



**Network of ASEAN
Chemical Biological Radiological
Defence Experts**

Recommended Operational Procedure

for

CBR SAMPLE COLLECTION

ASEAN-CBR-ROP-001 (draft)

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Amendment record sheet

This form contains a record of the amendments made to the previous version of this document.

Paragraph(s)		Brief details of amendment	Proposed by	Approved by
New doc.	Previous doc.			

1. Introduction

In the event of a CBR incident, sample collection is a critical operation to support the overall response and management of the incident. Analysis of these samples in the laboratory will provide many important and useful information. For these samples to be useful, they must be correctly identified and collected at the scene. It is also critical that the samples are collected and handled in a controlled manner so as to preserve their integrity. Where the results of the sample analysis are to be used for legal purposes, it is also important to maintain a robust chain-of-custody for every sample.

2. Purpose

The purpose of this Recommended Operating Procedure (**ROP**) is to provide guidance on the general procedures on the preparation, planning, management and execution of a sample collection operation at the scene of a CBR incident.

3. Scope

This ROP describes how a sampling team conducts an on-site sampling operation, up to the point of packaging and transporting the samples to a laboratory for detailed analysis. Key elements of procedures for the safe collection and splitting of samples are also addressed. The ROP also describes the communication required during the planning and execution of the sampling plan at the incident site.

This ROP covers the following topics:

- a) Recommended composition of a sampling team.
- b) Roles and responsibilities of the team members in a sampling team.
- c) Guidance on the avoidance of sample contamination.
- d) Recommended documentations for a sample collection operation.
- e) Recommended procedures on the maintenance of the chain-of-custody.
- f) Recommended methods to preserve the collected samples.
- g) Health and safety considerations in a sample collection operation.
- h) General response and management of the scene.
- i) Recommended procedures for sample collection.

Deviations or modifications to the procedures in this ROP can be undertaken if properly documented to allow evaluation of the impact on the sampling outcomes. Documentation of the deviation or modification may be documented using a “Non-conformity Report Form”. An example of the non-conformity form is shown in **Annex 1**.

4. References

The information contained in the following documents has been considered as a general guideline in preparing this procedure:

- a) ASEAN-CBR-ROP-002 on CBR Sample Documentation and Chain of Custody;
- b) ASEAN-CBR-ROP-003 on International Transportation of CBR samples;
- c) NATO Handbook for Sampling and Identification of Biological Chemical and Radiological Agents (SIBCRA);
- d) Krüger, S. (2005). On-Site Analysis by the Inspection Team. Sampling, Analysis, Equipment, Procedures and Strategies. In Chemical Weapons Convention Chemicals Analysis, M. Mesilaakso (Ed.). <https://doi.org/10.1002/0470012285.ch3>;
- e) IAEA-TECDOC-1092, Generic Procedures for Monitoring in a Nuclear or Radiological Emergency;
- f) UN SGM IAU CBR A/44/56L Guidelines and Procedures.

5. Annexes in this ROP

The following annexes can be found at the end of this document. They contain useful information that support this ROP.

Annex 1 – An Example of a Non-conformity Report Template

- Annex 2 – An Example of a Field/On-site Sampling & Analysis Booklet
- Annex 3 – An Example of Chain-of-Custody (Handover/Takeover) Form for CBR Sample
- Annex 4 – Recommended Procedures for Collection of Various Sample Types
- Annex 5 – Splitting of CBR Samples
- Annex 6 – Tentative Equipment Needed for CBR Sampling (examples)

6. Acronyms and definitions

CBR	Chemical, Biological, and Radiological
CMR	Confidential Material Register
CP	Command Post
CWA	Chemical Warfare Agent
DCM	Dichloromethane
DCN	Document Control Number
EOD	Explosive Ordnance Disposal
EMO	Sample/Evidence Recording/Maintenance Officer
ERW	Explosive Remnants of War
IED	Improvised Explosive Device
IPE	Individual Protective Equipment
MEL	Medical Element Leader
OCMR	On-site Confidential Material Register

OIC	On-site Incident Commander
POC	Point of Contact
ROP	Recommended Operational Procedure
RT	Response/Reconnaissance Team
S&A	Sampling and Analysis
SDS	Safety Data Sheet
ST	Sampling Team
STL	Sampling Team Leader
UXO	Unexploded Ordnance

7. Roles and responsibilities

At the scene of a CBR incident, a number of responding entities are likely to be present. These entities include the law enforcement personnel (police), military forces, civil force and medical personnel. An On-site Incident Commander (**OIC**) is usually designated as the person charged with the overall responsibility and authority to coordinate and manage the on-site responses to the incident.

a) On-site incident commander (OIC)

The On-site Incident Commander (**OIC**) shall be responsible for the efficient and effective conduct of the overall responses at the scene of the incident. In addition to securing the site the OIC shall ensure that the Sampling Team (**ST**) assigned with sampling tasks is fully dedicated to the operation. The commitment to the assigned tasks shall be maintained until the ST has completed all the sampling activities, or until law enforcement/investigators confirm that the scene is cleared for other stages of the response (such as clean-up, decontamination, etc.). After the sampling tasks have been completed, the OIC may allocate the resources held within the ST to other assistance/response efforts as required.

b) Sampling team (ST)

Sample collection at a CBR incident scene is highly specialised operation that requires a team of well-trained personnel working together in a seamless way. Each sampling team member must be trained to carry out the designated task correctly and effectively. The team members are expected to work in a coordinated manner, so it is important that ST clearly understands each other's tasks.

The recommended composition of a sampling team (ST) is as follows:

- Sampling Team Leader (STL) (x1)
- Sampling team members who may take up one of the following roles:
 - Deputy STL (x1, optional)
 - Evidence Recording Officer (EMO) (x1)
 - Sampler (one or more)
 - Sampling Assistant (one or more)

i. Sampling team leader (STL)

The Sampling Team Leader (STL) is a designated role who is the commander of the sampling team. As the leader of the sampling team, the STL is the person responsible for the planning, organization and execution of the sample collection operation. The STL normally has the delegated authority from the OIC for the collection of various types of material evidence at the incident scene.

The roles and responsibilities of the STL are as follows:

- To communicate and coordinate with the OIC to ensure the sampling operation meets its objectives and is carried out effectively;

- To clearly understand the objectives and scope of the sample collection operation;
- To obtain the following information (from the OIC or the designate):
 - background of the incident e.g. what had triggered the response
 - any account of the incident from witnesses at the scene (if available)
 - information regarding any samples or materials that had already been collected before the arrival of the sampling team
 - details concerning any response measures that had been performed before the sampling team arrived at the scene e.g. decontamination
 - details and results of any field measurements that had been performed before the sampling team arrived at the scene e.g. radiation dose rates
 - details of any significant findings at the scene
 - any limit on the duration for the sampling operation
- The STL should ideally be part of the Reconnaissance Team.
- The STL shall develop a sampling plan based on the information available and observations at the scene. He shall look out for indicators for presence CBR agents and identify sampling points.
- The STL shall present the sampling plan to the OIC for approval.
- Based on the sampling plan, the STL shall brief and prepare his Sampling Team for the sampling operation.
- The STL is responsible for ensuring that risk is managed appropriately for his sampling team
- The STL will chair the daily sample/evidence review meetings, if necessary.

ii. **Deputy STL**

The Deputy STL is an **optional** role that may be assigned to one of the senior sampling team members. A Deputy STL will be particularly useful for complex or prolonged sampling operation.

The Dy-STL will assist the STL in carrying his roles and responsibilities. The STL may also delegate some of his responsibilities to the Dy-STL.

iii. **Evidence maintenance officer (EMO)**

The responsibilities of the EMO are as follows:

- ensure the implementation of the sample collection priorities set by the STL for each entry to the affected area.
- responsible for daily updates to the team and STL/OIC on the state and progress of sample/evidence collection.
- responsible for maintaining the Sample Evidence Book which contains the registration information on each piece of sample collected
- responsible for maintaining the On-site Confidential Documents/Material Registry (OCMR)
- responsible for making sure that On-site/Field CBR Sampling and Analysis Booklet is properly registered and filled in for each collected sample. An example of the Booklet can be found in **Annex 2**.
- remind all team members of their obligations regarding the sampling, recording, extraction or receiving, processing and maintenance of samples/evidence.

- assist the STL to prepare daily sampling review meeting, which will keep the response/investigation moving towards a timely and accurate conclusion.

iv. Sampler

The Sampler shall be the only member of the sampling team who will collect the samples and transfer them into appropriate containment. He shall not come into contact with the other sampling equipment.

The sampler is assisted by the Sampling Assistant.

- Together with the Sampling Assistants, the Samplers shall prepare the equipment required to perform the sampling operation for each entry to the affected area, in accordance to the sampling plan. The only item that he will carry with him into the sampling area are disposable gloves.
- Using appropriate sampling tool, the Sampler shall collect and transfer the samples into appropriate containments with the help of a Sampling Assistant.

v. Sampling Assistant

The Sampling Assistant assist the Sampler to collect and transfer the samples into appropriate containment.

