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Remote Explosive Scent Tracing (REST)

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Foreword

International standards for humanitarian mine clearance programmes were first proposed by working groups at an international technical conference in Denmark, in July 1996. Criteria were prescribed for all aspects of mine clearance, standards were recommended and a new universal definition of 'clearance' was agreed. In late 1996, the principles proposed in Denmark were developed by a UN-led working group and the International Standards for Humanitarian Mine Clearance Operations were developed. A first edition was issued by the UN Mine Action Service (UNMAS) in March 1997.

The scope of these original standards has since been expanded to include the other components of mine action, and to reflect changes to operational procedures, practices and norms. The standards were re-developed and renamed as *International Mine Action Standards* (IMAS).

The United Nations has a general responsibility for enabling and encouraging the effective management of mine action programmes, including the development and maintenance of standards. UNMAS, therefore, is the office within the United Nations responsible for the development and maintenance of IMAS. IMAS are produced with the assistance of the Geneva International Centre for Humanitarian Demining.

The work of preparing, reviewing and revising IMAS is conducted by technical committees, with the support of international, governmental and non-governmental organisations. The latest version of each standard, together with information on the work of the technical committees, can be found at http://www.mineactionstandards.org/. Individual IMAS are reviewed at least every three years to reflect developing mine action norms and practices and to incorporate changes to international regulations and requirements.

Introduction

The use of vapour sampling and filter analysis, or Remote Explosive Scent Tracing (REST) as it is more commonly called, for explosive detection has seen limited acceptance by the international mine action community. Only a few organisations are currently using REST, which offers a fast and cost-effective way of checking suspected sectors of roads or land for mines or ERW, including unexploded sub-munitions.

Despite its current limited use, the REST system has the potential to significantly speed up the demining process, particularly as the system gets more refined. REST is one of the many demining tools available to mine action programmes today.

In a REST system, explosive vapour is captured onto filters, which are transported to locations where specifically trained sniffer animals check the filters for traces of the target odour. Each filter represents a sector of road or land, and the animal's response to a filter informs the demining agency as to where to focus their technical survey or clearance activities.

REST is not a stand-alone system and should be used in conjunction with other sources of information such as rapid detection tools. REST can be considered a technical survey tool that distinguishes between areas requiring further investigation, (termed suspect positive sectors) and areas that may not require further investigation (termed suspect negative sectors).

The REST system is described in detail in this standard. This standard also provides specifications and guidance for the planning, implementation, conduct and overall management of REST operations.

Remote Explosive Scent Tracing (REST)

1. Scope

This standard describes the REST system and provides specifications and guidelines for the planning, preparation, implementation, conduct and overall management of REST operations.

2. References

A list of normative references is given in Annex A. Normative references are important documents to which reference is made in this standard and which form part of the provisions of this standard.

3. Terms, definitions and abbreviations

A complete glossary of all the terms, definitions and abbreviations used in the IMAS series of standards is given in IMAS 04.10.

In the IMAS series of standards, the words 'shall', 'should' and ‘may’ are used to indicate the intended degree of compliance. This use is consistent with the language used in ISO standards and guidelines:

a) 'shall' is used to indicate requirements, methods or specifications which are to be applied in order to conform to the standard;

b) 'should' is used to indicate the preferred requirements, methods or specifications; and

c) 'may' is used to indicate a possible method or course of action.

The term 'National Mine Action Authority (NMAA)' refers to the government entity, often an inter-ministerial committee, in a mine-affected country charged with the responsibility for the regulation, management and coordination of mine action.

Note: In the absence of a NMAA**,** it may be necessary and appropriate for the UN, or some other recognised international body, to assume some or all of the responsibilities, and fulfil some or all the functions, of a MAC or, less frequently, an NMAA.

The terms 'demining organisation' refers to any organisation (government, NGO or commercial entity) responsible for implementing demining projects or tasks. The demining organisation may be a prime contractor, subcontractor, consultant or agent.

The term 'target odour' is used to describe the scent from the target item.

The term ‘scent trapping’ is used to refer to the process of collecting target odour in filters.

