



Iraq

Environmental Management Guidelines for Debris Recycling Sites

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Glossary

Debris	Materials arising from conflict and disaster damaged buildings and structures including structural elements (concrete, bricks etc.), furnishings, personal belongings and other wastes. Debris is different from normal construction and demolition waste due to potential presence of unexploded ordnance and corpses in the debris.
Debris Recycling	The process of treating debris to produce a new material for use in construction purposes, i.e. as gravel.
Disposal	The safe and regulatory compliant final removal of a waste, i.e. at a controlled landfill.
Hazardous Waste	Wastes that are harmful to humans and the environment thus requiring special procedures to prevent any negative impacts on human health and the environment.
Inert Debris	Debris materials that do not undergo any biological, chemical, physical, or radiological transformation, for example concrete, bricks, tiles etc.
PM₁₀	Organic particles, or particulate matter, as in dust or smoke, measuring between 2.5 and 10 microns in diameter.
PM_{2.5}	Air pollutants with a diameter of 2.5 microns or less, small enough to penetrate even the smallest human respiratory airways. These particles generally come from activities that burn fossil fuels, such as traffic, smelting, metal processing and dust storms.
Waste	For the purpose of this document, waste is deemed to be all materials in the debris which are not reusable or recyclable and thus are for disposal.

1. Introduction

In collaboration with the Iraq Ministry of Health and Environment, this document has been developed by UN Environment Programme (UNEP) for the purpose of supporting environmental and safety management at debris recycling sites in Iraq.

Debris recycling is a key phase of the rehabilitation and reconstruction works in conflict-affected areas in Iraq, with significant environmental benefits including:

1. Debris recycling leads to reduced quantities requiring disposal;
2. Savings in energy and emissions from reduced transport of waste debris for disposal and subsequent reduced transport of quarry materials into cities for reconstruction; and
3. Reducing the need to quarry natural raw materials for the reconstruction works since recycled debris can substitute these raw materials.

While these guidelines were initiated to support post-conflict reconstruction, they are also meant to assist Iraq in pursuing a sustainable construction pathway. Specifically, the longer-term policy aims to promote adoption of a circular economy approach integrating recycling and reuse of construction and demolition waste (CDW). Circular construction has the advantage of meeting several environmental goals including minimising waste, diverting CDW from landfills, reducing greenhouse gas emissions and limiting resource depletion. It should also help create innovative business opportunities and efficient methods of production and consumption.

Ideally, debris recycling sites are to be located close to the source of debris thus reducing transport requirements, leading to debris recycling sites being established in or near to towns and cities in Iraq.

As the activities associated with debris recycling may have potential negative impacts on the public and surrounding environment, the proper management of debris recycling sites is therefore key to minimising unwanted consequences. This includes the health and safety of the persons working at the debris recycling sites as well as the neighbouring public.

Regulatory compliance of debris recycling sites is a pre-requisite for installation and start-up of activities. Environmental approval before commencement of site establishment is to be obtained in accordance with Article (11) of the Protection and Improvement of the Environment Law (2009), which stipulates "Entities with environment affecting activities should be prevented from working without obtaining the approval of the Ministry".

In addition to these regulatory obligations and depending on the scale of the debris recycling project, there may also be a requirement to integrate Emergency Management, Environmental Management and Waste Management objectives and activities within the debris recycling operations planning.

2. Key Success Criteria

The following key success criteria for the safe and environmentally sound management of debris recycling sites are applicable:

- Ensure the debris recycling works do not impact negatively on the neighbouring residents and other human activities;
- Establish safe systems of work to protect the debris recycling operatives, staff and visitors;
- Ensure that the debris recycling works do not lead to a negative impact on the surrounding flora, fauna and environment including groundwater; and,
- Facilitate debris recycling to occur close to the source of the debris to reduce transport costs, emissions and truck movements.



Figure 1: Small scale crushing of debris by the International Organization for Migration (IOM) at the Mazen Debris Recycling Pilot Site in Mosul

3. Debris Recycling Activities

A typical debris recycling site will have the following activities:

1. Controlled receipt and unloading of debris to ensure the debris does not include any non-recyclable wastes;
2. Sorting of the debris into various types of recyclable debris, either by manual and/or mechanical means including conveyor belts and screens;
3. Crushing and screening of the debris into a recycled debris material such as gravel; and,
4. Loading of recycled debris into trucks for export from the site.