- Together with the Sampler, the Sampling Assistant shall prepare the equipment required to perform the sampling operation for each entry to the affected area, in accordance to the sampling plan;
- Carry the sampling equipment and accessories required to perform sample collection into the sampling area;

- Prepare and provide the Sampler with the appropriate sampling equipment at the sample collection point
- Assist the Sampler with the transfer of the samples into appropriate containment
- Seal the sample (double bag) with the appropriate sample documentation provided by the EMO.

vi. Additional sampling assistants

Where deemed necessary by the STL, an additional Sampling Assistant may be included to be in charge for photo/video recording of the sampling activities.

Where deemed necessary by the STL, an additional Sampling Assistant may be assigned to be responsible for communications/reporting and/or recording/documenting the sampling activities.

8. Categorization of samples/evidence

At incident site, materials within it are all potential evidence that could help with the investigation. However, it is essential to identify correct sample/evidence to be collected and also prioritized which sample/evidence should be collected first. For example, the most transient or fragile and potentially most important pieces of samples/evidence are collected first. Hence, in this document, sample/evidence was divided into three categories, mainly primary, secondary and tertiary based on their importance to the aim(s) of operation/response/investigation and fragility in the environment. Whenever possible, photograph and/or video should be taken and recorded for each sample/evidence in its placewhere it is being collected.

Category A Primary Sample/Evidence: Evidence/Samples of primary importance to the mission/response/operation which may be

transient in nature, due to the physical characteristics of the used CBR material – also primary evidence may well provide the response/investigation team with information to aid or update sampling planning as well as risk assessment. Time is of the essence for the collection of most primary evidence/samples.

Category B Secondary Sample/Evidence: Evidence/Samples that strengthens primary evidence if primary evidence is unavailable, secondary evidence may well provide useful investigative leads.

Table 1 below provides some example of sample/evidence and its proposed category.

Table 1: Suggested types of CBR sample/evidence, what could those sample/evidence be and its proposed category in a CBR Response/Operation/Investigation

Type of Sample/Evidence	What it could be	Category
C/B/R Ordnance or Device (UXO/ERW) Sample/Evidence	CBR material traces <u>on or around an unfunctional/unexploded CBR ordnance or device</u>	A
	C/B/R <u>ordnance or device fragments and/or components</u> with associated traces of CWA/BWA/Radioactive material or their characteristic degradation products (if applicable) that helps with the categorization of the delivery method and the targeting of neat agent or environmental sampling within the affected area (if applicable)	A
C/B/R agent/material & Environmental Sample/Evidence	<u>Neat C/B/R agent/material</u> – These are the most valuable and most transient of potential evidential items. Note: <ul style="list-style-type: none"> Transient potential of alleged C/B/R agent/material on the scene of use are dependent on the persistency of the agent/material which is contributed largely immediate surrounding environment and meteorological conditions (for example: degradation of C/B agent/material or removing/dilution of C/B/R agent/material). Opportunities for neat/source C/B/R agent/material sampling is usually identified by Reconnaissance Team. When no neat agent/material identified, all other environmental samples must be categorized as Primary Sample/Evidence (Category A). 	A
	Environmental samples – <u>Aqueous/Liquid, Solid, Air, Surface wipe, Soil, Vegetation</u>	A
Veterinary sample/evidence	Dead animal <u>carcasses</u>	B

9. Avoiding sample contamination

The value of samples lies with their potential to provide valuable information about the CBR incident. Sample contamination is a highly undesirable event where foreign materials are introduced into the samples. The foreign materials may interfere with the laboratory analysis of the samples, leading to wrong or misleading information. It is hence essential to avoid sample contamination by collecting, handling and transporting samples in a controlled manner that will prevent sample contamination. Where the results of the sample analysis are to be used for legal purposes, it is also important to maintain a robust chain of custody.

Sample contamination may arise via random transfer and cross contamination:

- **random transfer** occurs when materials from a person are transferred onto the sample
- **cross contamination** occurs when materials from the environment are transferred onto the sample

It is essential to prevent the contamination of samples by following these practices:

- Anyone who is not assigned for evidence-related tasks must not deal with any item/sample linked to the scene.
- Anyone handling the samples shall, as a minimum, wear disposable protective gloves. This measure is intended to protect the samples.
- Each sample should be dealt with independently of other samples.
- The packaging or container shall be taken to the sample and not vice-versa.
- Unsealed packaging should not be left unattended.
- Every sample must be packed separately.
- Samples must be packaged, sealed, logged and stored as soon as practically possible.

10. Maintaining the chain-of-custody

The term “chain-of-custody” is a legal term referring to the order and manner in which evidence have been handled during the investigation of a case. To be legally accepted as evidence in court, the prosecution must typically prove that all evidence was handled according to a properly documented and unbroken chain of custody. Crime-related items found not to have followed a properly documented and unbroken chain of custody may not be allowed as evidence in trials.

The labelling, marking, handling, packing, sealing, transporting and storage of the samples as evidence shall be carefully planned and carried out as well as properly documented.

Chain-of-custody procedures shall be strictly adhered to in order to ensure and protect the integrity of the sample (see section 9 (b)).

For more details on chain-of-custody procedures for CBR samples, refer to ASEAN-CBR-ROP-002 on CBR Sample Documentation and Chain of Custody.

a) Chain-of-custody documentation

An **On-site/Field CBR Sampling and Analysis Form** (Annex 2) shall be prepared and maintained for the sample collection/investigation. The Form shall provide control, accountability and accurate descriptions, photographs and/or diagrams of the samples to enable the examination of items without actual handling. It is the responsibility of the EMO to maintain this.

This Form shall be recorded (if not integrated) in the On-site Confidential Material Register (**OCMR**) and handled in accordance with investigating team confidentiality procedures.

The Form shall be used for evidence registration , and shall include the following information for each sample as evidence:

- entry number;
- description of sample/item;
- sample/evidence reference number;
- where the sample/evidence/exhibit was found;
- by whom the sample/evidence/exhibit was found;
- time and date the sample/evidence/exhibit was found; and
- seal number(s) on the sample/evidence container/package.

The Form shall also contain the information in relation to the depositing of sample/evidence in the secure storage room, including the following information:

- time/date of depositing the sample/evidence;
- name of operator depositing the sample/evidence;
- location where the sample/evidence is being stored;
- movement of the sample/evidence;
- time/date of taking out the sample/evidence;
- reason for taking out the sample/evidence;
- name of operator/investigator taking out the sample/evidence;
- time/date of returning the sample/evidence; and
- daily sample/evidence review findings/analysis results

- authorised disposal of sample/evidence (including time/date, authorised by whom and destroyed by whom).

Each sample/evidence container/package shall be properly sealed and labelled with the minimum information necessary for the identification of the item. The necessary information for the label includes evidence reference number/DCN, an “CBR Sample/EVIDENCE” marking and signatures of all persons who handled the sample/evidence. The label must not contain any information related to the investigation, the agency and/or the investigated site/incident. The detailed information on the evidence shall be entered into the sample evidence/exhibits form as described above.

Details on documentation for chemical, biomedical, and environmental samples may be found in the respective ROPs.

- i. For documentation, use the sample collection form that accompanies each sample taken (ASEAN-CBR-ROP-002, Annex 2. Part I.). Any further dilution/splitting/handling is properly documented as per ASEAN-CBR-ROP-002 (Annex 2. Part III – V.);
- ii. After the Sampler passed through the decontamination station, he/she shall reviews the information on the “Sample Collection Form”, and makes corrections if required, then signs it;
- iii. Any handover of sample material to other authorities must be recorded. Details are defined in ASEAN-CBR-ROP-002 (Annex 2. Part VI and Annex 3.).

b) Avoidance of a break in the chain-of-custody

The following conditions characterize breaking the chain of custody and must be avoided:

- leaving samples unattended (unless they are secured and only authorized persons can have access to them, or secured and sealed in such a way that any tampering is immediately apparent);
- receiving or handing-over samples without recording the hand-over;
- using an improperly sealed bag or container to transport or store sample;
- inappropriate or unrecorded breaking of a seal on a bag/container containing sample/evidence.

c) Transfer of samples between persons

The transfer of samples from one person to another must be duly documented in detail in a Chain-of-Custody form. **Annex 3** shows an example of a Chain-of-Custody Form for CBR Sample). In addition:

- The transfer shall be witnessed by the EMO;
- The transfer must be entered in the Sample Evidence Book (see next subsection) whenever receiving or handing over chain-of-custody
- The label or accompanying handover/takeover form must contain the signatures of the person handing over and the person taking over.
- The sample must remain in the physical possession of the person, taking charge of it, called the **custodian**. The sample may be secured such that only the custodian can have access to it, or be secured and sealed in such a way that any tampering is immediately apparent.

11. Sample preservation

The purpose of preserving samples is to prevent the degradation or changes of the samples between the time that they were collected and the time that the sample is analyzed. Preservation methods include sample temperature control, addition of chemicals or culture media to the samples.

a) Chilling

Generally, lower temperatures will better preserve chemical and biological agents in samples. Therefore, samples of these types should at least be refrigerated **but not frozen**. In the event where not all samples can be chilled, priority should be given to cooling of samples from biological origin. Cooling to 4 to 6 °C with ice or blue ice can help to reduce dehydration or microbiological growth.

