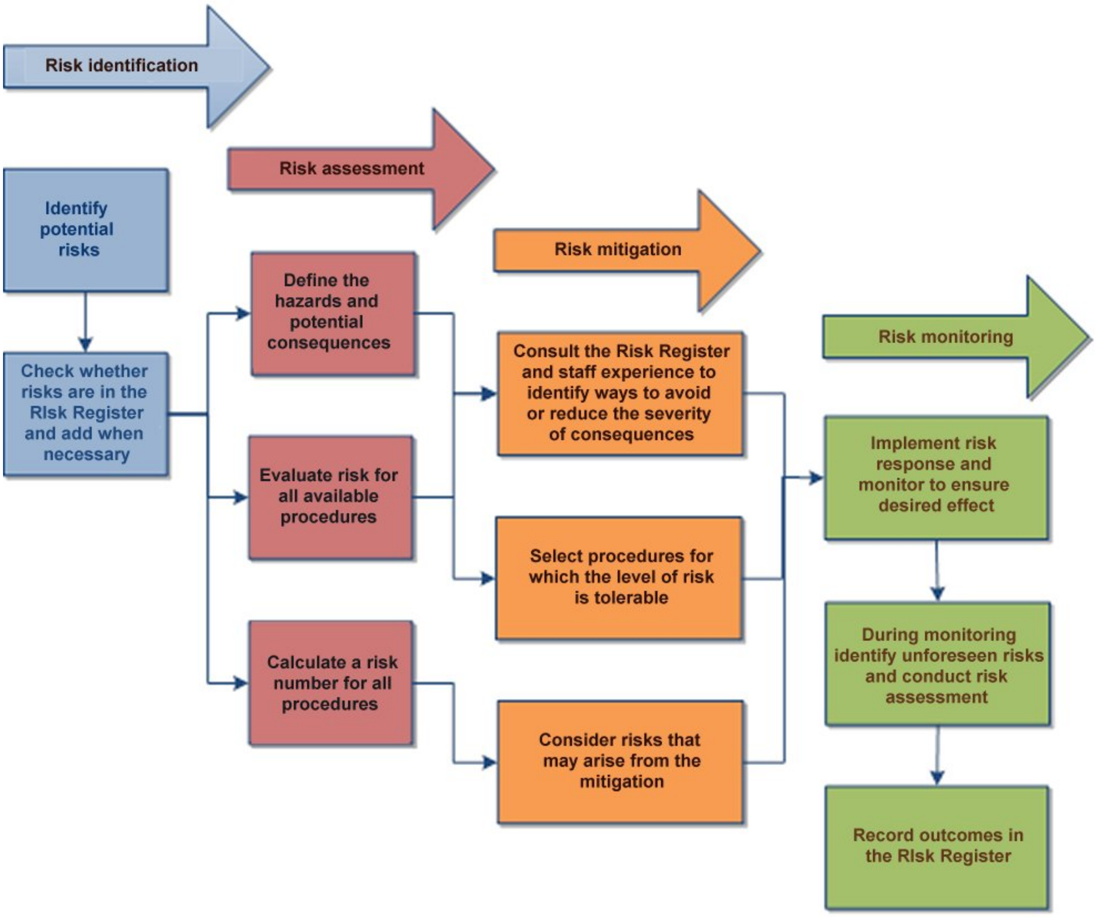
HMA Global SOPs 2018

CHAPTER 14: RISK MANAGEMENT

Release date: July 2018



Risk management is an essential part of Quality Management systems in every professional organisation. Critical risks are related to the failure to achieve the primary goals of the organisation, which may be expressly stated or implied in a mission statement or articles of association.

This Chapter describes risk management activities in HMA programmes. The risks to be managed may threaten the programme, individuals employed in the programme, or persons affected by its activities. The management of general programme organisational risks introduced here may be augmented or replaced by another organisational risk management system at the discretion of senior management. The detailed Task Risk Assessment (TRA) procedures described here must be followed when identifying and managing field specific risks during land release activities. The TRA may be augmented but should not be replaced.

CHAPTER 14: RISK MANAGEMENT IN HMA

A version of these SOPs has been available since 2007. This Chapter was not included in those versions released prior to 2018. Definitions that are necessary to understand this SOP are included at the start of the Chapter.

Contents

1. Glossary

The terms defined below are listed in alphabetical order. Terms not used in this SOP may be included for clarity. A full Glossary of terms used throughout the Global SOPs is included in the introductory Chapter.

Accident (Demining accident): following ordinary use of the term, an HMA 'accident' is any damaging or injurious event that occurs during working hours. This includes road traffic accidents and other events that give rise to injury which do not involve explosive hazards. Whenever an accident involving explosive hazards occurs (whether injurious or not), a detailed and objective accident report must be compiled and shared. Demining accident reports must be appended to the Field Risk Register and the appropriate risk mitigation strategies recorded. See also the entry for 'Incident (demining incident)'.

Clear (Presumed Clear): when applied to land, the word 'Clear' is used to describe land where there is no evidence of there being any explosive hazards (No Threat Evidence, NTE). When this is a result of the explosive hazards having been removed/destroyed during Search & Clearance, the area must be described as having been 'Cleared'. When land has been released by area Reduction, Verification or Cancellation, it has not been 'Cleared' but can be 'Presumed Clear' because there is no evidence of it being likely to be contaminated with explosive hazards (No Threat Evidence, NTE). The distinction between the use of 'Presumed Clear' and 'Cleared' is important because it can be critical in cases of litigation.

Clearance: 'clearance' is the removal or destruction of explosive hazards. Most in the industry describe what they do as 'clearance'. In fact what most field people are doing most of the time is preparing ground and searching. If there are no explosive hazards there, there is nothing to be 'cleared' so clearance cannot be happening. In these SOPs, the activity of searching for and removing or destroying explosive hazards is referred to as Search & Clearance despite the fact that, at some times, no hazards will be found and no 'clearance' will be required.

Cleared (land): 'cleared land' is a defined and mapped area that has been formally searched to a required depth and on which all explosive hazards have been removed or destroyed. An area can only be declared 'Cleared' after it has been subjected to disciplined Search & Clearance procedures that ensure the discovery and removal of <u>all</u> explosive hazards to a specified depth over the entire area. That depth must be determined during the Task Assessment and should be varied if devices are discovered at greater depths as work at the task progresses. If the depth that can be reliably searched using any one demining procedure is less than the requirement, additional search procedures must be used to gain confidence that thorough Search & Clearance to the required depth has been achieved before the area can be declared 'Cleared'. Following Quality Management principles in pursuit of efficient land release, if no explosive hazards are found, an investigation should be made into why the task documentation indicated that the area was contaminated with explosive hazards when it was not.

Explosive hazard: the term **'**explosive hazard' is used to describe mines and ordnance whether fuzed, fired or otherwise, and all explosive devices whether mass-produced or improvised. It also covers hazardous parts of these devices, including detonators, propellants and pyrotechnics. Following the usage in international treaties and conventions, the IMAS distinguish between 'mines', 'submunitions' and 'Explosive Remnants of War' (ERW) and treats them separately. This is confusing because, in normal language, 'mines' and 'submunitions' are also 'ERW'. Rather than trying to reclaim the commonsense meaning of ERW, the term 'explosive hazard' is used in these SOPs.

Field Risk Management: 'Field Risk Management' is concerned to identify, apply and complete the demining procedures without risk that explosive hazards will be left behind and with no more than a tolerable risk that staff will suffer explosive related injury.

Incident (Demining incident): avoiding the confusion between 'accident' and 'incident' apparent in the IMAS, in these SOPs a 'demining incident' is the discovery of one or more explosive hazard(s) on land that has been declared 'Cleared' or 'Presumed Clear' and released to the end-users as part of land release. The rigorous and honest investigation of demining incidents is necessary to ensure that errors are identified and corrected in pursuit of the primary goal of HMA. Demining incident reports must be appended to the Field Risk Register and the appropriate risk mitigation strategies recorded. See also the entry for 'Accident (demining accident)'.

Procedure(s), demining procedure(s): 'demining procedures' are activities conducted on land that may be contaminated with explosive hazards as part of preparing it for land release. Searching with metal-detectors or MDDs are demining procedures. Cutting undergrowth or ground processing with a demining machine are also demining procedures. One or more procedure can be applied to process the same ground to give confidence that the area can be released. Not all procedures, or combinations of procedures, constitute full Search & Clearance and so guarantee that no explosive hazards remain to the required depth in the area. This is not important when there is found to be No Threat Evidence in an area and it can be reliably 'Presumed Clear'.

Releasing land: land that is designated a task area may only be 'released' after either being declared 'Cleared' or 'Presumed Clear'. An entire task, or parts of the task area, can be released as Searched & Cleared, 'Reduced', 'Verified', or 'Cancelled' (see Chapter 3 for detailed explanations of these terms).

1. Land that is Searched & Cleared of all explosive hazards to a known depth is declared 'Cleared'.
2. Land that is 'Reduced' by processes that result in confidence that thorough 'Search & Clearance' is not necessary because there is No Threat Evidence (NTE) in the area can be declared 'Presumed Clear'.
3. Land that is 'Verified' as having NTE in the area can be declared 'Presumed Clear'.
4. Land that is 'Cancelled' as having NTE in the area can be declared 'Presumed Clear'.

Safety distance: the 'safety distance' is the distance at which <u>all</u> staff must be from a <u>deliberate detonation</u> in order to avoid injury. This is also the distance at which staff must be from a demining procedure that may predictably detonate some devices (such as processing the ground surface using a machine). See also the entry for 'working distances'.

Risk Register: a 'Risk Register' is a record of identified risks and the strategies adopted to manage them by reducing them (risk mitigation) or by avoiding them. Derived from as broad an evidence base as possible, it informs risk management decisions and allows experience to be shared and retained when staff move on. Two registers should be kept, a 'Programme Risk Register' and a 'Field Risk Register'.

Search & Clearance (Searched & Cleared): Search & Clearance refers to the disciplined use of demining procedures that are reliably able to locate all anticipated explosive hazards to a specified depth beneath the ground surface and the removal/destruction of those hazards over an entire recorded area. Only areas that have been Searched & Cleared can be released as 'Cleared'.

Task (demining task): a 'task' is a specified area of land on which a demining organisation must conduct activities detailed in a Task Release Plan in order to declare the area 'Cleared' or 'Presumed Clear' in preparation for land release.

Task Risk Assessment (TRA): a 'Task Risk Assessment' is a process designed to evaluate and manage risk before and during field tasks. A TRA takes account of all available information about conditions in the task area, the hazards present and the demining procedures that are available to be used. As work at the task progresses and more information becomes available, the TRA must be revised so that the work is always conducted in a manner that minimises the main risks during HMA field activities. The main risks are the risk of leaving explosive hazards in areas that will be released (demining incidents) and the risk of demining staff suffering explosive related injury (demining accidents).