The term ‘breaching’ is in the context of this IMAS used to describe the provision of safe access lanes for men and women involved in scent trapping.

The term ‘sampling operation’ is used to describe the overall field operation established for the purpose of collecting scent on filters. The term comprises the breaching and scent trapping functions as well as other related activities, such as field logistics, rescue services, medical back-up and communications.

The term ‘indication’ or ‘indicated’ are used to describe the trained response given by a sniffer animal which is used to return a filter as suspect positive.

The term ‘hit rate’ refers to the number of positive filters indicated by sniffer animal(s) as a percentage of the total number of positive filters available.

The term 'False Alarm (FA)' refers to an indication on a negative filter. The term 'false alarm rate' refers to the number of negative filters indicated by sniffer animal(s) as a percentage of the total number of negative filters available.

4. General

4.1. Overview of the REST system

REST involves the sampling of air and dust, possibly containing target odour, from the ground surface in suspected hazardous areas using vehicle mounted or portable-sampling machines. The sampling machines suck air and dust through filters designed to trap the particles of dust and any target odours contained in the air.

The sampling machines are carried or driven over sectors of land of a predetermined size at a steady walking or driving pace until the whole area within the sector has been covered. When walking, the filter, which is fitted in the head of a tube attached to the sampling machine, is swept from side to side to ensure that the entire area within the sector is covered.

Between each sector, the filters are changed, and the used filters are marked and stored in containers. Each filter is marked with a sector reference number. Sufficient survey information is recorded to ensure that the sector and the filter can be linked.

Upon completion of the sampling, the filters are transported to a central location for analysis by specially-trained sniffer animals (dogs or rats). The animals have been trained to sniff the filters and indicate which filters contain traces of the target odour. If the animals indicate a filter contaminated with target odour, the sector represented by that filter will be considered as positive and may contain mines or ERW, including unexploded sub-munitions.

When the filters have been analysed, follow-up investigation using manual, mechanical or Mine Detection Dog (MDD) techniques is required in all the sectors indicated as positive. Some investigation may also be carried out in negative sectors as an additional quality check.

To ensure that manual sampling can be carried out safely, lanes are breached into suspected hazardous areas in advance of sampling for the manual sampling teams to follow.

4.2. Components of a REST system

The system has five principal components:

a) breaching;

b) scent trapping;

c) analysis;

d) follow-up investigation; and

e) data management.

4.2.1. Breaching

One of the major challenges is to get access to areas where scent trapping is to be undertaken. Safe access is ensured by a breaching team whose main responsibility is to provide safe lanes for the scent trapping teams.

4.2.2. Scent trapping

The primary function of scent trapping is to ensure that air (and often dust) is collected systematically over the whole sector being investigated.

Note: Dust particles carry significantly more attached molecules of explosive chemicals than are freely available in the air.[1] However, dust can cause the filter to clog. If sampling is to be conducted in dusty environments, it is recommended that filters should be changed when the flow rate of air through the filter is reduced to 80% of the flow rate through a clean filter.

4.2.3. Analysis

Analysis is undertaken with specially-trained sniffer animals to determine whether a filter is contaminated with target odour. It may be possible to analyse filters using chemical analysis in a laboratory or other controlled environment.

4.2.4. Follow-up investigation

The purpose of follow-up investigation is to check the positive sectors and clear any mines or ERW located. This standard does not address the activities undertaken by the follow-up investigation teams.

For Quality Control (QC) purposes, some negative areas may also be subject to investigation. Quality Management (QM) for REST operations is covered in Annex B.

4.2.5. Data management

The data management system should ensure that a filter and its associated sector can be tracked from when the scent sample is taken, through analysis to the follow-up investigation.

Records should be kept on the mines and ERW (including unexploded sub-munitions) found, and the locations of these finds (whether in positive or negative sectors). The results should be fed back to the REST project manager and the external Quality Assurance (QA)/QC agencies, to provide a check on the reliability of the REST system.

The results of follow-up investigation should be used as part of QC on the REST system.