[Note: When wet ice is being used, ensure that vessels containing samples are not in direct contact with the wet ice. This is to prevent cross-contamination among samples as the ice melts.]

If facilities for chilling or freezing are not immediately available, wrap the **sample containers** in cloth saturated with ice water, water or a mixture of water and alcohol to chill them. Once chilled, the samples must be kept cool during transport.

b) Dilution of neat chemical agent for safe international transportation

The addition of solvent (e.g. DCM) is undesirable for samples collected for investigation of alleged use, but it may be necessary to dilute the sample for safe transportation.

c) Long term preservation

The samples may need to be preserved for a long time. Certain types of samples may require special storage conditions, such as freezing or storage in a dark area, or in inert atmosphere or vacuum. They should be stored in a secure storage room with a properly working alarm system, or at least with tamper-indicating seals. Access to the sample on-site storage room shall be controlled by the EMO or the Head of on-site Laboratory if the samples have been handed over to an on-site laboratory. A written record of any access to the secure storage room shall be maintained, including justification of the access, names of the persons accessing, signature, date and time.

12. Health and safety

The health and safety of the sampling team when operating at the scene are of utmost importance. The guidelines for safety are as follows:

- All relevant personnel, including the OIC, ST and other responders/sampling operators, must ensure that samples, which may pose a health and safety hazard from CBR agents or biomedical samples, are handled in accordance with the appropriate Health and Safety Policy and Regulations, Health and Safety Manual(s) and/or the Operational Health and Safety Plan. The STL and team health & safety officer must consider/develop the activity safety plan as required for sampling activities.
- Portable instruments for monitoring C/R contamination should be utilized.
- Items that pose a significant hazard must be identified to all personnel, and must display clearly recognizable warning labels. All personnel must be advised, by the team health and safety officer, of health and safety risks from samples or other evidential material.
- All members of the sampling team and other relevant personnel must familiarize themselves with the SDS (or other type of safety information) of the chemicals and mixtures used or CBR material suspected to be encountered on-site and must review any other relevant information

available to take proper preventive action and to prepare for measures in case of an emergency;

- All members of the sampling team must wear appropriate individual protective and safety equipment. In addition, all members must wear double gloves (e.g. thin nitrile gloves on top of the butyl rubber gloves). To avoid cross-contamination, the outermost pair of gloves should be discarded between samples and when suspected to be contaminated.
- During the collection of samples that are potentially radioactive or containing CWA or toxic chemicals or biological agents, safety is of the utmost importance. The procedure needs to be well planned and discussed in advance with the ST/RT;
- Samples shall be collected in proper containers, which shall protect handling personnel from CBR contamination and other safety hazards, as necessary.
- The members of the sampling team working in the hot zone must maintain eye contact as much as possible to observe each other's well-being.
- There should be communication between the sampling team and the command post. In the event that normal communications break down or prove insufficient (or are jammed, or pose safety/security issue), other means of communication (e.g. signalling, relaying of information, notes taking in the hot zone, etc.) should be established.

13. Response and management at the scene

a) Securing and controlling the scene

The incident site shall be under the control of the OIC or any official designated by the OIC. The site shall be protected and managed, with appropriate response, cordoning,

safety and security measures put in place. The OIC shall be responsible for the efficient and effective conduct of the overall response of the CBR incident. Priority should be given to rescue and life-saving operations, while minimizing the spread of CBR contamination. The command post (CP) shall maintain an Investigation Operations Log (if applicable), which provides a chronological record and description of investigation actions.

With regards to sample collection, the OIC shall ensure that the Sampling Team (ST) is fully provide with the required resources (e.g. manpower and time) to complete the sampling tasks.

The following steps shall be taken, as a minimum, to preserve the site of the possible/confirmed release of CBR material:

- minimize the spread of contamination by establishing contamination control procedures;
- prevent unauthorized entry; and establish via the cordon/law enforcement/1st responders as soon as possible if any response assets have entered the suspect area. If such entrance has occurred, the OIC and STL have to receive information about the scope of the performed activities (if anything has been removed from the scene, or left on the scene by 1st responders on the scene);
- ensure that appropriate protective clothing/equipment is worn by all who are authorized to enter the site;
- commence and maintain an Investigation Operations Log at the CP (if applicable) or with the lead investigating unit;
- coordinate with other local/international bodies and (inter)national teams in the area to secure the scene.

b) Investigation operations log

The Investigation Operations Log (handwritten or electronic) is maintained by the Command Post (CP). It provides a chronological description of investigation operations and may include:

- time, location(s) and descriptions of activities;
- paraphrased description of negotiations;
- departure and return times of individuals and sub-teams;
- descriptions of events;
- seal and tag numbers, when applied or removed; and
- any other information deemed relevant towards maintaining the investigation picture.

c) Reconnaissance of the scene

The investigative operation of the incident scene will usually commence with a reconnaissance of the site. Carried out by a small Reconnaissance Team (RT), the main purpose of the reconnaissance is to conduct ground observations and gather information to develop an appropriate investigation plan, including the proper evidence collection methods to deploy. The composition of the RT may vary and is likely to be decided by the OIC. Ideally, the STL should be part of the RT.

The RT (or other operators first on the scene) carries out the following tasks (if possible):

- Marks entry and exit points into the area;
- Determines the degree & types of contamination. Hazardous areas shall be well-marked and safety zones clearly designated.

- Determines the explosive hazards;
- Locates and marks possible sampling points for further action by the Sampling Team.
- Assesses and recommend the number and kind of samples to be taken;
- Estimates the surface area for wiping if wipe samples are to be collected;
- Determines the equipment required;
- Takes photos and/or videos. The scene/area of interest should be photographed and/or video recorded. The photographs and video recordings may provide evidentiary support.

The RT or other responders that were first on the scene may be requested by the STL (or STL may be briefed from the command post/CP of the OIC) to provide the location and characteristics of the area where CBR material is believed/confirmed to have been released and if any, information from the victims and witnesses (and where they can be found, if biomedical sampling or sampling of contaminated possessions/clothes is indicated). This may assist in the targeting of Category A samples while developing sampling plan.

14. Sample collection

The following sections provide the sequence of key activities for a sample collection operation.

a) Activation orders for sampling

The Sampling Team is not an autonomous entity - it conducts sampling operation only upon orders from higher command, which may be the OIC of the incident. Upon

receiving the activation and arriving at the incident site, the STL should obtain the following information from the OIC (or his designate):

- background of the incident e.g. what had triggered the response
- any account of the incident from witnesses at the scene (if available)
- information regarding any samples or materials that had already been collected before the arrival of the sampling team
- details concerning any response measures that had been performed before the sampling team arrived at the scene e.g. decontamination
- details and results of any field measurements that had been performed before the sampling team arrived at the scene e.g. radiation dose rates
- details of any significant findings at the scene
- any limit on the duration for the sampling operation

If the site has already been sampled by the responders that were first on the scene or other agencies as part of a response/investigative/assistance effort, the STL shall ask for results, location and nature of any samples already taken, which may include accepting a sample split. The ST may then resample the area, to attempt to verify the initial sample results.

If samples have not been taken yet, then the STL shall establish the priority of the sampling team taking samples at the site and ensure that the OIC and law enforcement (or other investigative agency) are appropriately and timely appraised or integrated.

If possible, areas suspected to contain CBR related material/contaminants and/or exploded or unexploded munitions have to be investigated by a Reconnaissance Team (**RT**) before sampling can be performed.

b) Identify sampling sites/points

The STL should ideally be part of the RT to conduct ground observations and gather information to develop an appropriate investigation plan, including proper evidence collection methods to deploy.

When selecting a sampling site, the following general considerations should be included:

- Sampling and measurements in support of military operations will be at the direction of the Commander, and potentially include field hospitals, staging areas, and logistical support areas. Local officials will likely have a list of high-priority sampling locations that, under the Commander's discretion, may be sampled.
- Radiation and chemical agent detectors will usually give guidance as to the radiological or chemical agent used in an attack. Radiation detectors can often indicate the type of radiation being emitted and some can identify the specific radionuclides. Hand held test kits may be used to give guidance about the type of biological agent used in an attack.
- The method of sampling will vary with the nature, source and dissemination method of the agent used. However, in general the best location for sampling will be where casualties have occurred or where there may be wilted or discolored plants or an unusual number of dead animals such as fish, birds, or rodents. The presence of radiological agent alone is unlikely to give rise to visible signs. The following general considerations should be considered as circumstances dictate:
 - i. Aerosols or Gases. Agents released as an aerosol or gas may leave little or no visible residue or physical evidence of an attack (other than possible casualties). However, useful samples may be taken from water, vegetation or other material such as protective equipment items in the immediate area and downwind of where the agent may have impacted or been absorbed. Avoid sampling in areas that are shielded by

obstructions (overhead and upwind at the time of release), because there will probably have been little deposition, there. For B and C agents, avoid sampling in areas that are exposed to direct sunlight and high temperatures, because these conditions promote fast degradation of agents, particularly biological agents. Samples are best obtained from shaded areas and sometimes from buildings.