Tolerable Risk: a 'tolerable risk' is the risk remaining after having taken all reasonable measures to avoid the risk event and/or to minimise its undesirable consequences. The International Standards Organisation (ISO) (and the IMAS) define 'tolerable risk' as "risk which is accepted in a given context based on current values of society". Every industry is intended to interpret that definition appropriately in their own working context. It would be inappropriate to adopt the high-risk mindset that may prevail in a post-conflict context because the current humanitarian values in peaceful and secure societies are the values of HMA and of those paying for the work. These are also the values that will be used to define what is 'tolerable' during any litigation that may follow accidents or incidents.

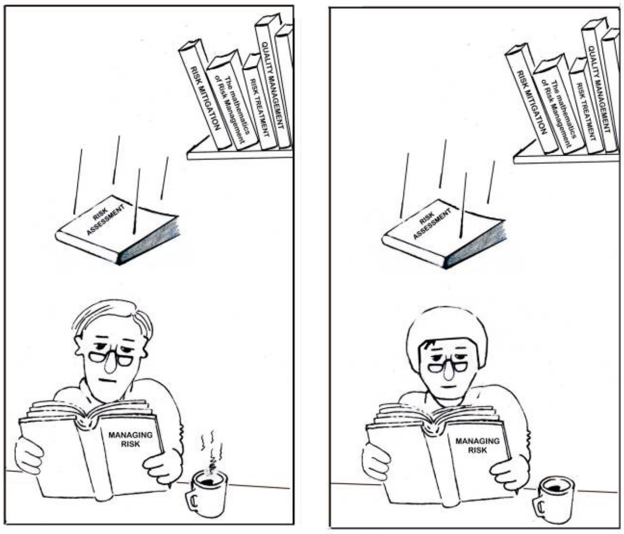
Working distance: the working distance should make it unlikely that more than one person will be injured in a demining accident. Working distances can generally be shorter than safety distances because there are no deliberate detonations occurring and the risk of an accidental detonation occurring should be very low. Working distances that are shorter than ‘safety distances’ can increase safety during Search & Clearance by improving the ease of supervision which ensures that procedures are conducted correctly and risks are appropriately managed. See also the entry for ‘safety distances’.

1.1 Should, Must, and Shall

Throughout these SOPs the distinction between the terms ‘should’ and ‘shall’ that is used by the International Standards Organisation (ISO) and in the International Mine Action Standards (IMAS) is adopted.

When ‘shall’ or ‘must’ is used, everyone working to these SOPs must comply with the requirements as they are written. No variation is permitted.

When ‘should’ is used, everyone working to these SOPs must follow the requirements unless they have a reason to vary them that has been approved by the senior staff with operational responsibility. Variations must be recorded in writing in the Task Release Plan and the person(s) making the variation must be identified.



First rule of Risk Management:
<u>avoidable risks should be avoided.</u>

Reducing the impact of a risk with PPE only makes sense after every practical way to avoid the risk has been explored.

2. Introduction

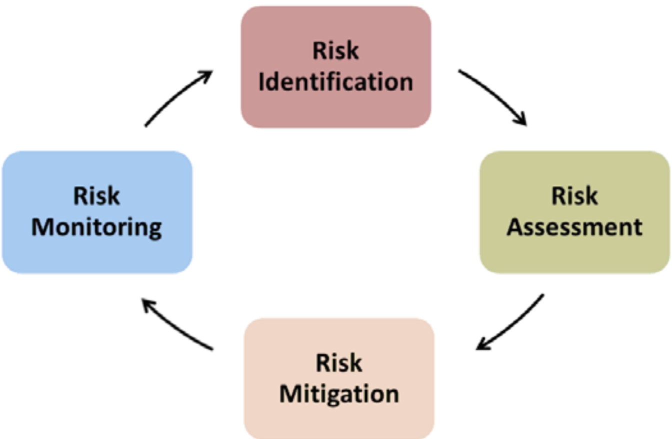
Risk management is a systematic process intended to identify programme risks, quantify and evaluate those risks and then manage those risks appropriately. Risk management is not always about avoiding or reducing risk because it is recognised that it is not possible to avoid all risk and the level of risk may already be 'tolerable'.

The advantages of conducting risk management procedures that ensure that all predictable risks have been identified and either avoided or minimised include:

- execution schedules will be more flexible and should be more reliable;
- start up can be faster and implementation uninterrupted when all the appropriate procedures and tools have been identified in advance; and
- avoiding the consequences of risks both controls costs and protects the organisation from undesirable consequences.

2.1 The risk management cycle

There are four steps to managing risk in an iterative cycle that is repeated as new risks are identified throughout the activities conducted by the programme.



1. Risk identification is the process of determining which risks might affect any aspect of the work. This is achieved using staff experience and all available data resources including risk registers. The risks are identified and written down without imposing an order of their probable occurrence or the severity of their impact should they occur.
2. Risk assessment/analysis involves a semi-quantitative process that estimates the probability of occurrence for each identified risk and the probable severity of the consequences should the risk event occur.
3. Risk mitigation and avoidance involves identifying possible responses and calculating the effect that varied responses could have on either avoiding a risk or mitigating the possible consequences of it.
4. Risk monitoring is the collection and analysis of data about the measures taken to manage risks. The timely identification of inadequate mitigation measures or measures that inadvertently introduce new risks is a safety priority. The recording of the results (positive or negative) of risk mitigation measures in the appropriate risk register provides a documented record of responsible risk management and also a permanent record that can inform future risk management endeavours.

3. Risk management in Humanitarian Mine Action (HMA)

Risks and uncertainties complicate the management of all planned activities. Although the complexities of many HMA programmes make it impossible to predict every risk that may occur in a programme, it is essential to identify and manage all predictable risks so that it can be shown that everything reasonable has been done to manage risk responsibly. The record of risk management activity can be used as a defence in case of dispute and can augment many project documents including reports to donors/clients and applications for support. Internal Quality Management systems also rely on these reports in order to identify revisions in management systems, working procedures and/or equipment that can have positive outcomes without compromising the quality of the work or the organisation's goals.

When possible, risk analysis should rely heavily on quantitative data so that two people conducting the analysis will reach broadly similar conclusions. However, quantitative data providing an accurate record of past events and experience can take time to amass. When a risk management system is conducted appropriately, the system itself can reduce the influence that the opinion of the individual conducting the assessment has on the outcome. Qualitative and quantitative approaches are required in order to make maximum use of the reliable data available as well as the experience and opinion of those involved in the process.

As the organisation's detailed risk registers grow, the body of evidence of identified risks and successful mitigation methods will provide a greater resource from which numerical data can be derived. Although numbers derived from data analysis are quantitative, the assessment of the data from which the numbers are derived is qualitative, so the result can never be more than semi-quantitative. Numbers are not necessarily more reliable than opinion when the numbers are themselves based on opinion, but they provide a common foundation for risk management.

To avoid identified risks being neglected, it is a policy that the responsibility for managing each identified risk is placed on a named member of staff with appropriate authority and oversight.

3.1 Risks to be managed in HMA

In any HMA organisation there are four categories of risk that must be managed.

1. **Primary goal:** risk of failure to achieve the primary goal.
2. **Personal injury**: risk of injury to staff.
3. **Reputational:** risk of damage to the organisation's reputation.
4. **Financial:** risk of failing to control costs appropriately.

The maintenance of a detailed Field Risk Register is a requirement that will make subsequent Task Risk Assessments (TRA) better informed. A separate Programme Risk Register should also be maintained in order to maximise programme efficiency as part of the Quality Management regime.

3.1.1 Primary goal

The primary goal of HMA is to reduce risk to those adversely affected by explosive hazards. The consequences of failing to achieve this can be human suffering, direct financial loss and/or damage to the organisation's reputation that has far reaching consequences. All four risk categories are affected, so it is essential that everything possible is done to manage risks that threaten the achievement of the primary goal.

The risk of financial or material loss resulting from explosive hazards being found on land after its formal release by an NMAA is borne by the NMAA that will have conducted QA and QC checks on the land release process and will have approved decisions made by this organisation using agreed land release assessment methods (as described in Chapter 3 or as defined by the NMAA). However, the risk to the organisation's reputation may still be severe, so every effort must be made to ensure that the land release process is safe for end users.

On land that has been released as having No Threat Evidence (NTE), so no reason to subject it to full Search & Clearance procedures, the status of the land will have been agreed with the NMAA and the absence of evidence confirmed. If an explosive hazard is located in an NTE area, there is an urgent need to mark the area for future Search & Clearance and to review the decision making process to determine whether the process can be improved in the light of the discovered evidence. No liability for errors in the process rests with this organisation, but the organisation must do everything reasonable to assist the NMAA in correcting the error and correcting any failings in the land release process.

If explosive hazards are found on land declared 'Cleared' by this organisation, there is an obvious risk of persons suffering injury that would contradict the primary goal of this organisation and may also involve claims for financial compensation. There is also a severe risk of the organisation suffering reputational damage that adversely effects future relations with the NMAA, which may restrict the allocation of tasks or withdraw accreditation to work. A further severe risk is that a perceived absence of quality may lead to donors/clients reducing or withdrawing their support. As a result, the risks associated with leaving explosive hazards on land declared 'Cleared' presents an intolerable threat to the organisation that must be avoided by ensuring that everything reasonable is done to avoid the event occurring and that the risk management and Search & Clearance procedures are documented in ways that provide compelling proof of the organisation's professionalism.

3.1.2 Personal injury

There is a varied risk of injury to staff or members of the public during any programme activity because accidental injury may occur in the office, on the roads, or in the field. The programme must have an Occupational Health and Safety policy that is designed to meet national and international standards and which will address the management of common occupational risks in a way that minimises the risk of human suffering. As part of this policy, the programme must have third party insurance cover or contingency set aside to cover the costs association with the medical treatment and compensation of persons affected.

When the NMAA requires a level of accidental injury medical cover and a specific compensation schedule, that must either be adopted or exceeded. To satisfy Head Office and any Insurance cover, all reasonable means must be taken to identify and avoid/mitigate risks and this must be formally recorded in risk management documentation. As long as this is done, the financial risk to the organisation is limited to the costs associated with the insurance and the costs of recruiting, training and paying replacement staff. This cost can be significant when key staff are involved in injurious accidents or become sick, so staff development plans should always ensure that persons with critical roles and/or skill sets can be readily replaced.

The nature of HMA field work means that there is a risk of injury caused by explosive hazards. The IMAS requires that all relevant planning, training and procedural efforts to reduce or avoid risk must be taken. To achieve this, the risk to staff must be managed using a Task Risk Assessment (TRA) and risk mitigation measures as described in Parts 5 and 6 of this Chapter.