4.3. System application

The primary use of a REST system is for eliminating sectors of land that do not contain traces of the target odour. It is best used in areas where a low density of mines or ERW is suspected. The following system applications are suggested:

a) elimination of sections of road. The REST system is a fast and cost-effective means of screening large sections of road. REST will have less application on heavily-mined roads or on roads with extensive previous military activity. Such stretches of road are likely to be heavily contaminated with target odour and few sectors would be eliminated by the screening process;

b) verification or releasing land. Because of a lack of specific information, areas are often cleared where no mines or ERW are present. While the REST system is not appropriate for areas with regular or patterned minefields, it may be used where the objective is to determine if there is a mine/ERW hazard in a large area (verification), or for releasing all or part(s) of a suspected land that contains no hazards; and

c) detection of explosives in enclosed spaces. Confined spaces with entrapped air may be ideal for the application of REST.

5. Air sampling

The air sampling operation is managed by a Field Manager whose responsibilities include, but are not limited to:

[1] Reference to be added.

a) planning and management of the overall air sampling operation;

b) co-ordination between the breaching and scent trapping teams;

c) ensuring that appropriate safety and security measures are applied;

d) ensuring emergency medical support and rescue systems are in place;

e) ensuring communications systems are in place and functioning whilst operations are ongoing;

f) co-ordination of logistic support to the operation;

g) managing the preparation, storage and transfer of records prepared during the air sampling operation; and

h) ensuring that procedures for the management and storage of unused and used filters are followed.

Air sampling comprises two main activities; breaching and scent trapping. There is a close link between a breaching team and a scent trapping team and the roles and responsibilities of both teams may overlap. For simplicity, the two functions are described separately in this standard.

6. Breaching

A key element of the sampling process is safe access for the scent trapping team. This is achieved by the breaching of safe lanes for the scent trapping teams to follow. Breaching is normally carried out mechanically, but breaching may also be carried out manually or by MDD. Only mechanical breaching is covered in this standard as it is most commonly used.

Mechanical breaching is carried out by driving mine-proofed vehicles in a regular pattern through the area prior to sampling. If the minimum ground pressure from the vehicle tyres exceeds the maximum pressure caused by normal walking, the tracks created from the vehicles can be considered safe to walk in.

The breaching Team Leader is normally located in the first mine-proofed vehicle during operations. Radio contact is maintained with a second mine-proofed vehicle (and any other vehicles) as well as the Project Manager and the scent trapping Team Leader.

Note: Some breaching operations may use a mine roller towed behind the lead mine-proofed vehicle as an additional search technique.

6.1. Breaching team composition

A breaching team should include the following male and/or female staff:

a) Team Leader (1). The Team Leader is responsible for the management of the breaching operation under the direction of the Field Manager and in accordance with Standard Operating Procedures (SOPs). Specific responsibilities include:

(1) inspection of vehicles, accessories, and other tools/assets prior to the breaching operation commencing to ensure that they are serviceable and the operations can be carried out safely;

(2) evaluation of the work area (in consultation with the Field Manager) to determine the suitability of the mine-proofed vehicles to operate in the area. This evaluation should consider the terrain conditions and any likely hazard to the vehicles/personnel;

(3) ensuring the safety of all personnel carrying out breaching operations;

(4) directing the travel of the breaching vehicle to ensure that the breaches are properly spaced and cover the whole of the sectors to be sampled;

(5) inspecting the lanes created by the wheels of the vehicles to ensure that they are clearly visible. If they are not, marking may be required;

(6) ensuring the marking of sectors to be sampled is carried out correctly, markings are accurate, and appropriate GPS readings are recorded;

(7) management and coordination of any vehicle recovery required; and

(8) overseeing the maintenance or repair of the mine-proofed vehicles.