Figure 2: Typical debris recycling operation with a debris crusher (yellow) and a screening unit (green)



Figure 3: Manual sorting of debris in Iraq with removal of non-recyclables such as plastic, furnishings etc

4. Debris Hazards

It is recognised that debris, especially from the conflict-affected areas of Iraq, can contain a range of wastes, materials and substances that are harmful to humans, flora, fauna and the surrounding environment. Operational procedures are to be developed and adopted for the debris recycling site to take into such risks. These wastes, materials and substances include:

- Explosive devices, unexploded ordnance;
- Hazardous wastes such as oils, lubricants and solvents from industrial sites;
- Corpses;
- Chemicals and pesticides, including chemical warfare agents such as Yperite (mustard gas) and explosive substances;
- Heavy metals from the structural elements of the damaged building; and,
- Medical wastes from hospitals or health centres.

Where there may be a reasonable potential for debris to contain hazardous contaminants, i.e. if the source of debris raises concern, then samples of the debris can be tested at appropriate laboratories for heavy metals, chemicals and other contaminants. Note that contamination will have both a negative impact on the health and safety of the persons handling the debris as well as potential detrimental impact on the end-use of the recycled debris.

For potential depleted uranium contamination of debris, the Iraqi Protection from Radiation Centre' (PRC) of the Ministry Health and Environment is the responsible monitoring agency on this issue. The PRC has not found any evidence of DU contamination based on its surveys of areas retaken from ISII. Furthermore, there are no reports or evidence of use of DU in the ISIL conflict.



Figure 4: Unexploded Ordnance with debris in Iraq

5. Debris Recycling Site Selection

Site Selection

In selecting debris recycling sites, there are some key aspects to take into consideration. The optimal site selection is typically a trade-off between proximity to the source of debris (reduced transport emissions, cost and increased safety from reduced truck movements on the road), and location of the debris recycling site. Key issues to consider include:

Ownership:

- Public (Preferred)
- Private (To be rented by the relevant Govt. department or agency)

If Ownership is Private:

- Ensure the rental agreement is of sufficient duration
- Ensure can amend / extend rental agreements
- Ensure end state for the site on completion of works is defined, i.e. landscape restoration agreement

Size:

Site needs to be large enough to accommodate the planned debris storage and recycling operations method.

Different types of sites: within city between be 1 – 5 acres, and out of city >5 acres. (1 acre equal to approximately 1.6 donums).

Location, What to Avoid:

- Water courses
- Public Water Supplies
- Areas of ecological importance
- Historic Sites

Locations needing mitigation:

Sensitive surrounding land uses may need additional environmental mitigation measures to reduce risk of negative impacts. These include residential areas, schools, mosques, churches, etc.

When siting near such land uses the prevailing winds are to be taken into account for dust and odour management.

Location, What to Look For:

- Good access to site for trucking
- Good transportation from debris removal sites to the recycling site (artery roads preferably not past sensitive receptors such as schools, hospitals etc.)
- Open flat topography
- Ease of establishment of site security with fencing etc.

Site Documentation

Once a site has been selected and agreed, it may be necessary to gather the following documentation for the site as a baseline.

Before Activities Begin:

- Aerial video/photograph (including drone footage)
- Ground video/photograph
- Note any important features? Structures, fences, culverts, landscaping, etc.
- Random soil sampling if previously used for industrial purposes
- Water samples from existing wells

Site Audits / Inspections:

Carry out regular (quarterly) site audit and / or inspection to assess compliance with approved plans, administrative codes, statutes, and land-use plans as well as to evaluate the performance of monitoring, engineering, and operational systems.

Audits are announced, scheduled inspections and are intended to complement other routine reviews and observations.

6. Environmental Impacts

The following potential negative environmental impacts can arise from the debris recycling activities where such activities are to be managed in an appropriate way to reduce such potential negative impacts:

Noise

Noise is emitted from several activities at a debris recycling site including the loading and offloading of the debris from and into trucks, the operation of wheel loaders around the site and the operation of the crushing and screening plants.

Noise can have a detrimental impact on the quality of life for neighbouring activities and residents where high levels of noise can have a health impact on humans and animals.

Dust

Dust can be created from the debris recycling activities where debris is handled, loaded, offloaded and physically crushed and screened. Dust is also created from road movements of trucks and vehicles.