The use of formal and documented TRA is mandatory because it is essential to show that everything reasonable is done to minimise the risk of explosive injury to staff during HMA activities. When this cannot be shown, that is a failure to achieve the primary goal of the organisation with consequences in terms of unnecessary human suffering, reputational damage and loss of confidence that may result in financial loss.

When everything reasonable has been done to ensure that risks are avoided or mitigated in a way that minimises the injurious consequences, any explosive accident that still occurs can be considered ‘unavoidable’. The accident event must be reported and investigated honestly, admitting error or omissions when appropriate so that improvements can be made. As long as all reasonable means to identify causes and prevent repetition are taken, there is no significant risk to the organisation.

3.1.3 Reputational

A reputation for professionalism that extends from office management to hands-on field work is necessary for the survival and/or growth of the organisation, without which the primary goal cannot be achieved.

The reputation of an organisation can be damaged in many ways, including the occurrence of accidents or incidents in working areas; financial irregularities; political, cultural or religious insensitivity; negative publicity; and any perceived unprofessional behaviour including dishonesty and a lack of transparency.

If events occur that damage the organisation’s reputation, this can adversely affect future relations with the NMAA which may restrict the allocation of tasks or withdraw accreditation to work in the country. Loss of confidence in the professional competence of the organisation can also affect relations with donors, clients, or the general public which can lead to the withholding of support and so prevent the organisation achieving its goals.

3.1.4 Financial

Even in the best planned programme, unanticipated events can occur that involve extra costs. In many cases, the unanticipated events could have been predicted and so the risk of them occurring should have been considered and the costs of avoidance or mitigation factored into the programme’s planning and cost estimates.

When risks have been identified, their management should be included in internal Quality Management systems that either avoid the risk or ensure that its potential consequences are minimised. An obvious example is the risk of fraudulent accounting that can be countered by adopting accountancy systems that are accessible enough to allow rapid and effective QA monitoring that ensures that discrepancies are identified and remedied without delay.

Contracts and applications for donor funding are managed from Head Office and should involve close cooperation with the programme manager because planning the cost of activities requires experience and knowledge of the costs and challenges associated with the specific working context.

The ideal HMA programme involves the contracted provision of a defined HMA capacity for a period of time (often known as a ‘Service Contract’), and may include a prioritized list of tasks (Contracted Outputs). It should not require that all prioritized tasks are completed within a limited timeframe because the varied nature of the work and its context usually makes it impossible to accurately predict how much work can be safely achieved to schedule. The contract should require an internal Quality Management audit trail that gives confidence that the defined HMA capacity is both available and working efficiently throughout the contract. It should also include independent oversight to ensure that the contract terms are safely and efficiently met and impose agreed penalties for ‘at-fault’ non compliance.

When the capacity is supported in terms of tasks completed, each task should have a base estimate of the costs involved in achieving the project goals and a contingency cost that reflects those costs that may occur if predictable problems arise during implementation. When these risks are identified and their management is agreed with the donor/client, the predicted contingency sum may be higher than when contingency only covers risks that have not been identified. The total project cost should be the sum of the base cost estimate plus the predicted contingency estimate. The addition of a small percentage for unpredicted risks may be negotiated. The undefined nature of field work in HMA means that a realistic estimate of contingency costs for any one task will often have to be high, so the contract should require under-spend to be carried forward into subsequent tasks.

Capital costs may be amortised over several contracts when organisational reserves allow this to occur. In any one contract, some capital goods may be inherited from previous contracts with a budget allocation that builds reserves for their replacement after an appropriate time period. It can be cost effective for the donor to agree to hire equipment from the organisation but the hire cost should not exceed the predictable amortised replacement costs. To maintain donor confidence, the hire of equipment that is held but is not actually needed for the contracted work in order to raise additional overheads for Head Office must not be allowed.

3.2 Required risk management activities

Risk management during any HMA programme should include the following five activities.

1. A SWOT analysis should be used to evaluate internal/external factors that may affect programme outcomes. SWOT requires the identification of Strengths, Weaknesses, Opportunities, and Threats, so can help in risk identification.
2. Risk registers must be used to record, analyze, mitigate, and manage identified potential risks. The maintenance of a Programme Risk Register and a Field Risk Register will provide valuable resources for future risk identification and management, so must be conducted diligently and with complete honesty. Although a few risks, such as the risk of road traffic accidents, may feature in both registers, the maintenance of separate registers simplifies the risk management process.
3. A contracting risk assessment that can be used to identify and address mismatches between the approach of the NMAA, the donor, and the organisation to the contract and their varied expectations of the outputs. Because the full nature of an HMA task is often not known until it is undertaken, the risks of performance shortfalls must be identified and variance parameters should be agreed as part of the contracting or tasking process.
4. A formal programme risk assessment should be conducted to identify predictable risks and ensure that there are Quality Management systems in place to manage and monitor those risks in a manner that complies with humanitarian principles, national laws, industry best practice, the requirements of the NMAA, and any further systems required by the donor or client. A new programme risk assessment must be conducted at regular intervals and whenever significant change occurs.
5. A formal Task Risk Assessment (TRA) process using an organised method of identifying potential field risks, assessing their ‘tolerability’ and taking all necessary risk avoidance or mitigation measures must be conducted. The detailed TRA included in this Chapter (see Part 6) gives a detailed way of assessing and mitigating field risks. A technology risk assessment is an integral part the TRA, taking note of technology limitations when making an informed selection of the procedures and technology/tools to be used.

4. Programme risk management

In these SOPs, 'programme risk management' is separated from 'field risk management' because the skills required have essential differences. Programme risk management is conducted to control general programme risks and field risk management is used only to manage field risks, including those posed by explosive hazards and the varied working environment. Although similar methods are used, the management of field risks requires a task specific approach to risk identification, assessment, mitigation and monitoring.

4.1 General risks in HMA programmes

The risks associated with the running any HMA programme vary and the following list is only intended to provide a common starting point that must be extended as appropriate.

Risks include those associated with:

- the rental or purchase of suitable premises (including the provision of essential services, such as power and water supplies);
- the recruitment and retention of suitable international and national staff (capable, experienced, trained);
- the continued health of key staff (with persons available to stand-in if required);
- the honesty and integrity of all staff (including problems establishing non-competitive teamwork in a deliberately self critical environment);
- the constraints imposed by national laws, including labour laws (including possible changes to these requirements);
- liability under national law for environmental conservation (including third party claims);
- road traffic accidents (staff injury and/or downtime and in terms of the effect of vehicle loss on programme efficiency and goals);
- security of equipment and of data (damage, loss and wider consequences);
- equipment availability (including purchase, transportation and importation costs and the costs of delay);
- reliable availability of programme consumables (from office to field);
- perceived inefficiency in programme management systems (by independent QM oversight by the NMAA or donor/client);
- changes to national socio-political security (requiring enhanced office, accommodation and/or staff security, and/or evacuation/shutdown); and
- delays in access to programme funding (including the cost of borrowing).

4.2 Programme risk categorisation

For ease of management, identified programme risks should be categorised to allow risk ownership to be assigned and for risks in each category to be separately prioritised.

A preliminary list of risk categories is given alongside. Some risks will fall into more than one category and may then be 'owned' by more than one risk manager.

Risk Category
Safety
Security
Quality of Services
Financial
Legislative Compliance
Environment
Reputation

4.2.1 Risk ownership

The following table shows the broad roles and responsibilities in the risk management process in a country programme. The programme manager may change these according to need. Responsibility for managing each identified risk should be delegated to named individuals with responsibility for implementing agreed risk avoidance or mitigation strategies and monitoring their success.

Position	Responsibilities
Programme manager	Ownership of all risk management execution throughout the country programme. The programme manager should not delegate ownership of reputational risks.
Office manager	Ownership of financial, legislative compliance, and environmental risks.
Quality management manager	Ownership of Quality of Services, maintenance of the Programme Risk Register.
Operations manager	Ownership of field risks, conduct of Task Risk Assessment (TRA) and maintenance of Field Risk Register.
Task supervisors	Responsibility for identifying field risks, updating TRA and implementing mitigation/avoidance measures.
All staff	Responsibility for identifying risks and possible avoidance/mitigation measures.

Head Office manages those reputational risks associated with publicity unless a programme publicity officer is appointed.

The risk management process is an endless cycle, so the risk registers must be regularly updated to record the measures taken to avoid or mitigate risks, their success or failure, and any new risks that are identified.

The programme manager must ensure that the organisation's Quality Management regime facilitates regular risk identification and assessment sessions.

4.3 Calculating programme risks

A numerical value should be assigned to each identified programme risk so that they can be compared, prioritised and appropriately managed.

Risk numbers are generated using this formula:

$$PoO \times SoC = R$$

The Probability of Occurrence (PoO) multiplied by the Severity of Consequences (SoC) equals the Risk Number (R).

4.3.1 Probability of Occurrence (PoO)

A number is assigned to the probability of an event occurring by reference to the table below.

1	**UNFORSEEABLE** not foreseen occurring	These are events that have not occurred in the past and there is no reason to think they are likely to occur now.
2	**VERY LOW** probability of occurrence	These are events that have occurred once in the past but could only recur in exceptional circumstances that are not anticipated.
3	**LOW** probability of occurrence	These are events that have occurred more than once in the past and that might occur again in circumstances that are not currently anticipated.
4	**MEDIUM** probability of occurrence	These are events that have occurred more than once in the past and that might occur again in one or more circumstance that is anticipated.
5	**HIGH** probability of occurrence	These are events that have occurred more than once in the past and will predictably occur in the circumstances that are anticipated.
6	**VERY HIGH** probability of occurrence	These are events that have occurred frequently in the past and are expected to occur in the circumstances that are anticipated.

4.3.2 Severity of Consequences (SoC)

A number is assigned to the severity of the potential consequences of a risk using this table.

1	**No significant consequences**	There would be no human suffering, no financial loss and no reputational threat.
2	**VERY LOW**	There would be no human suffering and no reputational threat. There may be a low financial cost in terms of increased working hours or capital expenditure that would not impact on the achievement of programme goals.
3	**LOW**	There would be no human suffering and no reputational threat. There may be a minor financial cost in terms of increased working hours and/or capital expenditure that could impact on the achievement of programme goals.
4	**MEDIUM**	There may be limited human suffering (minor injury) and consequent reputational threat. There may be a minor financial cost in terms of medical treatment, compensation, increased working hours and/or capital expenditure that could impact on the achievement of programme goals.
5	**HIGH**	There may be significant human suffering (severe injury) and consequent reputational threat. There may be a significant financial cost in terms of medical treatment, compensation, increased working hours, recruitment/training of staff and/or capital expenditure that will have some small impact on the achievement of programme goals.
6	**VERY HIGH**	There may be very significant human suffering (more than one severe injury or a fatality) and consequent reputational threat. There may be a high financial cost in terms of medical treatment, compensation, recruitment/training of staff, increased working hours and/or capital expenditure that will have a significant impact on the achievement of programme goals.