b) Marker (1). The Marker is responsible for marking and recording the sectors to be sampled, including the locations where filters will be changed. The Marker normally uses a measuring wheel to measure the distance between each filter change. The Marker works a safe distance behind the lead mine-proofed vehicle(s) and in front of the scent trapping team. One of the Deminers may be employed as the Marker (see sub clause f) below);

c) Paramedic (1). The Paramedic is responsible for ensuring that emergency medical support in accordance with IMAS 10.40, national standards, or the demining organisation's SOPs, is available at all times while REST operations are ongoing. The Paramedic is also responsible for the treatment of non-urgent injuries and illnesses;

d) Drivers (2-3). Drivers are responsible for driving assigned vehicles, routine driver level maintenance and assisting the Mechanic with repair and maintenance of the vehicles;

e) Mechanic (1). The Mechanic is responsible for the establishment of maintenance routines, overseeing the maintenance and repair of vehicles and the spare-part requirements during the operation. The Mechanic may be one of the Drivers; and

f) Deminers (2-3): Deminers provide manual demining in the event of an accident, vehicle breakdown or other emergency situation. Deminers have dual roles supporting other elements of the breaching or scent trapping teams.

6.2. Mine-proofed vehicle specifications

Mine-proofed vehicles used for REST breaching operations shall conform to the following standards:

a) the vehicles shall be designed to withstand AT mine detonations without putting the crew or passengers at intolerable risk or causing irreparable damage to the vehicle;

b) the vehicles shall exert a ground bearing pressure that exceeds the pressure caused by personnel walking and carrying equipment. The pressure shall be determined by Testing and Evaluation (T&E) of the mine-proofed vehicle under all likely operational scenarios, in accordance with the requirements of IMAS 09.50; and

Note: The ground pressure from a foot varies from 2kg/cm^2 to about 15kg/cm^2, depending on the weight of the person, the equipment being carried, the soil type, the speed and way of walking, and the pressure distribution in the footwear. The ground pressure created by the most common mine-proofed vehicles varies from 10 – 45kg/cm^2 depending on ground surface evenness, pressure distribution, tyre pressure, load, and speed. The relatively small margin between the pressure applied by the vehicle and the foot gives reason for caution. Thus the concentrated load on the ground caused by sampling staff should be sufficiently distributed by issuing footwear constructed to distribute the pressure. Military boots with hard heels will result in a reduced pressure area making them less suitable. Large, flat, soft rubber soles provide a better distribution and reduce the concentrated load on the ground.

c) each track (safe lane) created by the vehicle shall be at least 30 cm wide and clearly visible to staff required to follow behind the vehicle on foot.

6.3. Operational procedures for mechanical breaching

SOPs developed for REST operations shall include the following requirements applicable to mechanical breaching operations:

a) prior to any mechanical breaching operations an evaluation of the work area is to be carried out by the breaching Team Leader (in consultation with the Field Manager) to determine the suitability of the mine-proofed vehicles to operate in the area. This evaluation should consider the terrain conditions and any likely hazard to the vehicles/personnel;

b) at least two mine-proofed vehicles shall support one air sampling operation (breaching and scent trapping). The main function of the first vehicle is to provide safe access for the marking and scent trapping staff. The main function of the second vehicle is to provide rescue support including recovery of the first vehicle (see IMAS 09.50). The second vehicle shall therefore be equipped with towing hooks and cables, crowbars, spares, demining equipment and medical equipment;

c) all personnel in mine-proofed vehicle shall always be securely strapped into their seats while a vehicle is moving. If some of the staff need to undo the strapping during driving, the vehicle shall be stopped before the straps are undone and remain stationary until all staff are fully strapped in again; and

d) all equipment carried inside the cabin of a mine-proofed vehicle must be adequately tied down.

7. Scent trapping

7.1. General

Scent trapping can be undertaken mechanically by mounting filters onto mine-proofed vehicles, although manual scent trapping is used more widely. Manual scent trapping gives better control of the trapping process by ensuring that samples are taken at the required distance above the ground surface and the whole area within a sector is covered.

Manual scent trapping is carried out using portable motorised vacuum pumps attached to an extendable tube. The filter is fitted in the head of the tube (filter holder). The filter is systematically swept in a regular pattern over the ground surface so that the whole area to be sampled is covered.

