IRAQ CONTAMINATED SITE ASSESSMENT WORKSHOP REPORT

Post-Conflict and Disaster Management Branch, UN Environment

Includes a Review of Central Environmental Laboratory and Recommendations for Capacity Building

Baghdad, 29 January – 1 February 2018

Contents

1. Introduction

During the period July – November 2017, UN Environment undertook two rapid scoping missions in areas formerly occupied by the so-called Islamic State in Iraq and the Levant (ISIL) in northern and western Iraq, with a focus on the city of Mosul and its surrounding regions. This rapid review revealed the extensive environmental damage caused by the ISIL conflict, which was both severe and widespread. The review concluded that detailed contaminated site assessments need to be carried out for a selected number of priority sites.

As an initial step towards strengthening the capacity of the Ministry of Health and Environment (MOHE) in addressing the pollution impacts of the ISIL conflict, the UN Environment's Post-Conflict and Disaster Management Branch conducted a 3-day workshop in Baghdad to provide an overview of the international best practices on contaminated site assessments. The workshop was attended by 40 staff members of the Ministry of Health and Environment (MOHE) and other partner ministries from the central and governorate levels. Separate technical sessions were also held on chemical weapons and radiation contamination. In addition to UNEP staff, the workshop facilitation team comprised of senior environmental experts from Canada, and long-standing UNEP partners Spiez Laboratory[1] in Switzerland and ALS Global in the UK.

To obtain a more comprehensive overview of national capacity, the UN Environment team also visited MOHE's Central Environmental Laboratories (CEL) in Baghdad. Discussions focussed on the scope of work and current capacity of the laboratory, and the vision and plans of its senior management to attain international standards. UNEP would like to acknowledge the assistance of the representative of the Department of International Environmental Relations (MOHE) in organizing the workshop and laboratory review.

This report provides a summary of the contaminated site assessment (CSA) workshop activities, and UN Environment's observations on the apparent gaps in MOHE's capacity to conduct CSAs. The report concludes with a set of recommendations that aim to reduce these shortcomings and empower the MOHE staff in collaboration with national institutions to conduct CSAs in a manner that measures up to international best practices.

2. Workshop Context

The CSA workshop was jointly organized by the Ministry of Health and Environment and UNEP from 29-31 January 2018 over a 3-day period at the Royal Tulip Al Rasheed Hotel in Baghdad's 'Green Zone'. In his opening remarks, the Honourable Dr. Jassim Humadi, Deputy Minister of Environment, underscored the importance of having an empowered and skilled workforce that can tackle the toxic environmental legacy caused by decades of conflict, especially in areas devastated by the ISIL conflict.

Mr. Hassan Partow, Programme Manager at UN Environment, recalled the long-standing involvement of UN Environment in Iraq; including its post-conflict recovery programme from 2004-2006, which helped build the capacity of the nascent environment ministry with a special focus on conducting environmental site assessments. He reiterated UN Environment's commitment to support Iraq in addressing the

[1] Swiss laboratory of the Department of Defence and Civil Protection

2. International laboratory based in the UK

environmental impacts of the ISIL conflict in line with the recent UN Environment Assembly resolution (2017) to mitigate pollution from armed conflict and terrorism.

The CSA Workshop was the first occasion in over two decades for UN Environment to hold an event in Baghdad conveying growing international confidence to engage in Iraq's reconstruction and development.

This allowed a large number of government staff to attend the workshop from across the country than is otherwise possible. It is hoped that the success of the workshop demonstrates UN Environment's and the Iraqi Government's ability to host similar events, and that the security situation is currently at an acceptable level to conduct in-country technical assistance and capacity building activities in a cost-effective manner.

3. Target Audience

Workshop participants, numbering a total of 40 persons, hailed primarily from the MOHE's headquarter office in Baghdad, and its regional offices in the five governorates impacted by ISIL occupation. In addition, officials from the Ministry of Oil, and the Ministry of Industry and Minerals also participated. Finally, representatives from the Ministry of Foreign Affairs office dealing with international organizations attended as observers.