If a risk meets any part of the definitions shown, it is assigned that SoC number. So, for example, any risk of severe injury has a SoC number 5 whether or not its consequences may include a financial impact that affects the achievement of the programme's goals.

4.3.3 Calculating risk numbers

The PoO is multiplied by the SoC to generate a risk number. For example, an event that has a very low probability of occurrence (2) and a high SoC (5) has a risk number of 10. The numbers are then assessed using the following table and the appropriate risk management conducted.

INTOLERABLE RISK Nos 30-36	Immediate action to either avoid the risk or reduce the probability of its occurrence or the severity of its consequences is required.
HIGH RISK Nos 20-25	Action to reduce risk is necessary whenever reasonably possible. The authority deciding what is reasonable may be Head Office, the NMAA, or national/international legislation.
MONITORED RISK Nos 10-18	Continuous monitoring is necessary to ensure the probability of occurrence does not increase or that the risk is being effectively mitigated.
TOLERABLE RISK Nos 1-9	A very low level of risk that it is reasonable to tolerate and which there is no legal or humanitarian obligation to address.

All risks with a risk number of 10 or above require active risk management.

4.3.4 Calculating programme risk numbers with a risk matrix

A risk matrix can be used to calculate risk numbers at a glance. Simply read off the number where the PoO line intersects with the SoC column. So a PoO of 2 and an SoC of 5 intersect in the yellow square 10.

The colours in the matrix provide a visual reference to one of the four risk categories in the table on the next page.

Probability of Occurrence							
6	6	12	18	24	30	36	
5	5	10	15	20	25	30	
4	4	8	12	16	20	24	
3	3	6	9	12	15	18	
2	2	4	6	8	10	12	
1	1	2	3	4	5	6	
	SoC 1	SoC 2	SoC 3	SoC 4	SoC 5	SoC 6	Severity of Consequences

	INTOLERABLE RISK Nos 30-36	Immediate action to either avoid the risk or reduce the probability of its occurrence or the severity of its consequences is required.
	HIGH RISK Nos 20-25	Action to reduce risk is necessary whenever reasonably possible. (The authority deciding what is reasonable may be the NMAA or national and international legislation.)
	MONITORED RISK Nos 10-18	Continuous monitoring is necessary to ensure the probability of occurrence does not increase or that the risk is being effectively mitigated.
	TOLERABLE RISK Nos 1-9	A very low level of risk that it is reasonable to tolerate and which there is no legal or humanitarian obligation to address.

All risks with a risk number of 10 or above require active risk management.

A problem with all simple risk matrices is that many of the numbers in the scale (1-36) cannot be generated by the equation. The numbers 7, 11, 13, 14, 17, 19, 21, 22, 23, 26, 27, 28, 29, 31, 32, 33, 34, 35 in this example (half of the numbers) cannot be generated. They are sometimes called 'blurred' because the distinction between the numbers they fall between is blurred. For example, the next possible number before 30 is 25 and the next possible number after 30 is 36. Number loss is higher amongst the high numbers, making the distinction between 'high risk' and 'intolerable risk' less precise than a 1-36 scale implies. For a way to avoid this, see the more complex matrix used in Task Risk Assessment (Part 6.1 below). Programme managers are encouraged to adapt and improve the risk matrix shown above.

1,2,3,4,5,6,
7,**8,9,10,**11,**12,**
13,14,**15,16,**17,**18,**
19,**20,**21,22,23,**24,**
25,26,27,28,29,**30,**
31,32,33,34,35,**36.**

4.4 Programme Risk Register

A Programme Risk Register should be maintained in a spreadsheet format and regularly revised as a result of:

- the cycle of risk management activities,
- internal Quality Management reviews and
- experience gained in other programmes.

All Programme Risk Registers should be sent to Head Office at regular intervals so that the record can be preserved and shared.

The HMA industry is competitive and the maintenance of a good Programme Risk Register can give a distinct advantage when seeking support or contracts. While the results of programme risk management may be made public, the actual Programme Risk Register must not be shared with the NMAA or any other HMA organisations without express permission from Head Office. In contrast, the Field Risk Register described in Part 6.2 below is primarily concerned with avoiding human injury and should be shared with other HMA organisations in reciprocal agreements.

As a minimum, a Programme Risk Register using the headings shown on the left in the following table should be used to record the office based risk management process. This format is a simple example. Head Office may require a specific Risk Register format to be used to ensure that registers can be easily shared throughout the organisation.

Programme Risk Register	
Office ID and Risk Numbers:	A unique reference number that is given to each identified risk event. The office ID allows registers to be combined at Head Office.
Risk type:	One <u>or more</u> of the four risk types: primary goal, personal injury, reputation, and financial.
Risk name:	A risk name that will be easily recognised by others.
Description:	A description of the risk event that is used to discriminate between this and other risk events that may be superficially similar.
Consequences:	The undesirable consequences that this risk event could have for the HMA programme.
Date risk identified:	Date on which the risk was identified and entered in the Risk Register.
Date last updated:	Used to demonstrate active monitoring of avoidance/mitigation.
Priority:	High, Medium, or Low priority? Used to prioritise mitigation needs.
Probability of Occurrence:	High, Medium, or Low probability that the identified risk will occur. This must be updated as experience is gained.
Manageability:	Can the risk be avoided or its consequences mitigated?
Risk owner:	The person assigned to take responsibility for the management of the risk, including mitigation and monitoring.
Mitigation strategy:	Detailed description of how the identified risk will be mitigated or avoided: updated during monitoring and revised when appropriate.
Current status:	Current status of the risk: either avoided or the status of the chosen means of mitigation.

5. Field risk management

When working in the field, the three main risks to be managed in order of priority are:

Primary: the risk of leaving explosive hazards on land that is released, so increasing risk to civilians;

Secondary: the risk of staff suffering explosive hazard related injury; and

Tertiary: the risk of working inefficiently and so losing donor support.

Primary risk: the most damaging risk is that of failing to achieve the primary goal of Humanitarian Mine Action (HMA) which is to reduce the impact of explosive hazards on people. If explosive hazards are left on land that is released, those responsible have increased the risk to the end-users by making them believe the land is safe, so encouraging them to use it. This is a failure to achieve the primary goal of any HMA organisation.

Secondary risk: if HMA deminers/searchers are involved in explosive related injury that could have been avoided, their suffering also contradicts the stated goals of HMA. Every explosive accident that results in injury adds an unnecessary burden to humanitarian support systems in the country and may breach the employer's duty of care. The consequences to the individual can be catastrophic. The organisation may suffer reduced staff morale and self confidence as well as a loss of credibility and significant financial costs.

Tertiary risk: while donor support may be affected by accidents or incidents that put the organisation's reputation at risk, donor support may also be at risk if the organisation can be shown to have spent more money than was necessary to successfully release safe land. It is this risk that the land release concept was designed to address but it must always be remembered that cost efficiency has a lower priority than the primary and secondary risks involving human safety.

5.1 Tolerable risk

It is an obligation for any humanitarian organisation to do everything reasonable to manage and reduce risk of injury to its employees. A risk is only 'tolerable' if it can be shown that everything reasonable has been done to manage and mitigate risk in a way that would satisfy a court of law. For this reason, risk management must be conducted in a process that is reasonable, logical, and that is rigorously recorded in formal documents.

Unless otherwise required by the NMAA, the following definition of 'tolerable risk' must be used in field risk management.

Tolerable risk: a 'tolerable risk' is the risk remaining after having taken all reasonable measures to avoid the risk event and/or to minimise its undesirable consequences. In HMA, the following examples are useful.

1. The tolerable risk to end-users after an area has been released as 'Cleared' is the risk that there may be explosive hazards beneath the required search depth in that area. At each task, a search depth that is appropriate must be agreed with the NMAA and increased whenever necessary.

2. The tolerable risk to end-users after land has, by agreement, been released as having NTE so 'Presumed Clear' is that evidence of the presence of explosive hazards is later found. If this occurs, the land must be marked as hazardous and appropriate demining activities carried out. As long as the decision to release the land as having NTE was made using approved criteria, those making the decision are not at fault. The criteria for making the

decision may be at fault and must be reviewed with urgency (and revised when necessary) whenever explosive hazards are found on land that has been released as ‘Presumed Clear’.

3. The tolerable risk to demining staff is the risk remaining after all reasonable effort has been made to train, equip and supervise staff in the conduct of inherently safe demining procedures. All reasonable effort includes the production of a formal Task Risk Assessment (TRA) as part of a risk management process designed to ensure that appropriate measures to mitigate risk are always taken. Every TRA must be updated as work progresses and new information becomes known.

5.1.1 Risks associated with leaving explosive hazards behind

Records of explosive hazards located on land after it has been released have rarely been gathered and shared. However, efficient NMAAs are increasingly investigating these incidents and from the data already available, it can be reliably inferred that these incidents occur frequently.

When an explosive hazard is located on land this organisation has declared Searched & Cleared, the programme manager shall accept responsibility, order an in depth investigation into how the incident occurred, and ensure that the area is re-searched using proven procedures and enhanced supervision as a priority. When appropriate, other procedures and/or assets should be used to gain complete stakeholder confidence in the quality of the search. These responses are professionally correct and should limit any damage to the organisation’s reputation and standing with donors.

When an explosive hazard is found on land that this organisation has submitted for release as ‘Presumed Clear’, the release process included the NMAA and the end-users agreeing that there was no evidence of explosive hazards in the area, so this organisation is not at fault. The NMAA approved criteria used to make the ‘Presumed Clear’ decision may be at fault and must be reviewed/revised urgently. The NMAA should record the area as a task and schedule it for appropriate Search & Clearance.

Whenever an incident is reported on land that this organisation has submitted for release, this organisation must assist with the NMAA’s investigation or conduct an internal investigation with a view to discovering the causes. It must never be presumed that the hazard was placed after the land was released without convincing evidence that this was the case.

5.2 Principles behind Task Risk Assessment (TRA)

Task Risk Assessment (TRA) allows estimates of the risk involved in varied demining procedures to be made. This allows the informed selection of a combination of demining procedures that keep the risk of severe injury at a tolerable level. The method described in Part 6 of this SOP should be applied at all demining task sites, including EOD spot tasks. The first TRA at any task should be conducted by the Task Assessment team before any staff are deployed.

The primary purpose of a TRA is not to reduce risk, which may be very low anyway. It is to assess the level of risk involved in all the combinations of hazards and procedures that are at a particular task so that relative risk can be compared and appropriate procedures selected. Conducting a TRA ensures that everything reasonable is done to ensure that the risk to employees and end-users of the land is kept to a tolerable level.