7.2. Composition of the scent trapping team

A manual scent trapping team should include the following male and/or female staff:

a) Team Leader (1). The Team Leader is responsible for the management of the scent trapping operation under the direction of the Field Manager and in accordance with SOPs. The Team Leader normally follows behind the scent trapping staff and monitors their walking steadiness/speed, search pattern and filter changes. Specific responsibilities include:

(1) inspection of equipment and staff before scent trapping operations start;

(2) ensuring the safety of all personnel carrying out the scent trapping operation;

(3) monitoring the scent trapping staff to ensure that correct sampling procedures are followed in terms of speed, search pattern, avoidance of contamination, record keeping and changing filters;

(4) ensuring that the filters are changed at the locations marked by the marking staff;

(5) ensuring that the scent trapping staff walk steadily in the centre of their lanes and that the roles of the vacuum Pump Operators and Filter Handlers are rotated frequently;

(6) ensuring that routine maintenance of sampling equipment is carried out; and

(7) ensuring that the handling, marking, and storage of filters are carried out correctly. The scent trapping Team Leader is required to verify the marking of each filter as part of internal QA procedures.

b) Pump Operators (2). The Pump Operators are responsible for operating the vacuum pumps that suck the samples of air and dust. The two Pump Operators walk in the safe lanes created by the mine-proofed vehicle tracks (one in each lane), and sweep the filter systematically either side of the safe lane, out to a specific distance; and

c) Filter Handlers (2). Filter Handlers are responsible for monitoring the sampling pattern and walking speed, decontaminating the filter holder, changing filters, and either keeping records or ensuring that correct records are passed regularly to the Team Leader. Filter Handlers typically walk 2m to 3m behind the Pump Operators.

The Paramedic, Drivers, Mechanic and the Deminers support both the breaching and scent trapping teams.

7.3. Scent trapping - operational requirements

7.3.1. Detection distance

An animal can be trained to reliably detect a target odour on a filter when the filter has passed by a target item at some distance.

The ‘detection distance’ is the distance at which the filter must pass by the target item in order to ensure reliable detection.

The reliable detection distance dictates:

a) the maximum distance that the filter head must pass by all areas within the sector being sampled, for the entire area within a sector to be covered;

b) the lateral movement rate of the filter head; and

c) the forward movement speed of the scent trapping operation.

Demining organisations carrying out REST operations shall conduct T&E to determine the reliable detection distance for their operations. T&E shall take into account factors such as expected target items, capabilities of detection animals and likely operating conditions. T&E and supporting calculations shall be documented and available for inspection as part of the monitoring process.

The reliable detection distance shall be the value used for calculating area covered, for determining the lateral movement rate of the filter head and for determining the forward movement speed of the scent trapping operation.

During scent trapping operations the filter head shall pass within the reliable detection distance of all of the land area being sampled.

For mechanised sampling where filter heads are mounted on a vehicle, filter heads hang in a static position and have forward movement only. Thus the evaluated reliable detection distance shall be at least half the distance between the mounted filter heads, assuming more than one filter head is mounted on a vehicle.

7.3.2. Scent trapping technique

The lateral movement of the filter head and the walking speed shall be monitored by the scent trapping Team Leader during the search to ensure that the filter head passes within the reliable detection distance of all parts of the land being searched.

The filter head should remain close to the ground during scent trapping, while ensuring that the filter does not clog with dust. A ground-to-filter distance of 20cm should be regarded as a maximum.

If scent trapping is to be undertaken in areas with dense vegetation, the REST organisation should demonstrate reliable detection in similar vegetation. Dense vegetation is defined as vegetation through which it is not possible to move the filter in a standard arc.

7.3.3. Filter changes

Target odour molecules will be dragged through the filter by the flow of air and will eventually be lost. The point of molecule loss is called the 'breakthrough point'. The time required for breakthrough to occur depends on flow rate and filter material.

REST filters shall be replaced before the breakthrough point is reached.

T&E of the REST operation shall determine the breakthrough point of filters in terms of time, for the air sampling equipment used. T&E and supporting calculations shall be documented and available for inspection as part of the monitoring process.

The time to reach the breakthrough point shall be the maximum time for which one filter is used and therefore determines the maximum area covered by one filter during air sampling operations.