- ii. Liquids and Solids. Avoid areas that are shielded by obstructions. Select samples in areas which exhibit wet stains, powders, or particulate matter on surfaces, vegetation, water surfaces, or the ground. For B and C agents, less preferred sampling points are those exposed to direct sunlight and high temperatures and not exhibiting any visual indicators as described above.

In general, a good location for air sampling is also a good location for soil, vegetation or water sampling. As a rule, these are open undisturbed areas that are unaffected by water runoff, or unusual local wind patterns (e.g., away from buildings, trees, etc). Air sampling during accident condition will require samples to be taken in locations downwind and upwind from the site.

c) Develop a sampling plan

It is the duty of the STL to develop a sampling plan. He may include members of the Sampling Team to discuss and co-develop the plan with him. A simple drawing (sketch) of the incident site is highly recommended to be used to prepare the sampling plan. The area of operation, sampling sites, potential hazards, useful landmarks, etc should be clearly indicated on the sketch.

The sampling plan should include minimally the following:

- Number of sampling points and their locations;
- Types and amount of sample to collect at each sampling point;

- Sampling schedule e.g. number of sites/samples to be sampled per day.

d) Seek approval of sampling plan from OIC

The STL shall seek approval of the sampling plan from the OIC before proceeding with the execution. Members of the sampling team are strongly encouraged to be present at this meeting. At this time, the STL may request for additional resources to support the ST. Examples of additional support are detectors, manpower (e.g. to carry sampling equipment into the sampling area), removal of potential hazards and monitoring of hazards.

The STL should also take the opportunity to clarify any doubts or information with the OIC.

e) Orders to sampling team

Once the sampling plan has been finalized, the STL shall deliver his orders and brief his ST on the details of the sampling plan. This is an essential part of sampling operations as every member of the ST must have a clear understanding of his role and duties during operation. The following should be included in the briefing:

- The STL will assign specific roles and duties for each of the team member.
- The STL may appoint one of the members as Deputy-STL;
- Background information of the incident;
- Objective of the sample collection;
- The STL will brief the team on the details of the sampling plan, including:
 - Number of sampling points and their locations;
 - Types and amount of sample to collect at each sampling point;

- High-priority sampling point, if any;
- Sampling schedule e.g. number of sites/samples to be sampled per day.

If deemed necessary, the ST may rehearse selected aspects of the sample collection, documenting, packaging, decontamination and transportation/transfer/storing.

f) Planning and assembly of equipment and sampling kits

Based on the sampling plan, the ST will then gather and prepare the necessary equipment and sampling kits. Where the sample code of the sample to be taken has been assigned, mark the sampling bottle(s) with the sample identification code;

The equipment (and sampling forms) is prepared before entering the hot zone. This reduces the entry time into the contaminated area and consequently the risk of exposure for the personnel; pack the required sampling and splitting equipment, chemicals, and the safety equipment needed.

Samples that are potentially radioactive or possibly containing liquid CWA or toxic chemicals, are preferably diluted (if applicable/needed and/or not degrading the sample) or split in the hot zone.

Since the team will be operating in a CBR contaminated environment, it is important that the equipment and sampling kits are protected from contamination by storing them in transportation boxes (with wheels for easy transport). Sample transport containers shall be prepared where the samples will be placed after sampling.

g) Collect samples

Led by the STL, the ST proceeds to move in to the incident site and commence sample collection in accordance to the sampling plan. In the hot zone, the ST shall approach the sampling location as follows:

- a) If possible, a member who was in the RT shall lead ST to the sampling locations. This team member carries the handheld Chemical or Radiological detector;
- b) An EOD or other relevant specialist may be assigned to the ST depending on the type/origin of the samples to be collected;
- c) The Sampler carries only extra nitrile gloves;
- d) The Sampling Assistant carries the sampling equipment and a sample transport container where the samples will be placed after sampling. The Sampling Assistant hands the required sampling equipment to the Sampler and receives the collected samples which are then placed in the sample transport container;
- e) A second Sampling Assistant may be assigned to photo/video record the sampling activities and to communicate to cold area on behalf of the ST.
- f) Once the ST reaches the vicinity of the sampling location, the main Sampling Assistant prepares all the necessary tools for sample collection;
- g) The Sampling Assistant accompanies the Sampler to the sampling point and hands over the appropriate tools to the Sampler;
- h) Dependent on the sample type, the sampler collects the sample according to the sampling plan;
- i) Samples that are possibly or confirmed to be radioactive or contain CWA or toxic chemicals are preferably diluted (refer to para 11(b)) or split (see **Annex 5** for detailed procedures) in the hot zone;

- a. The collected CBR sample, sample dilution or sample splits¹ in primary vial/container are then over-packed (or double over-packed) in a plastic bag, taped shut, and placed in the sample transportation container and transported for decontamination
- b. If contamination occurs on personnel or on the outside of the sample container, sampling has to be stopped and initial decontamination procedures started;

h) Sealing the samples

- Wrap sample bottles tightly with tape to secure the bottle-lid joint. This step can be omitted for the air/vapour sampling tube holders.
- If necessary, seal the sample bottles and air/vapour sampling tube holder with tamper proof seals and record the seal numbers.
- Place each sample bottle or air/vapour sampling tube holder in a separate plastic bag. Close the bag. Place these bags into tamper-proofed bag and seal tight.
- Place the double-bagged samples into an on-site sample transportation container or bag.
- Seal the sample transport container/bag and surface decontaminate the container without compromising sample's integrities.

Any equipment that has been taken into the hot zone and is known or reasonably believed to be contaminated must either be decontaminated or left inside the hot zone. Any sampling tools that has been removed from its over-pack has to be discarded. All discarded items, including used nitrile gloves, should be deposited in a plastic bag, with a label identifying the contents as waste. The waste bag can be deposited at a

¹ Or collected duplicate samples (if splitting is not an option)

predetermined location within the hot zone for later removal and destruction/disposal (pending the type of C/B/R contamination).

15. Sample processing and transport

a) Decontamination of sample package²

Decontamination procedures depend on the type of working environment and samples composition and typically include the use of decontaminating solutions/emulsions/foams or powders.

If necessary, the sample transport containers/bag are fully immersed in an appropriate decontaminant for the required contact time and are then removed and rinsed. This does not apply for air/vapour samples collected in the sampling tubes.

Note: In situations where the decontaminant will remove markings on the containers, samples of the same type should be decontaminated and rinsed separately (i.e. one after the other) rather than together. Samples of different types can be decontaminated at the same time. Markings should be checked before decontamination and re-applied afterwards if necessary.

After the sample transport containers/bags are rinsed and thoroughly dried, a vapour check or surface swipe may be conducted with a corresponding hand-held detector (for C and R agents only). For the vapour check, place the sample transport containers/bags into larger bag, sealed and store them in warm place for approximately 30 minutes prior to checking with a hand-held detector (for C and R agents only).

² If the sampling is done in non-hazardous environment (outside hot zone), decontamination might not be required.

[Note for C agents: Some types of hand-held detector technologies give false positive reading in the presence of certain volatile components of plastic materials. To check for the false positive readings, screen with the hand-held detector an empty bag of the same type kept in the same conditions as the bag with samples.]

[Note for R agents: For the dose rate/contamination measurement, previous reading before the decontamination should be done as well as dose rate/contamination measurement on the surface of the primary sample vial/receptacle (before storing in outer container/packaging) for differentiation of packaging surface contamination and radiation originating from the sample itself]

b) Transport to laboratory

After decontamination, CBR samples are packed and sealed in accordance with the requirements for local and/or international transport. Typically, this involved double packing in plastic bags to prevent possible leaking into over-pack container. It is recommended to fill the transport container with (i) absorbent sheets sufficient to absorb entire sample volumes – for B agents, (ii) activated charcoal – for C agents or/and (iii) additional shielding – R agents.

If possible, the sample transport container/bag is put into the portable refrigerator for transportation to the on-site laboratory. The samples should be stored on-site in a refrigerator at a temperature of about 4 to 6 °C or in a cool and dark place, if a refrigerator is not available. Keep them out of direct sunlight to prevent photochemical decomposition.

Before opening sample transport container/bag retrieved from cold storage, let it warm up to room temperature to avoid condensation of water.

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Annex 1 – An Example of a Non-conformity Report Template

Date	
Operation/Deployment Code	
OIC/Team Leader	
Sub-team Leader of the Sampling/Identification Team	
Non-conformity related to ROP number	
Location/time of non-conformity action	

Reported by (Full name and Role): _____

Description of the non-conformity*:

Reason for deviation*

Signature of reporting team member	
------------------------------------	--

*include further pages if necessary

Annex 2 – An Example of a Field/On-site Sampling & Analysis Form

Example of “Sample Collection Form”

Field S&A Formt - Part I.