When possible, recorded information about past risk situations is used in the TRA. While the historical record can reliably show trends and generalisations, lessons derived from it are not relevant in all circumstances so an intelligent evaluation by experienced staff is always necessary.

As work progresses at a task, the information on which the first TRA was based must be updated and the TRA repeated whenever new information becomes available.

5.3 Risk factors at a task

Task risk factors are:

- human error;
- procedural error;
- explosive hazards;
- task conditions; and
- technology failure.

All but one of these factors are covered in the TRA process described in Part 6. The exception is 'technology failure'. It is excluded because it must be minimised by the implementation of appropriate maintenance and testing regimes.

5.3.1 Human error

Human error may be an individual's error, an error in training or in supervision, or a combination of these. It may be deliberate, through ignorance or curiosity, or it may be accidental, through lack of attention or sickness. Most recorded demining accidents involve an error in training, in supervision or in the judgment of the employee(s).

Control of the behaviour of the employees is ultimately the responsibility of the task supervisor who controls all staff at a task.

5.3.2 Procedural error

Procedural error may occur because an inappropriate procedure is used. It may also occur when there is a mistake in the way that an appropriate procedure is performed. To prevent procedural errors occurring, training must be appropriate and accessible, supervisors must be experienced and responsible, and employees must understand why they must work in the required way.

5.3.3 Explosive hazards

The specific explosive hazards at a task and their condition when they are found are critical risk factors. Some explosive hazards become easier to initiate as they decay while others may become incapable of functioning as designed. The condition of the devices found at the task may mean that the estimate of the risk they represent has to be reviewed after examples have been found. Normally, it is the condition of the fuzing system that is of greatest concern and the need to avoid initiating the firing train during the varied procedures that may be used is most important. However, in some cases other parts of a hazard than the fuze (such as volatile propellant or sensitive incendiary materials) may present the greatest risk. The condition of explosive hazards must always be assessed by EOD Operatives with extensive relevant experience who have access to appropriate reference works.

5.3.4 Task conditions

The selection of appropriate tools and procedures to use at a task can be dictated by the conditions that are present. The task conditions include the terrain, vegetation, any obstructions that are present and the weather conditions before and during the work. Task conditions vary at each task and can affect the probability of an unintended detonation occurring with any of the demining procedures that may be used. In some cases, procedures may need to be adapted or new procedures devised, and continuation training to extend the skills of the workforce may be necessary.

5.3.5 Technology failure

Technology failure is the failure of equipment and machines to work reliably. This may include mechanical or electrical breakdown. A breakdown may not cause an unintended detonation, but it can increase the risk of that occurring. The risk of technology failure must be reduced by ensuring that testing and maintenance regimes reduce failure to the minimum and ensure that any failure is noticed as soon as possible. For example, in these SOPs the metal-detector test requirements include checking the detector’s ability to reliably find the smallest anticipated target before and after each work period.

The significance of any technology failure is reduced by including failure scenarios in training to ensure that all employees know how to respond safely when a technology failure occurs.

5.4 Assessing the probability of a detonation occurring

The probability of an explosive hazard detonating should be assessed as a combination of the characteristics of the hazard, the procedures that will be used, and the context in which the work will be conducted.

It is important to know which activities have the greatest risk of causing a detonation. The accident record shows that detonations are most likely to happen during the following activities (listed in order of their frequency).

1. Excavation accidents (signal investigation and area excavation).
2. Handling accident (moving, defuzing or rendering safe).
3. Vegetation removal accident (with cutting tools in hand).
4. Detection accident (with metal-detector in hand).
5. Demolition accident (before, during or after a planned demolition).

More than twice as many accidents occur during excavation than the total of all the others added together, so this is a high risk activity that needs to be closely managed.

5.5 Assessing the severity of consequences of a detonation

The severity of the consequences of a detonation is a measure of the probable human injury and equipment damage/loss. An unintended detonation has often been presumed to cause either severe injury or death and so many risk control strategies have been designed to avoid all unintended detonations. However, when the combination of an explosive hazard and the procedures used at the time mean that the risk of severe injury resulting from an unintended detonation is low, it can be acceptable for the risk of an unintended detonation occurring to be higher. The severity of the consequences is what matters, not the fact of a detonation.

5.6 Assessing the probability of leaving hazards behind

The potential for leaving hazards behind should be assessed as a combination of the depth of the hazards, the procedures that are used to search for them and the context in which the work is conducted. The procedures used and the level of supervision must guarantee a thorough search of the entire area. As work progresses and devices are located, it may be found that the original depth of search is insufficient. When some hazards are found deeper than anticipated, the search depth must be increased without waiting for approval and any search already completed may need to be repeated.

5.6.1 Assessing the consequences of leaving hazards behind

The first consequence of leaving explosive hazards on land that is released is a risk of injury or death to the end-users of the land. Secondary consequences can be severe financial and reputational damage. No injury to an end-user because of explosive hazards left within the agreed search depth is tolerable. Explosive hazards buried beneath the search depth and later discovered are the 'tolerable risk' for land declared 'Cleared'. However, the consequences may still be severe if end-users encounter hazards that were beneath the search depth, so every effort must be made to ensure that the search depth is appropriate in each part of each task. It must be increased in any area where there is a suspicion that hazards may be deeper.

5.7 Probability of Detonation (PoD) during each procedure

For each demining procedure and for each explosive hazard, a Probability of Detonation (PoD) must be estimated. Using Table A below, the PoD is defined and given the number in the left column.

Table A: Probability of Detonation (PoD) for a given explosive hazard and procedure		
4	Frequent	Could occur often with this procedure.
3	Probable	Could occur if the procedure is used correctly.
2	Occasional	Could occur if the procedure is used incorrectly.
1	Improbable	Very unlikely to occur even if the procedure is used incorrectly.

A high PoD does not always mean that the procedure is inappropriate. If the likelihood of an injury occurring in an unplanned detonation is very low, a high probability of an unplanned detonation may not make a risk intolerable.

5.8 Severity of Consequences (SoC) of a detonation

The Severity of Consequences (SoC) of a detonation is estimated for each available procedure. It is calculated presuming that the explosive hazard is able to function, whatever its condition.

Using Table B below, the SoC for each explosive hazard is estimated and given one of the numbers from the column on the left.

Table B: Severity of Consequences (SoC)		
4	Catastrophic	Death.
3	Severe	Severe or disabling injury.
2	Minor	Minor injury.
1	Negligible	No injurious consequences.

NOTE: *The SoC should be estimated presuming that PPE is worn correctly and that staff are at the distance from the hazard required in the approved procedures. The SoC when the staff are protected inside a machine or behind an armoured shield will be very much lower than the SoC during manual Search & Clearance.*

SoC numbers for common mines detonated during any manual procedure are listed in Annex A of this Chapter. The most likely SoC number should be selected.

The risks added by the conditions at the task must then be considered.

5.9 Risks added by the Task Conditions (TC)

The Task Conditions are a combination of the terrain, ground conditions, vegetation, other obstructions that may be present at a task, and the weather before and during the work. The slope of the ground and the presence of vegetation, ditches and other obstructions all affect the ease of work and supervision. Some conditions also affect the equipment that can be used and the selection of a task marking system. TCs can affect the choice of appropriate procedures to use and the site supervision that is necessary. For example, more supervisors will be necessary when the distance from which workers can be overseen is limited.

5.10 Combining all relevant factors

The calculations for each hazard and procedure are combined as shown in Table C below.

When both PoD and SoC (Tables A and B) have been estimated for a procedure, the numbers are multiplied together and the additional risks posed by the TC are added. This gives risk numbers for procedures that can be easily compared.

Table C: Calculating a risk number for this procedure: ………….		
Table A: Probability of Detonation (PoD)		
4	Frequent	Could occur often with this procedure.
3	Probable	Could occur when the procedure is used correctly.
2	Occasional	Could occur if the procedure is used incorrectly.
1	Improbable	Very unlikely to occur even if the procedure is used incorrectly.
Table B: Severity of Consequences (SoC)		
4	Catastrophic	Death.
3	Severe	Severe or disabling injury.
2	Minor	Minor injury.
1	Negligible	No injurious consequences.
Increased risk in varied Task Conditions (TC)		
0-4	The total increased risk should be added.	
Total		

The result from Table A is multiplied by the result from Table B and the additional risk number for the Task Conditions is added. The total will be a number 1-20 which is the risk number for that explosive hazard and that procedure at that task.

5.11 Evaluating the risk numbers

The risk number calculated for a particular explosive hazard and specific procedure at a task should then be evaluated using Table D below.

Table D: Tolerable and unacceptable risk numbers		
Above 10	Not acceptable	This represents an intolerable risk: alternative procedures to reduce risk must be selected.
9	Tolerable, but undesirable	Can only be accepted if no alternative procedures can be deployed.
5-8	Tolerable	The level of risk means that hazard related injury should not occur if procedures are correctly conducted.
1-4	Normal	The level of risk means that hazard related injury or fatality is very unlikely.

Generally, procedures with a risk number lower than 9 should be selected for use at the task.

If a procedure has a risk number of 10 or above, ways must be found to reduce the risk of injury before the procedure is conducted. This may be achieved by adding ground preparation procedures or changing tools to reduce the PoD and/or by protecting employees with enhanced PPE, armour or distance to reduce the SoC.

5.12 Comparing risk numbers

The risk numbers for all the different procedures and hazards at the task should be calculated to allow the selection of demining procedure(s) that have a tolerable or normal risk. The selected procedure(s) may not always be the procedure(s) with the lowest risk number because working efficiency and the experience of the employees should also be considered. When the lowest risk number is not selected, the reason for using the procedure that is preferred should be recorded in the Task Risk Assessment.

NOTE: *The need for continuous revision of TRAs is unavoidable. It does not imply any failing in those carrying out the assessment as long as the revision is made as soon as possible after new information becomes available.*

6. Step by step Task Risk Assessment (TRA)

This method of Task Risk Assessment does not apply to mechanical procedures that are intended to detonate explosive hazards because, although suitably protected machines may be used to try to locate patterns of hazards, the use of machines to detonate/disrupt multiple explosive hazards does not leave land free from explosive hazards, so is not an effective Search & Clearance procedure.

A Task Risk Assessment is conducted following 7 steps.

Step 1: list the explosive hazards that can reasonably be anticipated at the task.

Step 2: list each of the available demining procedures that may be used at the task.

Step 3: assess the Probability of Detonation (PoD) for each hazard when using each of the available procedures.

Step 4: assess the Severity of Consequence (SoC) if an unintended detonation occurs.

Step 5: assess additional risk presented by Task Conditions (TC).

Step 6: calculate Risk Numbers.

Step 7: compare Risk Numbers and select appropriate procedures to use.

The Steps are described below.