Workshop participants notably included headquarter based staff from the Environment Ministry's Contaminated Site Assessment unit, and their counterpart colleagues from the governorates. These included senior managers with responsibilities to plan and implement contaminated site assessment programs, and ensure their departments have adequate staff and resources. They also have responsibility to prepare annual budget requests and work plans. Other participants were project managers coordinating contaminated site assessment fieldwork activities at various sites with the support of their technical and administrative teams. MOHE staff from the governorates typically conducted CSA field sampling campaigns with oversight from the regional office for northern Iraq based in Kirkuk and central headquarters. Senior officials from the Oil Ministry (North Oil Company) who had first-hand experience putting out fires in the oil fields, as well as explosive experts from the Environment Ministry's demining department also took part in the workshop.

Figure 1: Technical presentation by UN Environment expert

Participants had varied technical backgrounds including environmental engineering and science, agricultural engineering, water resources and soil science, occupational health and safety, petrochemicals management, chemical and hazardous waste management, and industrial engineering. In order to facilitate effective communication and interaction between the international and national experts, simultaneous Arabic-English translation was arranged for the workshop.

Figure 2: Technical presentation by UN Environment expert seconded by ALS Global

Figure 3: Group photo of workshop participants and facilitators

4. Workshop Activities

The CSA workshop programme was based on the key elements of a typical contaminated site characterization project. As the audience comprised of professionals from different work streams, many examples and case studies were used to illustrate a range of contexts and issues. The workshop comprised of five modules which are summarized below, and the agenda is provided in Annex I of this report. As the workshop progressed, additional presentation topics were included based on the UN team's evaluation of participant needs, and feedback.

To better understand the national context, MOHE's Contaminated Site Assessment Unit staff provided an overview of their mandate, organisational structure and activities. In addition, they presented their on-going site assessment campaign in the Mishraq sulfur complex and Qayyarah oil field; two heavily damaged sites in the former ISIL occupied territories near Mosul.

Figure 4: Technical presentations by UN Environment expert seconded by Spiez Laboratory

Module 1 of the workshop provided an overview of contaminated site assessments, risk assessments and remediation action plans, and described the link between these three key topics. It covered the main elements in each of these components and discussed some of the practical challenges that practitioners typically face in carrying-out such work. Technical and non-technical considerations of conducting a contaminated site assessment project were addressed. This included information dissemination to the public, transparency, public consultation and media coverage. Useful techniques and tools were highlighted so that they can easily be used by those in the field. Differences in the roles of contractors and site owners were underscored, and the main aspects of compliance monitoring and inspections were covered.

Module 2 addressed the preparatory activities for a contaminated site assessment project before the field campaign begins. This module included an introduction to environmental sampling planning and sampling strategies, with extensive case studies and examples of different methods and their respective limitations and challenges.

Module 3 addressed key issues encountered during implementation of field activities, including sampling tools and techniques, quality assurance, storage and transport of samples, and personal protective equipment requirements.

Module 4 discussed the activities in a contaminated site characterization project once the field campaign is completed. This included the environmental sample reception and analysis by environmental laboratories, the various equipment used for analyses, data interpretation, quality control and quality assurance, and some of the practical challenges experienced during laboratory reporting.

Figure 5: Workshop participants reporting on the outcome of group discussions

Module 5 covered the elements of a remedial action plan. In addition, based on participants' request, additional information was provided on the elements of Health and Safety Plans.

Furthermore, a CSA Project Planning session was conducted which included group exercises to enable participants to think through the entire process that needs to be considered when planning a contaminated site assessment project. Finally, information on an impartial web-based platform developed by the UN called MapX (www.mapx.org) was shared as a potential means to help map, monitor and facilitate access to information on contaminated sites. MOHE officials expressed interest in using MapX to support mapping of its ongoing CSA field campaign results, and help develop a regional strategy for pollution mitigation.

A complete set of workshop presentation materials as well as reference and guidance documents on various components of contaminated site characterization were provided to the participants on a USB memory stick. A certificate of workshop attendance was also presented to the participants.

5. Special Sessions

At the request of the environment ministry, two break-out sessions were held with a sub-group of workshop participants and other relevant national institutions on two separate topics: i) chemical weapon agents; and ii) radiation contamination.

The session on chemical weapons included representatives from the Ministries of Interior (Civil Protection Authority); Environment; and Science and Technology. The main topic of discussion was the challenge faced by the Environment Ministry in fulfilling its mandate to carry-out verification clearance of chemical warfare agent decontaminated sites. The clean-up itself is conducted either by the Ministries of Defence and/or Interior (Civil Defence). However, the Environment Ministry lacks the capacity, resources and equipment to deal with this specialized task. The Civil Protection Authority reported many sites where mustard was used including in Nineveh, Anbar, Salahaddin and Kirkuk governorates, which is the main concern (plus a large number of sites where chlorine was allegedly used).