CBR SAMPLE COLLECTION FORM

SAMPLE IDENTIFICATION

D D M M Y Y H H M M

T T P

Date and

--	--	--	--	--	--	--	--	--	--

(Bar)Code ¹

--	--	--	--	--	--

¹ If not with barcode generator (if possible, barcode generator should include):

##: chronological sample number, **TT**: sample type identifier according to table below, **P**: parallels (**S** for sample; **B** for method blank)

Seal Number(s):

SAMPLE TYPE

- Environmental:** ☐ Aqueous (**AQ**) ☐ Soil (**SL**) ☐ Air (**AR**) ☐ Solid (**SD**)
- Bulk:** ☐ Solid (**BS**) ☐ Liquid (**BL**) ☐ Neat CBR Agent (**NA**) ☐ Gel (**BG**)
- Wipe:** ☐ Dry (**WP**) ☐ With dichloromethane (**WD**) ☐ With acetonitrile (**WA**)
- Food:** ☐ Solid (**FS**) ☐ Liquid (**FL**) ☐ Headspace (**FH**)

Additional Information:

SAMPLING EQUIPMENT

- | | | | | |
|---|--|--|-----------------------------------|-----------------------------------|
| <input type="checkbox"/> Spatula, Spoon | <input type="checkbox"/> Trowel | <input type="checkbox"/> Syringe____ml | <input type="checkbox"/> Pipette | <input type="checkbox"/> Scissors |
| <input type="checkbox"/> Paint scrapper | <input type="checkbox"/> Wipe with wire | <input type="checkbox"/> Wipe with | <input type="checkbox"/> Hacksaw | <input type="checkbox"/> Chisel |
| <input type="checkbox"/> Air sampling | <input type="checkbox"/> Filter cassette | <input type="checkbox"/> Biological swab | <input type="checkbox"/> Impinger | <input type="checkbox"/> Tweezers |

Flow rate:

- ☐ Other, describe:

CBR SAMPLE CONTAINER

☐ wide mouth bottle ☐ narrow mouth ☐ wide mouth jar ☐ glass vial ____ ml ☐ Air sampling tube
____ ml bottle ____ ml ____ ml

☐ Biological swab medium _____ ☐ Filter cassette

Additional Information:

ENVIRONMENTAL CONDITIONS

Temp: ____ % rel. ☐ Sunny ☐ Cloudy ☐ Rain ☐ Snow

Additional information:

DESCRIPTION OF THE SAMPLING LOCATION

Detector(s) reading(s), where/what applicable:

Detector Reading - ID: ____ Bars: ____ Dose rate: ____

NAME AND SIGNATURE

Sample collected by: _____ [Sampler]

Witnessed by: _____ [Sampling Assistant]

Sampling Team Leader: _____

Sample transported by: _____

Example of “Sampling Team Personnel Form”**Field S&A Form - Part II****PERSONNEL HANDLING THE SAMPLE**

Function	Name and signature
Mission/Sampling Team leader	
Sampler / Witness	See ‘Sample collection’ form
Sampling sub-team leader (Warm person 1)	
Sampling assistant (Warm person 2)	
Sampling assistant (Warm person 3)	
Sample operator at Decontamination Station	
Operator taking notes (Cold person)	See ‘Sample collection’ form
Sample transporter	
Sub-team leader of the on-site laboratory (Identification Sub-team Leader)	
Chemical Analysis Technician (or N/A)	
Bio Analysis Technician (or N/A)	
Radioisotopes Analysis Technician (or N/A)	

Example of “Field CBR Sample Packing/Transfer Form”**Field S&A Form - Part VI****PACKING of SAMPLE SPLITS****Primary containers**

The seal numbers and the weight of the primary containers (with tape and seal) are recorded in the sample splitting form on page(s)

Secondary packaging

Frangible seal number	
Frangible seal number	
Frangible seal number	
Frangible seal number	
Weight	

Intermediate packaging (if optic. seals used)

Fiber optic seal number	
Fiber optic seal number	
Fiber optic seal number	

(Bar) code/CMR Registry number of the photographs of the fiber optic seal end patterns

Outer packaging

S/N number	
Transport tag/seal number	
Transport tag/seal number	
Transport tag/seal number	
Transport tag/seal number	
Weight	

Packing was performed by

Packed by, name and signature	
Date and time	

Notes:

Annex 3 – An Example of Chain-of-Custody (Handover/Takeover) Form for CBR Sample

CHAIN OF CUSTODY FOR CBR SAMPLE COLLECTED ³

CBR Sample/Evidence reference number

Year				Month		Day		CBR Sample/Evidence ID					

	Name / Function	Date/Time/Signature
Collected by (Sampler)		
Sampling assistant 1		
Sampling assistant 2 (comms)		
Sampling team leader		
Operator at Decontamination Station		
Evidence was transported by		
Seal number(s) on the transportation container		
Evidence deposited by (name/date/time/sig)		
Evidence Received by (name/date/time/sig)		
Evidence disposed by (name/date/ sig)	Authorised disposal by (name/date/ sig)	Witnessed by (name/date/ sig)

³ As supplemental part of Field S&A Booklet (to Part II./Part VI., Annex 2.) following the sample or as separate form (but following the sample)

Chain of custody

Received by (name/sig)	Date & Time	Location
Reason		

Received by (name/sig)	Date & Time	Location
Reason		

Received by (name/sig)	Date & Time	Location
Reason		

Received by (name/sig)	Date & Time	Location
Reason		

Received by (name/sig)	Date & Time	Location
Reason		

Chain of custody attach additional pages as required

Annex 4 – Recommended Procedures for Collection of Various Sample Types**(A) Collection of liquid samples from small vessels (≤ 1000 mL)**

Examples of aqueous samples include nutrient broth or media, environmental or food samples and may contain C, B, R materials and/or their degradation products.

- i. Liquid are usually the most dangerous form to handle due to their fluidity nature. Special care must be taken to ensure that equipment is used properly. For example, when tubing is being used, it must be securely fitted to the syringe (e.g. via Luer Lock). The tubing must be held and retrieved securely and carefully to prevent flipping of the tubing during the process as that might result in spillage of samples and contamination of sampling. If pipette is being used, ensure that the pipette is securely fitted onto the bulb or electronic aid during use. Empty as much liquid as possible from tubing, syringe or pipette before disposal.
- ii. When possible, seal the vessel tightly, swirl to gently mix and homogenized the sample within prior to collection of samples.
- iii. Use 100 ml syringe or pipette to take sample directly from the vessel.
- iv. Slowly draw liquid sample into the syringe or pipette, allowing pressure to equalize.
- v. Carefully empty the collected sample from the syringe or pipette into appropriate 100 mL container (e.g. glass bottle for C and sterile plastic bottle for B).
- vi. Collect a total of approximately 90 mL per bottle and two bottles each for C, B and R⁴ analysis (when necessary).
- vii. Refer to ASEAN-CBR-ROP-002 for ensuring chain-of-custody and ASEAN-CBR-ROP-003 for transportation.

(B) Collection of liquid samples from large vessels (> 1000 mL)

- i. Connect tubing of appropriate length (e.g. depth vessel or distance of the sampling point) securely to syringe.
- ii. Slowly draw liquid sample into the syringe, allowing pressure to equalize.
- iii. Carefully empty the collected sample from the syringe into appropriate 100 mL container (e.g. glass bottle for C and sterile plastic bottle for B).

⁴ During sampling, the dose rate from a sample should not exceed 10 μ Sv/h at a distance of 1 m. If found higher, remove water so that the dose rate does not exceed this recommended threshold. That ofcourse except for special circumstances.

- iv. Collect a total of approximately 90 mL per bottle and two bottles each for C, B and R⁵ analysis (when necessary).
- v. Refer to ASEAN-CBR-ROP-002 for ensuring chain-of-custody and ASEAN-CBR-ROP-003 for transportation.

(C) Collection of wipe samples

- i. Identify surfaces and areas to be sampled – 10 cm x 10 cm (i.e. 100 cm²) or 30 cm x 30 cm (900 cm²).
- ii. Collect a representative wipe sample from the identified sampling area using appropriate tools for respective C, B and R materials (e.g. for C: tweezers with a wipe wetted with solvent if needed, for B: flocked/macrofoam swab or sponge sticks moisten with buffer if needed).
- iii. Wipe the identified surface area by pressing the sampling tool firmly against it, and move in “S” stroke horizontally, vertically and diagonally, flip the tool (i.e. front, back, tip/side) on each change of stroke to maximize collection of samples on to all surfaces of the tool used.
- iv. Place the collected wipe sample in a labelled sample bottle. Close the lid tightly.

[Note: Some decontamination solutions or acidic chemicals will corrode the cotton wipe and could cause adverse chemical reactions. Solvent used may dissolve the surface material being wiped. Therefore, it is important to collect information about the surface prior to taking the sample]

- v. Refer to ASEAN-CBR-ROP-002 for ensuring chain-of-custody and ASEAN-CBR-ROP-003 for transportation.

(D) Collection of air/vapor samples

- i. Identify appropriate sampling tools/apparatus/equipment for C, B and R materials (e.g. for C: as illustrated in Annex 4, for B: air sampler with drawing rate of at least 200 liters per minute).
- ii. Set up the appropriate sampling tools/apparatus/equipment.
- iii. Sampling flow rate will be case dependent and will vary depending on the sampling time, types of agents being sampled and the estimated airborne concentration levels of chemicals in the sampling location.

⁵ During sampling, the dose rate from a sample should not exceed 10 µSv/h at a distance of 1 m. If found higher, remove water so that the dose rate does not exceed this recommended threshold. That ofcourse except for special circumstances.

i. **For sampling of C vapor and R particles**

- a. Refer to Figure Annex 4-1 - Fit the air/vapor sampling tube ends with the O-rings before enclosing the sampling tube holder with sampling end caps.