Filter change procedures shall be described in the demining organisation's SOPs and include the following requirements:

a) the maximum use of a filter on scent trapping tasks in terms of time; and

b) restrictions on personnel touching filters, the inside of the filter container or the inside of the filter holder;

c) decontamination of the filter holder before the first use each day and between each filter change.

7.3.4. Refuelling

Refuelling of the sampling machine should be carried out in areas that have already been sampled. Any fuels or oil spills onto the sampling machine during refuelling are to be thoroughly cleaned up.

8. Environmental conditions

Environmental conditions affect scent trapping. Demining organisations carrying out REST operations shall establish, through T&E, the acceptable environmental limits for the effective conduct of air sampling operations. These limits shall be documented in SOPs and should form the basis for QA on REST operations.

9. The analysis process

9.1. General

Upon completion of the sampling process, the used filters are brought to a central location for analysis by sniffer animals trained to detect traces of target odour.

There are four possible outcomes for the analysis of a REST filter:

a) the filter is a true positive, and is returned as a positive (a hit);

b) the filter is a true positive and is returned as a negative (a miss);

c) the filter is a true negative and is returned as a negative (a correct rejection); or

d) the filter is a true negative and is returned as a positive (a FA).

The aim of REST analysis is to maximise hits and minimise FAs.

A standardised analysis system shall be developed by the REST organisation and shall be described in the organisation's SOPs.

9.2. The analysis site

Analysis will normally take place inside a building specifically designed for the purpose. The building should be kept to a laboratory standard of cleanliness and be designed to provide a comfortable temperature. The analysis site should:

a) not be located in any area that may be affected by odours emanating from petroleum products, fertiliser, chemicals and garbage;

b) not be located in the vicinity of any explosive/munitions stores, minefields or places where demolitions are carried out;

c) not be exposed to pollution of the atmosphere by emissions from traffic, factories or domestic burning; or

d) be secluded or screened from potentially disturbing noise.

9.3. Handling of filters and accessories during analysis

A sniffer animal is trained to recognise one or several target odours, and to ignore all other possible scents that it encounters on filters. However, in order to avoid false indications due to unusual odours, odour contamination in the analysis facility should be minimised. The following procedures should be followed:

a) the stands and other accessories that the animal will be in contact with during analysis should be decontaminated before use, and regularly during use;

b) filters should remain sealed in their containers until placed on the analysis apparatus;

c) filters shall not be touched or come into contact with anything else that might cause contamination; and

d) only specially designed tools that are regularly decontaminated (at least daily) should be used for handling analysis equipment.

The design of the analysis apparatus and the analysis itself shall ensure that there is no possibility of cross contamination between filters during the analysis process.

9.4. Conduct of the analysis

The analysis process shall always be supervised by a qualified analysis manager.

Each sniffer animal shall sniff filters one filter at a time.

9.5. Criteria for returning a filter as suspect positive or negative

When the minimum number of animals (clause 10.3) is used for analysis of operational filters, a filter shall be returned as positive if indicated by one sniffer animal.

However, if more than the minimum number of sniffer animals is used for analysis, it may be appropriate to set a standard whereby a filter is returned as positive if indicated by more than one sniffer animal. The conditions under which the standard is adjusted will be determined in consultation with the NMAA.

9.6. Follow-up investigation

The sector of land linked to a filter returned as suspect positive shall be subject to follow-up investigation. When a positive sector borders on a negative sector, the follow-up investigation in the positive sector shall extend a minimum of 10 m into the negative sector.

The sector of land linked to a filter returned as suspect negative may be eliminated, subject to consideration of other available information including survey information and results from the use of other detection systems.

9.7. Storage of filters after analysis

Filters that have been analysed should be sealed and stored in a contamination-free location for a minimum of six months or as otherwise required by the NMAA.

10. Sniffer animal testing

10.1. General

The reliability and accuracy of each sniffer animal shall be determined through periodic testing, with testing procedures and frequency described in the demining organisation's SOPs.

'Reliability' measures consistency of performance through time. 'Accuracy' measures correct discrimination between positive and negative filters at one time.

Results of testing shall be used to determine which sniffer animals are to be used for filter analysis and the minimum number of sniffer animals to be used (see clause 10.3).

