to implementation and long-term monitoring—the SOP enables a transparent, adaptive, and technically sound process that can be applied across diverse geographies and institutional contexts.

This SOP supports national efforts toward land degradation neutrality and responsible post-conflict recovery. It is intended to guide authorities, private operators, and implementing partners in achieving ecologically functional, socially beneficial, and legally compliant quarry rehabilitation outcomes.

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