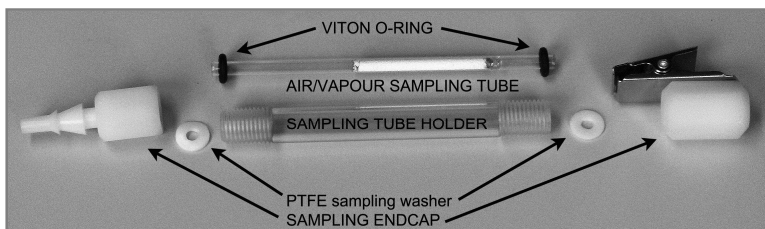


Figure Annex 4-1 : Air/vapour sampling tube parts

- b. Affix a label on the outside body of the sampling tube holder and transfer on it the respective air/vapour sampling tube serial number found on the outside body of the tube holder. Use clean powder-free gloves when handling the sampling tube. Assemble air/vapour sampling equipment calibration train as shown in the Figure Annex 4-2.

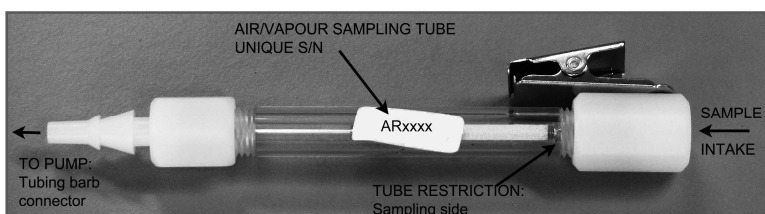


Figure Annex 4-2: 2 Air/vapour sampling tube – sampling assembly

- c. First, attach one end of the tubing to the barbed sampling end cap fitted at one end of the sampling tube holder, as shown in Figure Annex 4-3. The air pump should be calibrated before use and the calibrated flow should be recorded in the Sampling collection form (Annex 2 Part I.).

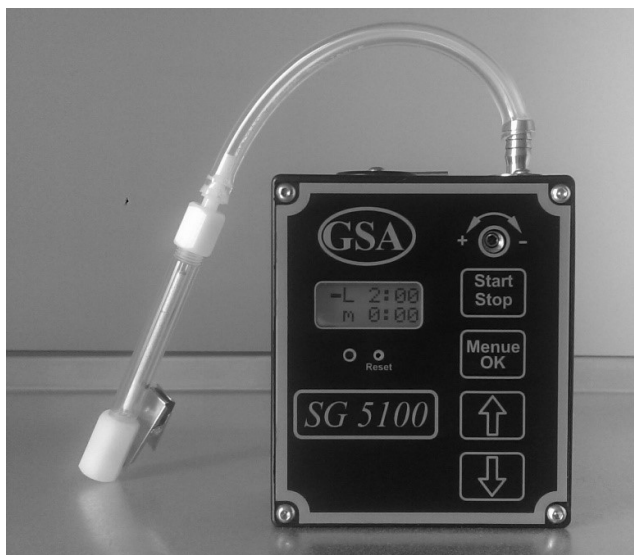


Figure Annex 4-3: Single channel SG5100 air sampler

- d. Place a ground sheet on any solid stationary surface and position the pump and sampling tubes, considering that majority of chemicals are heavier than air and are distributed close to the ground/floor level. Extend the sampling tubes close to the point of sampling. Model and use the stiff wire with an alligator clip attached as a stand for the sampling tubes, if necessary. The pump and tubes can be also hand-held for a predetermined period of time.
- e. For collecting a personal sample, clip the sampling tubes at the personal protective garment at desired height with air sampler placed in the pocket of the garment/clipped on the garment. The sorbent tubes should be placed in a vertical position, with the inlet directed upwards during sampling to avoid channeling.
- f. Start the pump. Record weather data (ambient temperature, relative humidity, wind direction and strength, etc.) in the Sampling Form (Annex 2, Part I.).
- g. At the end of the sampling period, check the pump display to determine if the pump ran for the scheduled time. At the end of the desired collection time (minimum collection volume is 100 L for C agents, 800(0) L for R agents) record the actual running time in the Sample collection form.
- h. Detach tubing from the air/vapour sampling tube holders. Exchange sampling end caps on the sampling tube holder for storage end caps (Figure Annex 4-4).

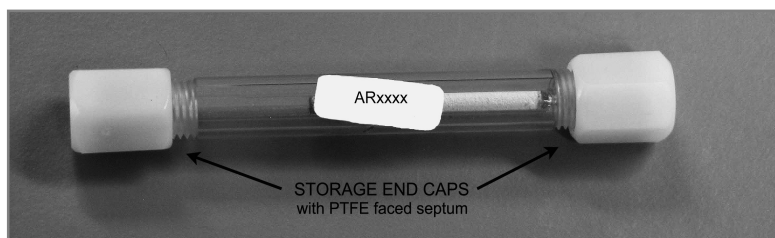


Figure Annex 4-4: Air/vapour sampling tube – storage assembly

- i. Refer to ASEAN-CBR-ROP-002 for ensuring chain-of-custody and ASEAN-CBR-ROP-003 for transportation.

ii. **For sampling of B particles**

- a. *Volume of air to be collected is largely dependent on the space/room to be tested. Aerosolised B particles in open space/field might be carried away by wind and drafts, hence, less likely to collect samples in open space/field. For indoor air sampling, the duration of sampling relies on air volume of the indoor space and the sampling flowrate. As a guide, air sample collected should be at least one volume of the indoor space. More samplers might be needed if the space is large.*
- b. Set up the air sampler according to manufacturer instruction.
- c. Estimate the volume of the space to be sampled.
- d. Set the sampling flowrate and duration to collect at least 1 x space volume.
- e. Refer to ASEAN-CBR-ROP-002 for ensuring chain-of-custody and ASEAN-CBR-ROP-003 for transportation.

(E) **Collection of soil samples**

- i. Remove debris such as grass, large stones, twigs, leaves and similar from the sampling area. Note: If contamination is expected on any of these debris materials collect them into another sample container as a separate solid/vegetation sample.
- ii. Use a steel scoop/spoon/chisel⁶ and wide mouth bottle to collect surface soil samples.
- iii. Collect the soil from an area of approximately 10 x 10 cm, digging approximately 2 cm (up to 5 cm for selected R) deep. If a soil sample is collected from an area that is stained on top of the soil, proper mixing at the site of collection is particularly important in order to ensure a homogeneous composition.

⁶ As appropriate to the type/condition of the soil (hard, moist, sandy, frozen ...)

- iv. Place the soil sample into the wide mouth bottle using a scoop/spoon. Fill the bottle up.
- v. Refer to ASEAN-CBR-ROP-002 for ensuring chain-of-custody and ASEAN-CBR-ROP-003 for transportation.

(F) Collection of food samples

- i. After a CBR incident, an assessment must be made of what sources or supplies may be affected.
- ii. Keep items in the original packaging if possible. Keep the product temperature constant: frozen stays frozen and cold stays cold. Refrigerator, dry ice or ice packs can be used.
- iii. When needed, use clean/sterile containers, wide mouth bottles or plastic bags, depending on the type of food. If possible, include the labels from the original packaging.
- iv. Using the bottles, make sure caps are tight, to prevent leakage.
- v. Do not use bags for liquids, which can leak and spill easily.
- vi. Bags may be used for solid foods, such as dry milk, meat, etc.
- vii. Collect an adequate amount of sample – at least 100-150 grams or ml (up to 1 kg or L).
- viii. If the sample is not homogeneous, ensure that you are collecting a representative sample by homogenising it before sampling, or by sampling different fractions separately.
- ix. Refer to ASEAN-CBR-ROP-002 for ensuring chain-of-custody and ASEAN-CBR-ROP-003 for transportation.

Annex 5 – Splitting of CBR Samples

(A) General points

1. Use appropriate chemicals, splitting equipment and safety equipment for splitting samples. Confirm that all necessary equipment is intact and clean and that it has not been tampered with. Check all bottles, vials and tools before use and record your findings;
2. Do not touch any surface that may come in contact with the sample with bare hands;
3. Environmental and diluted CBR samples are split at the laboratory, if available, inside a fume hood or biosafety cabinet/gloved box for B samples. Otherwise a suitable location close to the sampling point can be used;
4. Neat CWA samples are preferably diluted or split at the site of collection. If a sample is split at the laboratory then follow the instructions per paragraph 9.8 of this ROP;
5. Air/vapor samples cannot be split, but multiple air/vapor sampling tubes can be sampled with identical flow rates and sampling time from the same location to produce the approximate replicas;
6. In general, each sample is split into at least two portions, one of which is used for analysis and another is saved as a reference⁷;
7. Close the lid of each split sample bottle tightly. Wrap the entire bottle/lid joint with tape and apply a seal, if necessary;
8. Ensure proper recording of splitting. Split samples are identified by the unique sample codes, assigned during splitting.