The head of the Iraq Chemical, biological**,** radiological and nuclear (CBRN) programme at the Interior Ministry indicated that the key priority for Iraq is currently to build the environment ministry's capacity in decontamination clearance. UNEP informed that communication on this matter should be conducted through the Organisation for the Prohibition of Chemical Weapons (OPCW), including opportunities for Spiez Laboratory to host Iraqi experts under its in-house internship programme.

The second technical session with officials from the Radiation Protection Centre (RPC) discussed the radiologically contaminated sites in the areas retaken from ISIL. The Adaya[2] nuclear dump site located 50 km west of Mosul, which reportedly contains up to three tonnes of yellow cake, is considered by the RPC as the number one high risk radiation contamination site in Iraq today. A grab sample was taken at the Adaya site during UN Environment's scoping mission in November 2017, which showed high levels of radiation contamination requiring urgent remedial action. The site is currently unsecured as the fencing was removed during ISIL occupation and used to carryout artisanal oil refining activities. UNEP advised that urgent action is taken to secure the site, and that communication on this matter be channelled through the International Atomic Energy Agency.

Figure 6: Technical session on chemical weapons agents (left) and radiation contamination (right)

[2] From Iraq's decommissioning programme in the early 1990s.

6. Observations and Feedback

The environmental fallout from the ISIL conflict significantly increased the already substantial toxic legacy from decades of conflict in Iraq. MOHE staff at the Baghdad headquarters and in the seven governorates formerly occupied by ISIL have an enormous amount of contaminated site assessment work to carry-out; even if only to obtain a better picture of the extent of remedial work that needs to be undertaken.

There is an immediate need to comprehensively map the environmental contamination hot spots in the post-ISIL areas, and identify the nature and extent of contamination that could be immediately dangerous to life and health of the general population living in or near these sites.

In this context, during the course of the workshop, the UN Environment team could discern the major challenges faced by the project managers and field staff of MOHE as well as the other ministries and industries. There is a significant gap in the Environment Ministry's capacity in many areas, including staff resources and organizational infrastructure, staff qualification and training, field equipment and tools, laboratory resources, personal protective equipment, governing policies and procedures, and a framework for effective inter-departmental collaboration.

For example, ministry staff lack adequate hands-on training in project planning, field sampling techniques, screening level and site specific risk assessments, and remediation technologies. Their current inventory of field equipment does not appear to be up to the current standards for conducting contaminated site assessments, nor do they have an adequate supply of reagents. Most participants were not aware of the latest guidance and generic assessment criteria for contaminated site characterisation. In addition, the lack of a documented set of governing policies and procedures, both technical (e.g. field sampling procedures) and non-technical (e.g. public communication, emergency preparedness and response, compliance inspections), is an important shortcoming in undertaking successful contaminated site assessments.

Figure 7: Q&A sessions received good feedback

The feedback evaluation indicated the workshop content was overall highly appreciated by all the participants as an overview and primer on contaminated site assessments. The overview module was considered useful by managers and field staff alike in helping understand the context and interlinkages between various components.

The module dealing with the field campaign was of particular interest to the field staff, while it was largely a refresher for the MOHE contaminated site assessment unit staff; who found the laboratory analysis and data interpretation module more appropriate. A few participants were clearly interested in learning more about site specific risk assessment software tools and techniques, which was beyond the scope of this workshop. The feedback received from workshop participants reveals that the workshop modules covered most of their expectations, and that they were satisfied with the quality of the presentations and the workshop structure.

There was considerable interaction between the UN Environment team and the participants. The questions posed by the participants were relevant to CSA work and demonstrated an interest in practical aspects. Another positive workshop outcome was increased interaction between staff from within and between different ministries, and a realization that with better systemic collaboration considerable knowledge sharing could occur for their mutual benefit.

7. Conclusions

In conclusion, the workshop was an important first step in strengthening Iraq's capacity to conduct contaminated site assessments. Furthermore, UN Environment and the Iraqi government demonstrated that conducting this workshop in Baghdad for the first time was a successful and cost-effective strategy allowing a larger number of staff to benefit from the training.