Step 1: Listing the explosive hazards

Using the information in the Task Folder and information gained during the Task Assessment, list the explosive hazards that may be present at a task. Some hazards are listed in the Table in Annex A of this Chapter. Then find out how the anticipated hazards work and their content. When their design and hazardous content is known, estimate the probable condition of each hazard given the length of time they have been there and the context they are in.

Step 2: Listing the available Search & Clearance procedures

List all of the Search & Clearance procedures that could be used at the task. These will usually include some or all of the following procedures.

1. Manual search using metal-detectors and signal investigation.

2. Manual search using area excavation with hand tools.
3. Manual search using area excavation with Rake Excavation and Detection System (REDS) rakes.
4. Manual search conducting BAC.
5. Manual search conducting BACS.
6. MDD search with manual investigation of indications.

Ensure that the equipment necessary to use each procedure will be available during the task. If the equipment is not available, remove the procedure from the list.

Step 3: Assess the Probability of Detonation (PoD)

Each of the anticipated explosive hazards must be compared with all of the available procedures to decide how likely it is that the procedure may cause a detonation.

The Probability of Detonation (PoD) is assessed and given a number from the following list.

Probability of Detonation (PoD) for a given hazard and procedure		
4	Frequent	Could occur often with this procedure.
3	Probable	Could occur if the procedure is used correctly.
2	Occasional	Could occur if the procedure is used incorrectly.
1	Improbable	Very unlikely to occur even if the procedure is used incorrectly.

In TRA Table 1 below, write in each possible explosive hazard identified in Step 1 and circle a PoD for each of the available procedures.

TRA Table 1: Probability of Detonation (PoD) during available procedures				
Hazard:……………………………………………………………………………………	**PoD**			
Procedure 1: Manual search using metal-detectors and signal investigation.	**1**	**2**	**3**	**4**
Procedure 2: Manual search using area excavation with short hand tools.	**1**	**2**	**3**	**4**
Procedure 3: Manual search using area excavation with REDS rakes.	**1**	**2**	**3**	**4**
Procedure 4: Manual search conducting BAC.	**1**	**2**	**3**	**4**
Procedure 5: Manual search conducting BACS.	**1**	**2**	**3**	**4**
Procedure 6: MDD search with manual investigation of indications.	**1**	**2**	**3**	**4**
Hazard:……………………………………………………………………………………	**PoD**			
Procedure 1: Manual search using metal-detectors and signal investigation.	**1**	**2**	**3**	**4**
Procedure 2: Manual search using area excavation with short hand tools.	**1**	**2**	**3**	**4**
Procedure 3: Manual search using area excavation with REDS rakes.	**1**	**2**	**3**	**4**
Procedure 4: Manual search conducting BAC.	**1**	**2**	**3**	**4**
Procedure 5: Manual search conducting BACS.	**1**	**2**	**3**	**4**
Procedure 6: MDD search with manual investigation of indications.	**1**	**2**	**3**	**4**
Hazard:……………………………………………………………………………………	**PoD**			
Procedure 1: Manual search using metal-detectors and signal investigation.	**1**	**2**	**3**	**4**
Procedure 2: Manual search using area excavation with short hand tools.	**1**	**2**	**3**	**4**
Procedure 3: Manual search using area excavation with REDS rakes.	**1**	**2**	**3**	**4**
Procedure 4: Manual search conducting BAC.	**1**	**2**	**3**	**4**
Procedure 5: Manual search conducting BACS.	**1**	**2**	**3**	**4**
Procedure 6: MDD search with manual investigation of indications.	**1**	**2**	**3**	**4**

Hazard:……………………………………………………………………………………………	PoD			
Procedure 1: Manual search using metal-detectors and signal investigation.	**1**	**2**	**3**	**4**
Procedure 2: Manual search using area excavation with short hand tools.	**1**	**2**	**3**	**4**
Procedure 3: Manual search using area excavation with REDS rakes.	**1**	**2**	**3**	**4**
Procedure 4: Manual search conducting BAC.	**1**	**2**	**3**	**4**
Procedure 5: Manual search conducting BACS.	**1**	**2**	**3**	**4**
Procedure 6: MDD search with manual investigation of indications.	**1**	**2**	**3**	**4**
Continue this Table for all the anticipated Hazards at the task.				

Step 4: Assessing the Severity of Consequences (SoC)

The procedure that is being used can affect the severity of the consequences of the detonation of each hazard.

Either choose a SoC number for the hazard from the Table in Annex A, or use the following general rule for manual Search & Clearance procedures.

General rule for SoC numbers for manual procedures	
Small AP blast mines (under 50g HE)	2
Large AP blast mines	3
POMZ 2 and 2M AP frag mines	3
All other AP frag mines	4
All AT mines	4
Separate AP mine fuzes	2
All other separate fuzes	3
All submunitions	4
All Simple IEDs	3
All Complex IEDs	4
All other explosive hazards	4

The table in Annex A lists devices by name and the associated SoC numbers are derived from the injuries that have occurred in recorded demining accidents.

Then fill in TRA Table 2 below by writing in the hazard name and circling its SoC number.

TRA Table 2: SoC for the detonation of each hazard during manual procedures				
Hazard name/description				
	1	**2**	**3**	**4**
	1	**2**	**3**	**4**
	1	**2**	**3**	**4**
	1	**2**	**3**	**4**
	1	**2**	**3**	**4**
	1	**2**	**3**	**4**
	1	**2**	**3**	**4**
	1	**2**	**3**	**4**
Extend this Table if there are more hazards.				

Step 5: Assess additional risk presented by Task Conditions (TC)

The Task Conditions (TC) are the combination of the terrain, ground conditions, vegetation, weather, and any other obstructions there may be at a task. The additional risk presented by TC depends on the type of explosive hazard that is at the task and the procedures available to use.

TC that are known to increase risk of an unintended detonation during manual demining procedures are listed in the left hand column of TRA Table 3 below. Suggested ways to reduce the risk of an unintended detonation are listed on the right.

TRA Table 3: Task Conditions and ways to reduce risk of detonation

Task Conditions (TC)	Ways to reduce risk of detonation
When searching for AP blast mines	
Hard/rocky ground	Use blast resistant and long tools. Issue knee protection. Allow extra time for excavations. Use mechanical ground preparation when appropriate.
Soft/wet ground	Allow to dry. Check that the detector will locate the hazards at the required search depth in wet ground. Consider using mats for the searchers to stand/kneel on. Mechanically excavate and search the spoil after it has drained.
Cut or dead vegetation on ground	Search with a metal-detector, then use long handled light/leaf rakes to remove the vegetation, then search again with a metal-detector.
Dense undergrowth	Cut vegetation using a machine, or cut carefully by hand until the ground surface is visible and the metal-detector can be moved close to ground. Use long handled leaf rakes to remove the cut vegetation carefully.
Roots on ground surface	Issue long handled cutting tools and train to use them at as great a distance as possible. Do not allow long lengths of root to be pulled. Use mechanical ground preparation when possible.
More than 7 fragments in every m^2	Use powerful magnet wands (where no magnetic influence fuzes are anticipated) before and during metal-detection procedures.
Steep incline	Work uphill and ensure that employees have slip resistant footwear.
Wire obstructions	Issue high quality wire cutting and pulling tools and conduct refresher training in their use at the task. Cut wire into short lengths whenever possible. Issue heavy protective gloves when required.
Wrecked vehicles	Search up to the wreck, then use an armoured machine to move the wreck into a safe area. Issue strong flashlights to inspect the wreck when necessary. Plan to use area excavation to search where the wreck was because of heavy ground contamination. When appropriate, anticipate AXO/UXO associated with the wreck.
Ditches, trenches or canals	Train in a similar situation and increase depth of search inside the obstruction. Be aware that non-combatants may have put other explosive hazards in the ditch for ‘safe keeping’. Increase supervision to ensure oversight and revise working distances to allow for possible blast channelling. Use a suitably armoured excavator and sifter when available.
Presence of livestock	Liaise with owners to arrange absence of livestock. If livestock or wild animals enter, stop work and withdraw workers to rest areas. Post security guards to drive animals that may enter away.
When searching for AP fragmentation mines (stake mounted)	
Cut or dead vegetation on ground	Use metal-detectors, then use again after vegetation is removed piece by piece by hand. Issue vegetation cutting tools to allow the material to be removed in short lengths. Do not use leaf rakes.

Dense undergrowth	Cut undergrowth using an armoured machine. When machine cutting is not possible, stress the need to use visual search while cutting vegetation from the top in short lengths, sweeping with metal-detector after each cut below 40 cm. Use a tripwire feeling procedure before each cut when tripwires may be present.
More than 7 fragments in every m^2	Stress the need to use visual search as well as metal-detectors. Use powerful magnet wands (where no magnetic influence fuzes are anticipated) before and during metal-detector searches.
Steep incline	Work uphill and ensure that employees have slip resistant footwear.
Wire obstructions	Issue high quality wire cutting and pulling tools and conduct refresher training. Cut into short lengths whenever possible. Issue heavy protective gloves when required. Pull from as great a distance as possible and from a protected position. Use an armoured machine to pull the wires if tripwires or explosive hazards may be among the obstructions.
Wrecked vehicles	Search up to the wreck, then use a machine to move the wreck into a safe area. Issue strong flashlights to inspect the wreck when necessary. Plan to use area excavation to search where the wreck was because of heavy ground contamination. When appropriate, anticipate AXO/UXO associated with the wreck.
Ditches and canals	Train in a similar situation. Be aware that non-combatants may have put other explosive hazards in the ditch for 'safe keeping'. Also increase depth of search inside the canal/ditch. Increase supervision to ensure oversight and revise working distances to allow for possible blast channelling. Use a suitably armoured excavator and sifter when available.
Presence of livestock	Liaise with owners to arrange absence of livestock animals. Post security guards to drive animals that may enter away.
When searching for AP bounding fragmentation mines	
Cut or dead vegetation on ground	Use metal-detectors, then use again after vegetation is removed by hand. Issue vegetation cutting tools to allow the material to be removed in short lengths. Do not use leaf rakes.
Dense undergrowth	Cut undergrowth using an armoured machine. When machine cutting is not possible, stress the need to use visual search while cutting vegetation from the top in short lengths, sweeping with metal-detector after each cut below 40 cm. Use a tripwire feeling procedure before each cut when tripwires may be present.
Cut or dead vegetation on ground	Use appropriate metal-detectors to search the vegetation, then remove it cautiously/slowly by hand (do not use leaf rakes). Issue tools to cut the vegetation into short lengths when necessary.
More than 7 fragments in every m^2	Stress the need to use visual search as well as metal-detectors. Use powerful magnet wands (where no magnetic influence fuzes are anticipated) before and during metal-detector searches.
Steep incline	Work uphill and ensure employees have slip resistant footwear.
Wire obstructions	Issue high quality wire cutting and pulling tools and conduct refresher training. Cut into short lengths whenever possible. Issue heavy protective gloves when required. Pull from as great a distance as possible and from a protected position. Use an armoured machine to pull the wires if tripwires or explosive hazards may be among the obstructions.
Ditches and canals	Train in a similar situation. Also increase depth of search inside the obstruction. Be aware that non-combatants may have put other explosive hazards in the ditch for 'safe keeping'. Increase supervision to ensure oversight and revise working distances to allow for possible blast channelling. Use a suitably armoured excavator and sifter when