The generation of dust may impact the welfare and amenity of the surrounding areas, and cause health problems to workers at the site and surrounding land users if transported off site.

For the measurement of dust and in addition to visual observation, it is applicable to use hand-held dust meters that give automatic readings of dust particles (PM_{2.5}, PM₁₀). These should be used within and outside the site boundary downwind of the wind direction at the time of sampling, and should be conducted at least twice daily.

When wind conditions and/or dry weather conditions lead to potential for more than usual dust generation, the frequency of dust sampling can be increased to hourly. For more detailed air quality monitoring of long-term recycling sites, a fixed dust monitoring station may be installed at the recycling centre for continuous readings.

As a general standard, any documented dust levels above PM₁₀ concentrations of 250 µg/m³ averaged over a 15-minute period should trigger a cessation of the dust emitting activity within the site and opportunity to re-address the activity to find ways of reducing the dust generation.

Odour

Odour may be generated from the storage of odorous putrescible wastes at the site, and the release of any chemicals of hazardous wastes within the debris as well as odour from corpses. Significant odour emissions may reduce amenity values for site workers and surrounding land users as well as attracting vermin. As no putrescible wastes are accepted on site, the likelihood for odour emissions is considered to be negligible from the debris except where the potential for chemicals, hazardous wastes or corpses is possible.

Stormwater

During heavy rain season stormwater can flood the site if not managed properly and enter into neighbouring sites if not managed properly.

Traffic

A typical debris recycling site will involve the receipt and dispatch of debris from the site, typically by trucks and other vehicles. Such vehicles will be entering and exiting the site from the public road and thus can cause congestion at peak times.

Litter

Litter may be generated at the site as a result of the movement of waste and poor housekeeping practices, particularly during windy conditions. As well as reducing visual amenity, litter can attract vermin to the site and may affect surrounding land uses if allowed to migrate off site.

Vermin

Vermin such as rats, mice, birds and insects may be attracted to waste management facilities. If uncontrolled, vermin can present a health risk to site workers and surrounding land users. As the site does not accept any food waste, the potential for vermin to be attracted is low. Vehicle movements and use of machinery are also likely to deter vermin from the site. Only inert debris materials will be accepted.

Chemical contamination

Since the sources of debris will include commercial and industrial premises, the likelihood of chemicals and pesticides being present in debris is high. This includes hazardous wastes such as oils, lubricants and solvents. Procedures are to be in place that enable the site staff and operatives to identify such chemical contamination and take the necessary precautionary steps to safely remove this contamination and enable the controlled disposal of such hazardous wastes in regulatory compliance.

In the event that the contamination risk by chemical warfare agents such as mustard gas and other toxic industrial chemicals is considered to be high, specialised chemical monitoring detectors (portable and fixed) may be used to provide early warning. In such situations, it is advised to contact the Chemical, biological, radiological and nuclear (CBRN) programme of the Ministry of Interior.

Radioactive Sources

In the event that there is good reason to suspect radiation contamination, hand-held Geiger counters can be used for the detection, measurement and monitoring of broad spectrum, low energy radionuclides (alpha, beta, Gamma, and X-Ray). Radiological surveys should be conducted by the Protection from Radiation Center of the Ministry of Health and Environment.

7. Environmental Mitigation Measures

The following typical measures are taken at debris recycling sites to minimise the potential negative impacts:

Noise
<ul style="list-style-type: none"> Debris receipt and the operation of equipment and machinery on site is restricted to operational hours only
<ul style="list-style-type: none"> Vehicles are restricted to a maximum speed of 5 km per hour (km/h) at the site
<ul style="list-style-type: none"> Noise reducing workplace procedures are adopted such as tipping waste onto the tipping floor and into storage areas slowly and from the lowest height possible
<ul style="list-style-type: none"> The use of reverse beepers as a safety strategy can be replaced with alternative visual safety devices (where practical and appropriate)
<ul style="list-style-type: none"> Vegetation screens can be developed and maintained, where appropriate, surrounding the site; and
<ul style="list-style-type: none"> All equipment and machinery is maintained in good working condition.
Dust
<ul style="list-style-type: none"> Works to be located at site take into account prevailing wind direction and distance to neighbouring activities
<ul style="list-style-type: none"> Apply sprinklers to the crushers and screening units over the hopper, end of the conveyor and other discharge points
<ul style="list-style-type: none"> Manual spray system within the debris offloading and recycled debris loading points
<ul style="list-style-type: none"> Vehicles restricted to a maximum speed of 5 km/h at the site
<ul style="list-style-type: none"> Site operations stopped during periods of high winds
<ul style="list-style-type: none"> Vehicles to enter and exit the site via sealed access road
<ul style="list-style-type: none"> The site to be cleaned of dust, dirt and sand on a daily basis
<ul style="list-style-type: none"> Undesired materials such as non-recyclable inert materials, timber, metal and plastics and small volumes of green waste are stored in designated hardstand areas prior to being transported off site for recycling or disposal
<ul style="list-style-type: none"> Vegetation screens can be developed and maintained, where appropriate, surrounding the site
<ul style="list-style-type: none"> Water trucks/bowsers are utilised on site as required (mainly on internal roads)
<ul style="list-style-type: none"> Materials can be dampened prior to processing (crushing and screening).
Odour
<ul style="list-style-type: none"> Only inert debris materials to be accepted. All loads to be inspected at the weighbridge from the viewing platform
<ul style="list-style-type: none"> All loads to be inspected when unloading
<ul style="list-style-type: none"> Undesired materials to be stored in designated hardstand areas prior to being transported off site for recycling or disposal

<ul style="list-style-type: none"> • If any odorous materials are found, including chemicals, hazardous wastes or corpses, these are to be scheduled to be removed from the site as soon as practicable
Stormwater
<ul style="list-style-type: none"> • Stormwater to be collected in the current drainage system and discharged via on site soak wells. Culverts and other structures to manage stormwater to be constructed and maintained, as needed.
Traffic
<ul style="list-style-type: none"> • A maximum speed of 5 km/h can be applied to all vehicles on site and clearly displayed at the entrance to the site
<ul style="list-style-type: none"> • All vehicles to be maintained in good working condition
<ul style="list-style-type: none"> • All vehicles to be required to comply with the traffic management system at the site.
Litter
<ul style="list-style-type: none"> • Any litter generated around the site and along fence lines to be collected on a daily basis as part of routine housekeeping procedures.
Vermin
<ul style="list-style-type: none"> • All loads to be inspected at the weighbridge from the viewing platform
<ul style="list-style-type: none"> • All loads to be inspected when unloading
<ul style="list-style-type: none"> • Undesired materials will be stored in designated hardstand areas prior to being transported off site for recycling or disposal
Chemical Contamination
<ul style="list-style-type: none"> • Trained controllers for the identification of debris with potential for chemical contamination including at viewing platform and unloading
<ul style="list-style-type: none"> • Clear instructions for staff and operatives to identify and safely separate chemical contaminants
<ul style="list-style-type: none"> • Onsite facilities for the safe and controlled storage of chemical contaminants and hazardous wastes until dispatch for regulatory compliant disposal
<ul style="list-style-type: none"> • Agreements in place for the disposal of chemical contaminants and hazardous wastes that are approved by the relevant Municipality and regularly audited for regulatory compliance

8. Health and Safety

Handling debris is a high-risk activity due to the potential contents of the debris ranging from asbestos, syringes and other healthcare wastes, sharp items such as reinforcement bars and concrete/brick blocks as well as the debris itself if in large quantities (weight). In addition, the operation of plant and machinery for the handling and processing of the debris has inherent risks.

The handling and processing of the debris can thus lead to significant Health and Safety (H&S) incidents which are to be mitigated primarily through:

- Safe systems of work whereby the site operations are to include Health & Safety Plans focussing on minimising risk to the working personnel at site; and,
- Personal Protection Equipment (PPE) which is to be determined based on the identified risks and worn by all operatives in the different work areas of the debris recycling site.

The process of developing safe systems of work incorporates the identification of alternative means of work (i.e. lifting debris onto a truck) which encompass less risks. Hence, the importance of defining mitigation measures for H&S risk from the start. If the activity is absolutely necessary and involves human interface, then PPE will be required. Generally, the more mechanised the work approach, the less risk to human health.

Typical PPE includes adapted footwear (hard boots to prevent spikes entering the sole and minimise the risk of harm from heavy materials dropping onto feet), gloves, overalls and masks.

The site layout of the recycling site is to take into account H&S aspects. For example, one-way traffic systems and limited cross over between vehicles and humans at site. In addition, people working with the debris should have access to proper and clean changing and washing facilities for use during and after the debris handling and processing works.