At the same time, a number of important gaps between Iraq's current capacity and their actual needs were identified. The recommendations provided in section 9 of this report are meant to reduce the gaps identified and help empower the MOHE in the process.

8. Rapid Review of the Central Environmental Laboratory

The Central Environmental Laboratory (CEL) which is part of the Ministry of Health and Environment is meant to serve as the main reference laboratory for environmental tests at the national level. The UN Environment team visited CEL offices in Karrada, Baghdad on 1st February 2018, in order to obtain first-hand information on their current capacity for processing environmental samples from contaminated sites in areas retaken from ISIL. This included extended discussions with senior staff and a a tour of laboratory facilities.

Figure 8: Visit to the Central Environmental Laboratory

The CEL has a complement of technical and scientific staff including organic chemists, analytical chemists, environmental biologists, microbiologists, environmental engineers, technicians, environmental statisticians and administrative and support staff. The laboratory has a good range of analytical instruments including gas chromatography, mass spectrophotometer (GC-MS), high pressure liquid chromatography (HPLC), atomic absorption spectrometer, UV spectrophotometer, pH-meter, conductivity-meter, turbidity-meter, oxygen-meter, flame photometer, rotary evaporator, ovens, COD meter, water bath, incubators, autoclave, microscope, and centrifuge. There are some portable monitors including x-ray fluorescence (XRF), and personal alarms for hazards (e.g. hydrogen sulphide, sulphur dioxide, carbon monoxide).

8.1 Key Observations:

The CEL Director underlined the Laboratory's goal to obtain accreditation for the latest ISO Standard 17025, in order to assure reliable results and the best possible service to the MOHE and other clients. As part of this effort, a Quality Assurance department was recently created which is in the process of being

staffed. It is also understood that the Ministry of Planning has an ISO accreditation process for organizations in Iraq.

At present, CEL receives soil and water samples for analysis including for drinking water, industrial effluents, contaminated sites, and municipal sewage. It was also noted that air quality assessment was handled by a different department although ambient air monitoring station samples were analysed at the CEL for heavy metals. Approximately 8 to 10 samples per day are reportedly received for analysis.

Figure 9: CEL staff explaining laboratory procedures

Overall, the UNEP team observed that CEL had a basic laboratory infrastructure in place with some key elements of an organizational structure in place. However, as recognized by the CEL Director, the laboratory needs to strengthen its governance system and technical capacity to conduct analysis of certain environmental components. This includes bacteriological analysis (algae, lichens and mould), and analysis of organic pollutants and hydrocarbons in the air. Broadening the current capabilities of CEL to analyse these environmental components is one of the key priorities in the coming years.

For the UN team, it was evident from the visit that the laboratory needs to strengthen its capacity at both the infrastructure as well as at the administrative and quality assurance levels.

With regards to CEL equipment, it was observed that several items were not functional, reportedly due to lack of replacement parts or other maintenance challenges. Some other equipment was observed to have expired reference standards. Laboratory staff noted logistical challenges in replenishing supplies due to ongoing turmoil in the country. A number of equipment appeared not to have been used for some time and may have fallen into disrepair. The laboratory's eye-wash stations were empty and dust-laden and would not be of use in the event of an emergency.

An important gap between CEL's expectations on standard sample collection and transportation and clients' current practices was evident. The samples received by the laboratory appeared to be in non-standard containers and stored without proper precautions and therefore analytical results for these

samples may have low confidence in representing field conditions. If the correct containers are not used or the samples are not handled properly or the chain of custody process is not in place, then the value of submitting the samples to the laboratory in the first instance is questionable.

The administrative processes applied from the time of sample reception to the communication of analytical results can be strengthened considerably, some of which can be implemented without additional infrastructure. The UN Environment team observed errors in data transfer from the laboratory analysis to the final laboratory report. The aforementioned mistakes underscore the need for CEL to have a systematic approach on sampling and data management, and dedicated oversight capacity from qualified quality assurance staff. It also highlights the need for additional training for existing scientific staff on the latest developments and best practices in their respective scientific fields as well as in modern laboratory management processes.

Figure 10: UN Environment team reviewing laboratory facilities

With respect to the ISO accreditation process for CEL, it is the team's opinion that while this is a worthwhile and legitimate goal, fulfilling the requirements of ISO 17025 will be a challenging process under existing conditions. There are many organizational, process-related, technical and economic issues that will have to be addressed to attain this result.