(B) Splitting of soil samples

1. Mix the soil sample thoroughly in a bowl;
2. Split soil samples into two sub-samples, if possible using the cone and quartering method (see below);
3. Place each split sample (approximately 20-30 g) in a wide mouth bottle. Close the lids tightly and shake the samples.

Cone and quartering method – Sample splitting procedure for soil and bulk samples

Sample splitting using the cone-and-quartering method is a procedure for sub-sampling non-homogeneous solid materials and soil.

⁷ Additional splits, pending quantity sampled and appropriate scenario (CBR incident, accident and/or scene of the crime), might be required (for law enforcement, if not part of the ST, or for separate investigative, operational or other purposes)

Procedure:

- i. Wear appropriate protective gear;
- ii. Perform the splitting inside a fume hood or biosafety cabinet/gloved box, if available. Cover the working surface with plastic coated paper. If on-site laboratory and a fume hood or biosafety cabinet/gloved box are not available, perform the sample splitting in the sampling area; cover the ground with a ground sheet;
- iii. Wrap four square boards in aluminum foil (shiny side outside), folding the excess underneath to create a smooth surface on top;
- iv. Mix the sample thoroughly; try to break large chunks, and remove large stones. Place sample in a cone shaped pile onto one of the foil covered boards;
- v. Flatten the pile with another board until it is about one fourth of its original height;
- vi. Divide the pile into four equal parts by drawing a spatula twice through the center of the pile making right angle cuts (see Figure Annex 5-1);
- vii. Separate two opposite quarters from the pile and discard them;
- viii. Mix the rest of the material, form the cone, and repeat steps (v to viii) 4-5 times;
- ix. Remove the aluminum foil from the boards and replace it with new foil for each additional sample to be split and use new gloves, ground sheets, and spatula.

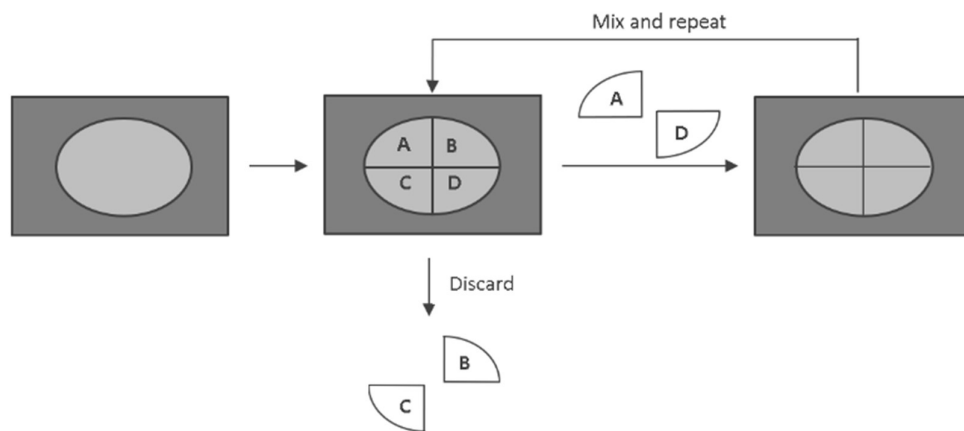


Figure Annex 5-1. The cone-and-quartering method – steps v to viii.

(C) Splitting of wipe samples

Wipe samples are not split as such. The wipe (if applicable for a particular type of CBR wipe sample) is extracted with solvent (for chemical and radiological agents) or buffers (for biological agents) and the extract is split during the sample preparation process (per the requirement of the analytical equipment being used).

(D) Splitting of solid samples

Cut the non-soil solid sample (paint, rubber, wood, etc.) into small pieces, then follow the same extraction/splitting method used with the wipe.

(E) Splitting of bulk solid samples

1. Mix the sample thoroughly (if not homogenous);
2. If possible, use the cone and quartering method (see Annex B) to create two split samples;
3. Transfer at least 2 g of each split to separate vials using a spatula;
4. Only transfer the bulk solid samples off-site in the solid state if it cannot be dissolved in any solvent available for sample preparation (per the requirement of the analytical equipment being used)

(F) Splitting of liquid samples*Bulk aqueous samples*

Transfer at least 90 ml of aliquots to two primary containers using a pipette. Add appropriate amount of 10X Phosphate buffer to achieve final concentration of 1X strength as a preservative for Biological agents

Smaller volume aqueous samples

1. For smaller vessel (i.e. ≤ 1000 mL). When possible, seal the vessel tightly, swirl to gently mix and homogenized the sample within prior to collection of samples. For each split transfer one 90 mL of aliquots of aqueous sample into an appropriate bottle using a syringe or pipette;
2. For biological agents. To add appropriate amount of 10X Phosphate buffer to achieve final concentration of 1X strength as a preservative. Close the lids tightly and shake the samples.
3. Diluted CWA agents. Transfer 3 mL of aliquots to two glass vials using a pipette.

4. Neat CWA agents. It is preferable to perform the splitting of neat CWA in the contaminated area /hot zone. For splitting in the laboratory, follow the steps below
- i. The laboratory is a restricted area while any work with neat agent is in progress. All personnel in the laboratory must wear appropriate protective clothing;
 - ii. Splitting is performed only in a fume hood. Cover the working surface of the fume hood with plastic coated paper and remove all unnecessary items and equipment;
 - iii. Place vials in a vial rack to secure the samples. Make sure that fresh decontamination solution is available inside the fume hood to perform decontamination if any agent is spilled;
 - iv. Only one person works with his/her hands inside the fume hood. Keep your hands and all equipment at least 20 cm inside the fume hood. Leave the outer protective gloves inside the fume hood when the work is completed;
 - v. Have an assistant available to pass equipment into the fume hood. The assistant never touches the hands of the person working at the fume hood or any contaminated equipment;
 - vi. Split samples according to the instructions above;
 - vii. After splitting of the samples check for contamination. If needed decontaminate the vials, rinse and dry them;
 - viii. Drop all used items including gloves into the decontamination solution;
 - ix. Leave the exhaust motor on for at least one additional hour before turning it off. This will safely remove residual vaporous toxic contamination. Check for contamination on all surfaces using available CWA detection equipment. Check the outside of the fume hood to determine possible leakage of vapors and decontaminate if necessary.

(G) Health and safety of mobile/on-site/off-site Laboratory personnel

All laboratory personnel must wear appropriate protective equipment while splitting, preparing and handling samples. The minimum protective clothing when working in the on-site laboratory fume-hood or biosafety cabinet/gloved box consists of: laboratory coat, safety glasses with side-shields or safety goggles, protective gloves.

1. When working with samples containing or suspected to contain harmful CBR compounds an air-purifying respirator has to be within hands reach;
2. When sampling or splitting highly hazardous CBR samples follow protection and safety measures for operating in hazardous environment (up to protection level of operators in the hot zone);
3. Highly hazardous CBR samples must be handled in teams of at least two persons maintaining visual contact at all times. The working area has to be monitored by the most sensitive real time alarm monitor(s) available. The proper function of the monitor(s) has to be confirmed before starting work;
4. Perform all operations with hazardous materials inside the fume hood/gloved box. Check for proper function of the fume hood/gloved box before starting work;
5. All team members have to familiarize themselves with the Safety Data Sheets (SDS) and any other relevant safety information for all the materials used in the laboratory in order to be able to take proper preventive action and to initiate first aid measures in case of an emergency;
6. Check the sample transport container for contamination before opening. Check the double bagged samples for contamination before opening and/or storing. Decontaminate samples and equipment if necessary.

Annex 6 – Tentative Equipment Needed for CBR Sampling (examples)

(A) EQUIPMENT COMMON TO ALL SAMPLING/SURVEYING

Sampling equipment list for forensic and operational sampling and transport to a mobile or fixed-site (forensic) laboratory.

Supplies

- Rucksack;
- Binoculars (wide depth of field);
- Stop-watch
- Measuring tape (50 m) or laser range finder;
- Flashlight (torch) and spare batteries, whistle;
- Ladder (collapsible);
- Indelible ink pens / writing pad;
- Log book;
- Small tool kit containing hammer, knife, screwdrivers, pliers;
- Paint brushes or air-duct brushes;
- CBR hazard labels;
- Sample position markers: flags, spray paint, etc.;
- Bar code labels;
- Disposable plastic sheeting;
- Duct tape rolls;
- Tissues/paper roll (for cleaning purposes);
- Solvent, alcohol or de-ionised water (for cleaning/decontamination purposes), in liters;
- Groundsheet;
- Camera (with time and date display facility), films and spare batteries;
- Video camera, video tapes and spare batteries, charger (for forensic missions).

Protective Equipment and Measures

- National CBR detector kits where available;
- Protective clothing (CBR suit, overshoes, gloves);
- Respiratory protection (air-purifying respirator, dust-masks, self-contained breathing apparatus);
- Specialist protective clothing (if appropriate);
- Vinyl and heavy duty gloves (C-agent resistant will also lock out B and R agents);
- First aid kit, antidote kit, antibiotics, and individual decontamination equipment;
- Prophylaxes, where available; such as B agent-related vaccinations, chemoprophylaxis, and thyroid blocking agents.