During the processing works, the site operatives for the crushing and screening activities are to wear appropriate clothing that does not get caught in the machinery. Examples of protective clothing for crushing and screening activities are a hard hat, safety shoes, safety glasses, a well-fitting overall, ear-protectors and industrial gloves.

All plant and machinery are to have suitable mounted machinery guards to prevent accidents from improper use.

At the debris recycling sites there are to be requisite first aid provisions, a trained first aider and clear instructions for how to call the emergency services as well as guidance on reaching the nearest hospital.

The following table provides an overview of the expected types of PPE required at typical debris recycling sites.

Threat	Pathway	Effects	Measures
Chemicals in the Debris (Household cleaning products)	Direct contact	Skin: rashes, eczema, chemical burns	Gloves, overalls, washing facilities, minimize handling. For dangerous chemical agents, gloves should be durable as well as impermeable.
	Aerosols	Eyes: irritation, conjunctivitis, temporary blindness, permanent damage	Protective goggles
	Inhalation	Respiratory system: tracheitis, bronchitis, asthma	Mask. In case of suspected chemical warfare agents and toxic industrial chemicals, full protective mask covering eyes, face and respiratory system, including activated charcoal filter, should be used.
Biological (human / contaminated)	Direct contact	Diarrhoeal disease, Hepatitis A, Intestinal parasites, Polio, Typhoid fever, Cholera	Gloves, washing facilities, masks, minimize handling, vaccination
Biological (Vectors: vermin, scavengers, stray animals)	Direct contact (bites, including fleas & ticks)	Leptospirosis, rabies, Typhoid fever, Lyme disease, Tularemia (rabbit fever), west Nile virus	Gloves, overalls, vaccination
	Direct contact (faeces)	Leptospirosis, polio, Rabies, brucellosis, hantavirus, Echinococcosis	Gloves, minimize handling, washing facilities
Physical (sharps)	Direct contact (puncture & scratches)	Hepatitis B, C & E; Tetanus, HIV, TB, Diphtheria, Toxoplasmosis	Gloves, overalls, minimize handling, vaccination
Physical (bulky heavy waste)	Lifting	Back (vertebral column): Chronic back pain, permanent back injuries (herniated disk)	Container size and shape, ramps, proper lifting techniques, belt/back support, lifting machinery
Environmental (Transport vehicle)	Impact (load fall/unloading)	Limbs, head, torso: sprains, fractures, other traumas (workers/bystanders)	Helmet, safety boots, proper loading (balanced/not excessive)
	Litter and particulate	Negative visual impact and population perception	Tarpaulin over load, lower travelling speed
	Impact (car crash/car hit)	Physical and psychological traumas	Use of safety belts, defensive driving, appropriate speed
	Impact (manoeuvring / maintenance)	Physical and psychological traumas	Switch off vehicle before maintenance, safe manoeuvring/pedestrian awareness

Table 1: Personal Protection Equipment for typical debris handling operations

9. Regulatory requirements

In addition to the requirements presented in these guidelines, the Ministry of Health and Environment may require debris recycling sites – especially medium to long-term operations (i.e. more than 3 years) and those operating close to environmentally sensitive areas - in Iraq to have the following site management aspects incorporated into the site operations planning:

Emergency Management

Procedures in place for actions to be taken by the site management and operatives in the event of an incident such as detonation of Unexploded Ordnance, flooding or fire.

Environmental Management

Procedures in place for the site which seek to minimise the impact of the site operations on the local environment including noise, dust, emissions and water management. This plan should also include mitigation against climate impacts such as flooding and storm weather.

Due consideration should also be given to site decommissioning and return to a sound environmental condition for future uses.

Waste Management

Systems in place for the receipt, identification, documentation, handling, processing and treatment with subsequent dispatch from site for onward reuse, recycling or disposal of all waste and debris received to the site. This should include actions to be taken when unacceptable waste is received and safe storage of waste and debris whilst held at the site.

10. Debris Recycling Examples

Recycling debris in urban areas is common practice around the world as long as proper environmental management is implemented.



Figure 5:Crushing and screening debris in Gjakova, Kosovo (2001)



Figure 6:Urban crushing of demolition waste in the UK

Note proximity to residential areas provided that appropriate mitigation measures are implemented.