10.2. Testing procedures

When testing sniffer animals:

a) testing should be carried out at regular intervals as documented in a demining organisation's SOPs;

b) records of testing should be retained at the analysis site for inspection by external QA teams as required;

c) at least 10 known positive filters should be used in the test with the percentage of positive filters used in the test to be 5% - 20% of the total;

d) no one present during the analysis of the test filters shall know which filters are positive and negative (including the testing agent if one is present);

e) the test filters should be made in areas that are similar to the environments where operational sampling is carried out;

f) the scent trapping team should apply the same sampling procedures as the REST organisation would apply during operational sampling when making test filters; and

g) some of the positive test filters should be made over targets that have not previously been used for training by the REST organisation.

10.3. Test standards

10.3.1. Individual animal standards

In a test using known positive and negative filters representative of those likely to be encountered during operational analysis:

a) each sniffer animal shall achieve a minimum hit rate of 70%; and

b) each sniffer animal should achieve a maximum FA rate of 5%.

10.3.2. System standards

In a test using only sniffer animals who meet the criteria in clause 10.2.1, the system as a whole (cumulatively over a number of animals):

a) should achieve a hit rate of 100% and shall achieve a hit rate of 90% or greater; and

b) should achieve a FA alarm rate below 20%.

10.4. Minimum number of animals

A REST system shall use a minimum of three sniffer animals.

In order to achieve the standards of clause 10.2.2 a), more sniffer animals may be required.

10.5. Accreditation testing

Accreditation testing requirements for REST operations are included in Annex C.

11. Logistic considerations

11.1. Filters

Filters shall be stored and transported (including for daily field use) in a way that protects them from undesired contamination. Filters shall be stored in a clean and dry environment and protected from high temperatures and direct sunlight. Unused and used filters should never be stored in the same tent, room, or proximity. Filters shall never be transported or stored with:

a) weapons and ammunition;

b) explosives and demolition accessories;

c) petroleum products and paints; or

d) personnel that have been in contact with any of the above who have not been properly de-contaminated (e.g. EOD staff).

11.2. Scent trapping equipment

The sampling machines used should maintain a consistent suction rate. Suction should be measured regularly during sampling to ensure a consistent flow rate.

Double-headed sampling tubes should not be used for making operational filters.

Annex A
(Normative)
References

The following normative documents contain provisions, which, through reference in this text, constitute part of this standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of the standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid ISO or EN:

a) IMAS 04.10 Glossary of mine action terms, definitions and abbreviations;

b) IMAS 09.50 Mechanical demining; and

c) IMAS 10.40 S&OH - Medical support to demining operations.

The latest version/edition of these references should be used. GICHD hold copies of all references used in this standard. A register of the latest version/edition of the IMAS standards, guides and references is maintained by GICHD, and can be read on the IMAS website (www.mineactionstandards.org). National employers, mine action authorities, and other interested bodies and organisations should obtain copies before commencing mine action programmes.

Amendment record

Management of IMAS amendments

The IMAS series of standards are subject to formal review on a three-yearly basis, however this does not preclude amendments being made within these three-year periods for reasons of operational safety and efficiency or for editorial purposes.

As amendments are made to this IMAS they will be given a number, and the date and general details of the amendment shown in the table below. The amendment will also be shown on the cover page of the IMAS by the inclusion under the edition date of the phrase *'incorporating amendment number(s) 1 etc'.*

As the formal reviews of each IMAS are completed new editions may be issued. Amendments up to the date of the new edition will be incorporated into the new edition and the amendment record table cleared. Recording of amendments will then start again until a further review is carried out.

The most recently amended IMAS will be the versions that are posted on the IMAS website at www.mineactionstandards.org.

Number	Date	Amendment Details
1	01 Mar 2010	1. Updated definition of NMAA. 2. Updated UNMAS address. 3. Minor changes throughout out to integrate land release and cluster munitions issues. 4. Also reviewed to ensure gender issues – minor changes to that effect.
2	01 Aug 2012	1. Reviewed for impact of IATG development. 2. Minor typographical amendments.