	available.
Wrecked vehicles	Search up to the wreck, then use a machine to move the wreck into a safe area. Issue strong flashlights to inspect the wreck when necessary. Plan to use area excavation to search where the wreck was because of heavy ground contamination. When appropriate, anticipate AXO/UXO associated with the wreck.
Presence of livestock	Liaise with owners to arrange absence of livestock. If livestock or wild animals enter, stop work and withdraw workers to rest areas. Post security guards to drive animals that may enter away.
When searching for <u>AT mines</u>	
Hard/rocky ground	Do not use two handed hand tools, such as picks. Expose all around the mine and pull to turn it over from a safe distance.
Presence of livestock	Liaise with owners to arrange absence of livestock. If livestock or wild animals enter, pause work and withdraw workers to rest areas. Post security guards to drive animals that may enter away.
When searching for <u>general explosive hazards</u>	
Hard/rocky ground	Use distinct area marking and appropriate metal-detectors.
Soft/wet ground	Allow to dry. Check that the detector will locate the targets at the required search depth in wet ground. Consider using mats for the searchers to stand/kneel on. Do not rely only on visual search.
Significant undergrowth	Cut vegetation from the top sweeping with detector after each cut below 40cm. If hazards were air dropped, search the vegetation before each cut.
Steep incline	Conduct search uphill and ensure employees have slip resistant footwear.
When searching for <u>submunitions</u>	
Hard/rocky ground	Use distinct searched area marking and appropriate metal detectors designed for area search. Do not use ferrous locators unless the target is mainly ferrous. Do not use stick detectors for area search because a larger search head is required to ensure full ground coverage. Do not rely only on visual search.
Soft/wet ground	Allow to dry. Search to greater depth. Check that the detector will locate the targets at the required search depth in wet ground. Consider using mats for the searchers to stand/kneel on.
Cut or dead vegetation on ground	Use appropriate metal-detectors to search the vegetation, then remove it cautiously/slowly by hand (do not use leaf rakes). Issue tools to cut the vegetation into short lengths when necessary. Do not rely only on visual search.
Dense undergrowth	Armed submunitions may be expected to be trapped in vegetation or slowed to the extent that they may be lying on the ground surface. Cut undergrowth cautiously after visual search. Cut from the top in short lengths, sweeping with a metal-detector after each cut. Do not rely on search using stick detectors.
Steep incline	Conduct search uphill and ensure employees have slip resistant boots. Presume munitions may have moved downhill.
Wire obstructions	Issue quality cutting and pulling tools and conduct refresher training. Pull from a distance using a suitably armoured machine when munitions may be among the wire obstruction(s).
Ditches and canals	Use distinct area marking, train in a similar situation and increase depth of search inside the canal/ditch. Use a suitably armoured excavator and

	sifter if available and the risk of damage to the machine is acceptable (when submunitions have not armed, for example).
Presence of livestock	Liaise with owners to arrange absence of livestock. If livestock or wild animals enter, stop work and withdraw workers to rest areas. Post security guards to drive animals that may enter away.
When searching for IEDs	
Urban areas	Approach and examine with a remote camera whenever possible (ground robot or SUA). Presume multiple initiation systems that may extend a distance from the hazard. If battery operated initiation systems are anticipated, do not presume that the batteries or capacitors will be dead after a period of time. Disrupt from a distance or attach a pulling system (robotically whenever one is available). In buildings, remember that the electrical wiring may be part of the initiation circuit.
All these entries should be extended to include the experience in the working area. They provide the basis for a Field Risk Register which every programme must keep.	

TRA Table 4 below shows how to assess the additional risk presented by the TC at each task.

TRA Table 4: Assessing increased risk presented by TC

Hazard type	Hard/rocky ground	Soft/wet ground	Cut or dead vegetation on ground	Dense undergrowth	Roots on ground surface	More than 7 fragments p/m^2	Steep incline	Wire obstructions	Wrecked vehicles	Ditches, trenches or canals	Presence of livestock	TC number
AP blast mines	+4	+3	+1	+1	+2	+1	+1	+1	+2	+3	+2	
	+1	0	0	0	0	0	0	0	0	0	0	
AP frag mines (stake mounted)	-	-	+2	+3	-	+1	+1	+1	-	-	+1	
	-	-	0	0	-	0	0	0	-	-	0	
AP bounding fragmentation mines	-	-	+1	+4	-	+1	+2	+1	-	+3	+1	
	-	-	0	+1	-	0	0	0	-	0	0	
AT mines	+2	-	-	-	-	-	-	-	-	-	+1	
	0	-	-	-	-	-	-	-	-	-	0	
Ordnance	+1	-	-	+1	-	-	+1	-	-	-	-	
	+1	-	-	0	-	-	0	-	-	-	-	
Submunitions	+2	+3	+2	+4	-	-	+2	+1	+1	+2	+1	
	+1	+1	0	+1	-	-	0	0	0	0	0	

The additional risk presented by the conditions is the number with a yellow background. In most cases, the measures in TRA Table 3 can be taken to reduce that risk. When those measures have been taken, the numbers with a green background should be used.

Add the relevant TC risk numbers for each type of hazard and write the total in the right hand column.

The TC number represents the additional risk presented by Task Conditions for each type of explosive hazard and all manual Search & Clearance procedures.

Step 6: Calculating the risk numbers

For each explosive hazard expected at the task, you now have a Probability of Detonation number (PoD), a Severity of Consequences number (SoC) and a number for the additional risk presented by the Task Conditions (TC).

Write each explosive hazard into TRA Table 5, then calculate the total risk number for that hazard and that procedure at this task by multiplying the PoD by the SoC number, then adding the TC number.

TRA Table 5: Calculating Risk Numbers

	PoD	x	SoC	+	TC	=	Total Risk Number
Hazard:							
Procedure 1		x		+		=	
Procedure 2		x		+		=	
Procedure 3		x		+		=	
Procedure 4		x		+		=	
Procedure 5		x		+		=	
Hazard:							
Procedure 1		x		+		=	
Procedure 2		x		+		=	
Procedure 3		x		+		=	
Procedure 4		x		+		=	
Procedure 5		x		+		=	
Hazard:							
Procedure 1		x		+		=	
Procedure 2		x		+		=	
Procedure 3		x		+		=	
Procedure 4		x		+		=	
Procedure 5		x		+		=	
Hazard:							
Procedure 1		x		+		=	
Procedure 2		x		+		=	
Procedure 3		x		+		=	
Procedure 4		x		+		=	
Procedure 5		x		+		=	
Hazard:							
Procedure 1		x		+		=	
Procedure 2		x		+		=	
Procedure 3		x		+		=	
Procedure 4		x		+		=	
Procedure 5		x		+		=	
Extend this table when there are more anticipated hazards at the task.							

Step 7: Comparing risk numbers

With the risk numbers prepared, the appropriate procedures to use at the task must be decided.

The risk number calculated for a particular hazard and procedure at a task can be evaluated using TRA Table 6 below.

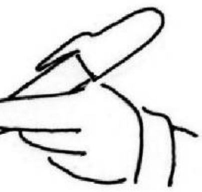
TRA Table 6: Tolerable and unacceptable risk numbers		
Above 10	Not acceptable	This represents an intolerable risk: alternative procedures to reduce risk must be selected.
9	Tolerable, but undesirable	A number 9 can only be accepted if no alternative procedures are available.
5-8	Tolerable	The level of risk means that hazard related injury should not occur if procedures are correctly conducted.
1-4	Normal	The level of risk means that hazard related injury or fatality is very unlikely.

Use the results to select which procedures are appropriate to use at the task.

6.1 Calculating using a risk matrix

The basic formula used in this risk assessment is:

$$(PoD \times SoC) + TC = R$$



This formula has the advantage that all numbers in the scale can be generated by the formula. This risk matrix can be used to read off the result.

PoD				
PoD 4	4	8	12	16
PoD 3	3	6	9	12
PoD 2	2	4	6	8
PoD 1	1	2	3	4
	SoC 1	SoC 2	SoC 3	SoC 4

\+ SoC

TC
0
1
2
3
4

=

1	5	9	13	17
2	6	10	14	18
3	7	11	15	19
4	8	12	16	20

Example: we are using metal-detectors to search in an area where the hazards include bounding fragmentation mines and there is dense vegetation. Accidents have occurred doing this when the procedures appear to have been conducted incorrectly, so the Probability of Detonation (PoD) is 2. The Severity of Consequences for a bounding fragmentation mine is 4 because these accidents often cause catastrophic injuries and are frequently fatal. So read off the intersection of a PoD of 2 against a SoC of 4 and the answer is the orange square 8. We are working in an area with dense vegetation so must add a TC number of 4. The risk number is equal to 12, shown red in the matrix because it is not tolerable. If we take the measures to reduce risk that are suggested in TRA Table 3, the TC number drops to 1 and the risk number is reduced to 9. This is tolerable, but still undesirably high. We have already reduced the TC by planning to cut the vegetation with a machine before the Search & Clearance procedure is conducted. After the machine has passed there will be cut vegetation on the ground which has an additional TC number of 1. If we reduce the risks associated with having cut undergrowth on the ground that are recommended in TRA Table 3, the TC number becomes 0. The risk number for this procedure with these hazards at this task is now 2 x 4 + 0 = 8. This is the lowest potential risk number we can generate and means that an unintended detonation should not occur if procedures are correctly conducted. By increasing supervision and conducting some task specific continuation training before starting the work, there can be confidence that the staff will conduct the procedures correctly and that everything reasonable to minimise risk has been done.

6.2 Field Risk Register

A formal Field Risk Register must be kept in all programme offices and be accessible to all Task Assessment teams. The Field Risk Register must be derived from a broad knowledge base including all available documented experience/evidence and contributions from experienced staff. A Field Risk Register provides a reference when conducting TRA and will help the organisation to make risk management decisions that are based on evidence (and that can be shown to have been based on evidence in the event of need). Risks identified in a TRA that are not already in the Field Risk Register must be added to it, along with the means of reducing or avoiding them that are used.

The content of TRA Table 3 can be used as the basis of a Field Risk Register with fields added to indicate whether the risk mitigation/avoidance measures were successful, as shown below.