Communication / Location Equipment

- Mobile (cellular) phone;
- 2-way Radio;
- Global Positioning System (GPS);
- Compass;

Supporting Documentation

- Sample forms and sample custody forms (Appendix C, estimate quantity by forms per sample);
- Field/On-Site Sampling and Analysis Booklets
- Sample transport forms – for example IAW IATA guidelines;
- Maps;
- Equipment operation manuals;
- Sample collection procedures;
- Field monitoring procedures;
- CBR protection instructions.

Sample Transportation

- Packing/Transport containers;
- Absorbent packing material;
- Seals for transport containers;
- Boxes/crates (for temporary storage of samples prior to transportation).

(B) GENERAL SAMPLING EQUIPMENT AND SUPPLIES

2. General Sampling Tools

- Shears, secateurs and scissors (large)
- Scalpels and spare blades
- Trowel
- Spade/shovel (small)
- Disposable scoops (plastic) (e.g., 100 ml, 200 ml)
- Long handled dipper
- Pipettes, syringes, vacutainers
- Funnels
- Hammers (various)
- Tongs, forceps

3. Container Related Supplies

- Indelible ink pens;

- Polyethylene tape (for additional securing of sample containers);
- Teflon tape (for additional sealing of screw top lids);
- Labels for container;
- Security seals (if required);
- Boxes for transport of samples (IATA approved);
- 1 x portable refrigerator unit powered by battery and capable of maintaining 2-8 °C.

(C) SPECIFIC BIOLOGICAL SAMPLING EQUIPMENT

In addition to the basic IPE, medicine kits, maps and recording devices, recommended equipment for a ST sampling team should include:

- Hand held biological agent detection kit (where available)
- 10 x aerosol sampling filters assemblies (capacity 20 L/min; 5-10 cm diameter)
- Or 1 x hand-held aerosol impinger (capacity 20 L/min) with 10 sampling bottles and capturing liquid
- 12 x sterile spoon spatulas
- 10 x sterile disposable scalpels
- 1 x scissors
- 1 x roll aluminum foil
- 1 x tongs
- 5 x disposable artery forceps
- 10 x sterile dry rayon swabs
- 10 x sterile swabs in microbiological transport medium
- 100 ml phosphate buffered saline
- 12 x 20 ml sterile disposable hypodermic syringes
- 12 x 18 gauge blunt sampling needles
- 12 x pipettes (50-100 mL)
- 60 x airtight sealable bags (various sizes)
- 10 x 50 ml sterile wide necked glass or plastic bottles (air tight)
- 6 x 250 ml sterile wide necked glass or plastic bottles (air tight)
- 2 x marker pens (waterproof)
- 4 x transport bags (50 L)
- 1 x box tissues
- 50 x sample log sheets
- 5 x pairs NBC gloves
- 1 x bottle of sodium hypochlorite solution (12-15% chlorine) or similar disinfectant
- 1 x bag sealer (portable)
- 1 x roll sealing tape
- disinfectant-impregnated absorbent material for transport packaging

- 10 x lint swabs for cleaning

(D) SPECIFIC CHEMICAL SAMPLING EQUIPMENT

In addition to the basic IPE, medicine kits, maps, and recording devices, recommended ST sampling teams' specific chemical sampling equipment includes:

- 1 x Portable, battery-powered chemical agent vapour monitor
- 1 x chemical agent vapour (and liquid, if necessary) detection kit for detection of agents such as nerve agents, mustard, Lewisite, hydrocyanic acid, cyanogen chloride, and phosgene to a specific level.;
- Sealed packages of glass tubes packed with adsorbents such as Tenax (TA or GC), or Chromosorb 106, which can be fitted to the air pump and provided with adequate closures at a wide range of temperatures
- 1 x air pump for vapour/aerosol sampling (capacity 100 mL/min or more);
- 12 x Teflon or glass bottles of a few different sizes (minimum capacity 100 mL), complete with Teflon cap liners;
- 1 x roll of 100% cotton swiping material;
- 24 x disposable polyethylene or nylon bags (heavy duty, 500 mL or larger; with self-closures);
- 10 x pipette (50-100 ml) or syringe (50-100 ml);
- 2 x bulb for pipettes;
- 10 x Vacutainer tube (10 mL, provided with a silicon rubber stopper);
- 10 x polypropylene Terumo Venoject (or equivalent) needle holders, needles and safety caps;
- 30 m length of narrow bore PTFE tubing;
- 5 x lead fishing weights (25 g);
- 1 x tailor-made tube rack of PVC/metal (with a capacity for ten tubes);
- 1 x roll of sealing tape;
- 2 x packet of labels;
- 1 x pair of scissors;
- 12 x spoon spatulas (disposable, individually sealed);
- 1 x pair of beaker tongs;
- 1 x scalpel handle;
- 1 x package of 10 scalpel blades
- 4 x felt tip pen, black, waterproof;
- 30 x external aluminum foil lined or bubble pack paper bags;
- 1 x 250 ml Teflon or other bottle containing acetone or another suitable organic solvent;
- 1 x box of 2-ply tissue paper;
- 5 m length of metal measuring tape;
- 50 x evidence sticker;

- 1 x notebook (type “write in rain”);
- 50 x sampling log sheet
- 1 x plastic can filled with decontamination powder;
- 1 x tin can filled with coarse-grained charcoal (250 g);
- 1 x set of china markers and waterproof pen markers, as available;
- 5 x pair of NBC gloves;
- 12 x disposable forceps.

Chemical sample tube size and compatible thermodesorption unit.

Tube Size (length x outer diameter)	Compatible Thermal Desorption Unit
9 cm x 6 mm	Perkin-Elmer ATD400, Markes Unity
15 cm x 6 mm	Chrompack TCT
10 cm x 6 mm	Fisons (Carlo Erba) TDA-5
17.6 mm x 6 mm	Tekmar Model 5010 ATDU

(E) SAMPLING EQUIPMENT FOR TEAMS WITH CHEMICAL SPECIALISTS

- 1 x Personal air sampler with rechargeable battery (adjustable flow between 100-1000mL/min);
- 1 x adapter for charging personal air sampler battery;
- 2 x aerosol filter holder;
- 12 x weighed glass microfibre filter (diameter 25 mm), Whatman GFA;
- 1 x package of twelve charcoal tubes (NIOSH standard);
- 12 x package of Bond-Elute C18 and/or XAD cartridges (activated or with a means of activation);
- 12 x Teflon container with Teflon cap liners (for storage of Bond-Elute C18 and /or XAD cartridges);
- 2 x syringe (10mL) with ¼ inch fittings for connection with cartridges (XAD and/or Bond-Elute C18);
- 1 x tool kit containing items such as hacksaw, pliers, screwdrivers and chisels;
- 1 x digital thermometer;
- 1 x package of pH test paper (pH1-10);
- 12 x disposable forceps.

(F) SPECIFIC RADIOLOGICAL SAMPLING EQUIPMENT

1. Personal Protective/Detection Equipment

- Individual direct reading dosimeter (1 per person);
- Individual passive (permanent dosimetry), (for the record) dosimetry (1 per person);

- Contamination monitor (calibrated) and spare batteries (2);
- Dose/dose rate meter with telescoping-reach arm and spare batteries (2);
- Directional beta/gamma meter (2);
- Portable air sampler with filters and ancillary equipment (2);
- Gloves - heavy duty (1 per person);
- Tool decontamination supplies;
- Protective clothing (anti-Cs, overshoes, gloves; 2 per person);
- Respiratory protection (air-purifying respirator, dust-masks, SCBA; 6 per person);
- Prophylaxes - such as thyroid blocking agents (as required).

2. Sampling Tools

- Robots (if necessary for recon of hazardous areas), as required

3. Storage

- Polyethylene tape (for additional securing of sample containers; 2 rolls);
- Teflon tape (for additional securing of water sample containers; 2 rolls);
- Permanent markers (10);
- Label for container (300);
- Security seals (if required; 600);
- Boxes/crates for transport of samples, various sizes (30);
- Area Radioactive Hazard Signs - IAW IAEA Safety Series No. 115 (10);
- Radioactive warning non-adhesive tape rolls (4);
- "whirl-pack"/ziploc plastic swipe storage bags (as required);
- Spare polyethylene re-sealable sample bags (20cm x 30cm; 120);
- Spare heavy-duty black plastic bags (for sample grouping/waste storage; 30).

4. Transportation

- Packing/Transport containers (e.g. Type A, excepted packages, etc.; 2 of each size);
- Radioactive adhesive warning tape, as required;
- Lead shielded containers to hold "hot particles", as required;
- Absorbent packing material, as required;
- Seals (tamper evident) for transport containers, as required;
- Pre-printed address labels (for dispatch to analysing laboratory; 2 for each container);
- Consignors paperwork, as required;
- Transport and shipping labels, as required

5. Site Kit Contents

Terrestrial sites

- polyethylene bags 60
- polyethylene bags (outer for double bagging) 60
- 1 litter polyethylene bottles

Urban sites

- heavy-duty polyethylene bags 30
- polyethylene bags 30
- heavy-duty polyethylene bags (outer for double bagging) 30
- polyethylene bags (outer for double bagging) 30

Hydrological sites

- cubetainers, 1 - 4 liter volume 30