Example Field Risk Register template			
Identified Risk	**Ways to reduce risk**	**Ways to avoid risk**	**Success?**
Wet ground made the deminers slip when using a metal-detector and when excavating detector indications.	Tried 1m x 1m closed-foam kneeling mats. Tried 2m x 1m closed-foam kneeling mats.	Wait until ground is dry.	Small mats did not work, deminers stepped off them frequently and they got in the way. 2m x 1m mats were successful and deminers were able to work longer without discomfort.
Sharp rocks prevented deminers kneeling to work. This made them unsteady and clumsy when exposing hazards.	Issued Velcro fastening gel knee pads.		Deminers kneel on sharp rocks without discomfort. The knee pad straps needed to be reinforced because they broke quickly.
Etc.			
Redesign and extend this table as much as necessary. A Field Risk Register should be a large document.			

The maintenance of a detailed Field Risk Register has the added advantage of maintaining an institutional record (corporate memory) of experience that survives the changing of staff.

The Field Risk Register provides a dataset of field risk management that records whether the risk avoidance and mitigation methods tried have been successful. Having a detailed record of successes and failures makes subsequent field risk management simpler and prevents mistakes being repeated.

When the NMAA or other HMA organisations ask to share the Field Risk Register, this should only be done on a reciprocal basis.

6.3 Re-evaluating risk in the event of an accident or incident

After any accident or incident, the TRA should be reviewed to find out whether the risk assessment should be revised because of the event. Changes in demining procedures and tools may be required in order to prevent a repetition of the accident/incident. Changes must be made if the procedures or tools made an unintended detonation more likely than expected or were the reason for leaving a hazard behind. Changes may involve continuation training or the use of other procedures and tools at the task, or part of the task, where the accident/incident occurred.

If an unintended detonation results in injury or an explosive hazard is located during an internal QA check, all work in the hazardous area should stop until the review of the TRA has been conducted and the accident/incident has been investigated in accordance with the requirements of the NMAA and internal accident/incident investigation requirements (see Chapter 13 of these SOPs).

The available accident records imply that, in a worst case scenario, an injurious demining accident may be expected to occur once in every 33 person-years of work. A severely disabling or fatal accident may be expected to occur once in 50 person-years of work. An accident once in every 33 years means that for a team of 33 deminers, one injurious accident a year might be expected. This represents a worst case situation and so includes a margin of error that overstates the risk rather than underestimates it. If there are accidents with greater frequency in any one year (measured in months leading up to the latest accident), the potential for remedial action must be urgently explored.

Annex A: Data from demining accidents

The Database of Demining Accidents (DDAS) is an informative reference in the IMAS and an online version is available at www.ddasonline.com. The DDAS contains records of investigations into unintended detonations from demining programmes around the world. Common features can be compared and trends identified with a basis of statistical evidence that is more reliable than any individual's experience.

Many observations of value about the risk presented by types of explosive hazards to employees can also be gathered from the Database of Demining Accidents. For example, previous risk assessment for demining in mixed minefields have often imposed safety requirements based on the presumption that the greatest risk is presented by the largest device present. The accident record indicates that the device most likely to be detonated during manual Search & Clearance procedures is usually not the largest device present (which is usually not an anti-personnel device designed for victim initiation).

Although the DDAS has real value, the accident record is only a record of risk management failings. A mature Field Risk Register which lists identified field risks and the actions taken to reduce or avoid them provides a dataset of field risk management successes as well as failures and so can be of greater value.

Experience of demining accidents and incidents should be shared with the NMAA and other agencies as a means of sharing experience to prevent any misunderstandings or mistakes being repeated. As a minimum, accident and incident data must be shared with the Database of Demining Accidents, which shares its records after removing all names and identifiers. Reports should be sent to avs@ddasonline.com.

Mines and ERW involved in demining accidents

More than 2/3rds of all demining accidents involve AP blast mines. The remaining 1/3rd involve other explosive hazards. Device types involved in accidents are listed below in order of frequency, starting with the most frequent.

1. AP blast mines.
2. AP bounding fragmentation mines.
3. AT mines.
4. Submunitions.
5. Fuzes (unidentified).
6. AP fragmentation mines (stake mounted).
7. All other explosive hazards.
8. Grenades (hand).
9. IEDs.
10. Mortar bombs (HE).
11. Phosphorous.
12. Propellant.

Of course, explosive hazards that are rarely found are not likely to feature in many accidents even if they are particularly dangerous, so while the list above is accurate, it does not mean that an AP blast mine is more hazardous than an IED.

SoC numbers for common mines and munitions

The table below is derived from accident data and lists SoC numbers for some named mines and ERW when conducting any Search & Clearance procedure (including BAC and BACS).

NOTE: *The SoC number presumes that PPE is worn correctly and that appropriate medical treatment is immediately available.*

The explosive hazards in the table are listed in alphabetical order. When an explosive hazard is not listed, the SoC number for a hazard with similar properties should be used.

Severity of Consequence (SoC) numbers for common mines and munitions			
Explosive hazard	**Recommended SoC number**	**Explosive hazard**	**Recommended SoC number**
APM-1 AP d/frag	4	PMD-6/M AP blast	3
APPM-57 AP blast	3	PMN AP blast	3
C-3-A/B AT blast	4	PMN-2 AP blast	3
Cuban AT blast	4	POMZ-2 AP frag	3
Cuban box AP blast	3	POMZ-2M AP frag	3
DM-11 AP blast	3	PP Mi-D AP blast	4
DM-31 AP b/frag	4	PP Mi-Sr AP b/frag	4
FBM AT blast	4	PPM-2 AP blast	3
FFV 013 AP d/frag	4	PRB M3/A1 AT blast	4
GYATA-64 AP blast	4	PRB-M35 AP blast	2
Hamdy AP d/frag	4	PROM-1 AP b/frag	4
LI-12 AP d/frag	4	P-S-1 AP b/frag	4
M14 AP blast	2	Pt Mi Ba III AT blast	4
M15 AT blast	4	PT Mi-D AT blast	4
M16 and M16A1 AP b/frag	4	R2M1/2 AP blast	3
M16A2 AP b/frag	4	SA No.8 AT blast	4
M18A1 AP d/frag	4	Shrapnel No 2 AP d/frag	4
M19 AT blast	4	SPM limpet	4
M24 AT HEAT blast	4	TM-46 AT blast	4
M6A2 AT blast	4	TM-57 AT blast	4
M7A2 AV blast	4	TM-62B AT blast	4
MAI-75 AP blast	3	TM-62M AT blast	4
MAPS/M/411 AP blast	3	TMA-2 AT blast	4
MAT-76 AT blast	4	TMA-3 AT blast	4
MI AP DV 59 AP blast	3	TMA-4 AT blast	4
Mini MS-803 AP d/frag	4	TMA-5 AT blast	4
Mk 2 AP b/frag	4	TMD-44 AT blast	4
Mk 5 AT blast	4	TMD-B AT blast	4
Mk 7 AT blast	4	TMK-2 AT blast	4
MON-100 AP d/frag	4	Type 66 AP d/frag	4
MON-200 AP d/frag	4	Type 72(a) AP blast	3
MON-50 AP d/frag	4	Valmara 69 AP b/frag	4
MPM limpet	4	VAR/40 AP blast	3
No.4 AP blast	3	VS-50 AP blast	3
NR409 AP blast	3	VS-MK2 AP blast	3
OZM 3 / 4 AP b/frag	4		
OZM 72 b/frag	4		
OZM-160 AP b/frag	4	Fuzes (separated)	3
P3 Mk 2 AT blast	4	Grenade (hand or rifle)	4
P4 Mk 1 AP blast	3	IED (Simple)	3
PMA-1 AP blast	3	IED (Complex)	4
PMA-2 AP blast	2	Mortar HE (various)	4
PMD-6 AP blast	3	Phosphorus	3

Annex B: Examples of hazards with a varied Probability of Detonation

Accidents sometimes occur when using the same procedures and tools that have been used in areas where there have been no accidents. In some cases, this can be explained by the fact the explosive hazards were in an unanticipated condition, or in an unexpected position in the ground. The Task Risk Assessment must be urgently reviewed whenever unanticipated finds increase the Probability of Detonation (PoD) at a task.

When a hazard has been damaged or decayed and the fuze mechanism may be unstable there can be an increased risk of injury. Other parts of a munition may present a greater hazard than the fuzing system. Examples are corroded phosphorous munitions that ignite when the filling is exposed to air, and corroded rocket munitions that leak propellant when moved.

Any explosive hazard that cannot be identified should be 'turned' from a safe distance before deciding whether it is safe to move. Whenever its condition is uncertain, it should be destroyed where it is.

Demining procedures that increase the distance between the deminer and the hazards should be selected whenever possible.

Hazards damaged by age and fire

Corrosion and other degradation can significantly alter the degree of risk faced when exposing or destroying an explosive hazard. Sometimes the way that a hazard atrophies over time can make it present less risk to the deminer, sometimes more.

The extreme temperatures in the desert in Iraq have made this TM46 expand dramatically. While the fuze may no longer be in contact with the High Explosive, it is uncertain what has happened inside so the mine should be destroyed without moving it.

Exposure to the sun has split this PFM-1 open so that its High Explosive content has evaporated. It still contains a detonator so must be handled with caution, but it can be moved for demolition.

This POMZ2-M had fallen over and become buried, then corroded so badly that the MUV fuze has not functioned despite the fact that its retaining pin has rusted away. Its High Explosive was no longer inside. This mine could be moved for demolition but some others in the same minefield had not fallen over and corroded in the same way and their fuzes were still functional (although no sign of their original tripwires remained).

Anti-tank pressure mines usually take a considerable force on the pressure plate to initiate but it would take much less force to depress the exposed fuzes in this SACI mine after the top had atrophied in the sunlight and broken away.

Hazards may also be damaged by fire, which destroyed the rubber top of this PMN.

When heated in a fire, plastic MUV-4 fuzes soften and may collapse or the firing-pin may spring away backwards. meaning that the initiation system is no longer able to function.

Tripwires are typically weakened in a fire by losing their paint or plastic protection, after which they rapidly corrode.

Hazards in unusual positions

If the mine is lying on its side, the first thing touched by an excavation hand tool may be the pressure plate.

Mines may have been deliberately placed on their sides, in which case the pressure plate will probably face the enemy. But they may have been moved into this position by soil movement or root growth, so the pressure plate could face in any direction.

This M14 was found in an area where a river had deposited a lot of silt.

It was found unusually close to another mine that was in a horizontal position. They may have been moved by floodwater but they were found in a known minefield, so it is likely that one mine was deliberately placed on its side to target anyone trying to remove them.

This PMN was found with several others that had been laid on their side amongst a patterned minefield of mines laid horizontally. They had definitely been placed to target anyone trying to clear the minefield because many other mines were found with ML-7 anti-lift devices placed beneath them in the same minefield.