9. Recommendations

The CSA workshop and the rapid review visit to the CEL allowed the UNEP team to acquire an understanding of the important challenges and capacity gaps in Iraq's environmental institutions to conduct environmental pollution investigations in a proper and timely manner on par with international best practices. In order to do so, there is a time-sensitive need for more targeted training for Iraqi experts in various subject areas. Furthermore, trainings need to be tailored to well identified groups such as field staff, project managers, laboratory staff and those involved in environmental risk assessments.

The below recommendations are provided to help strengthen Iraq's capacity and ability to conduct effective contaminated site assessments that can withstand international scrutiny with support from Iraq's international partners, as needed.

10. Overarching Recommendation

The MOHE should conduct a comprehensive survey based on contaminated site assessment approach of hot spots in the ISIL affected areas, with a view to identifying the nature and extent of contamination that could be immediately dangerous to life and health of the general population living in those areas. Policy makers in Iraq should use the survey results in conflict affected governorates to:

a. secure contaminated areas to prevent further exposure;
b. remove and safely dispose the hazards right away where possible, or
c. relocating people at a safe distance from contaminated sites (if necessary).

As a first step to this end, MOHE and partners should conduct a screening level inventory of contaminated sites in the conflict-affected areas. The information collected should ideally be mapped and published on a web-based platform to ensure broad and easy access to the information. In undertaking a comprehensive contaminated site assessment programme, the MOHE will need to coordinate with interested international agencies to mobilize the required support.

10.1 Short-term Recommendations (<1 year)

1. Pending a longer-term review, start using the most recent versions of the generic assessment criteria, as opposed to those used in previous investigations carried out in 2005 such as the Australian (1999) and Dutch (2000) standards. Both these standards have since been superseded. Consider using appropriate granularity in analysis (example: aromatic and aliphatic fractions of Total Petroleum Hydrocarbons, instead of together) so that the results are more meaningful during environmental risk assessment work.
2. Organize targeted training on detailed project planning and reporting geared to MOHE staff who are in the project/task management roles. This training should include the development of conceptual site modelling, and standard operating procedures and templates. It should also address preparation of project plans for various elements including health and safety, emergency preparedness and response, site security, transportation, public consultation and information dissemination, documentation and reporting, and compliance oversight inspection procedures.
3. Organize training program on contaminated site assessment field campaigns for MOHE field staff. This training should include hands-on sampling best practices, use of field monitoring instruments, sample storage and transport, record keeping, occupational health and safety orientation, appropriate PPE requirements, and the development of Standard Operating Procedures for the field sampling campaign.
4. Organize targeted training program for MOHE staff to carryout contaminated site assessments of suspected chemical agents used in chemical weapons. This should include special precautions and practices, specific sampling, storage and transportation methods to be used, record keeping, and stakeholder coordination.
5. Organize orientation training and/or internships for CEL technical staff at reputable accredited environmental laboratories outside of Iraq on best practices in analytical laboratory work.
6. CEL should establish a stronger working relationship with the Contaminated Site Assessment Unit of the MOHE. This is needed in order to ensure that sample collection and field measurements meet the standards and expectations of CEL, and that CEL and the CSA teams are aware of each other's capabilities and limitations. This includes sampling techniques and knowledge of sample

matrices, transportation and storage of different sample types, and documentation and chain of custody requirements. In this regard, a combined workshop involving both CEL and CSA team members would be useful.

7. Organize training for Radiation Protection Centre staff to conduct a contaminated site assessment, and remediation plan for uncontrolled radioactive wastes in the Adaya site.
8. Carry out a review of MOHE/CEL's field equipment inventory and procure additional supplies to support the various contaminated site assessment projects to be undertaken in the country.
9. Organize training program for a targeted group of qualified MOHE staff on conducting screening level and site-specific risk assessments following the contaminated site assessment projects. In addition, procure appropriate computer software and provide related training to enable Iraqi experts to conduct these activities.
10. Undertake a review of the organizational governing documents (policies, procedures, standards, templates and tools) and fill the gaps in order to ensure consistent application of contaminated site assessment protocols in various locations across the country.

10.2 Medium Term Recommendations (1-3 years)

1. Develop and/or update a protocol for inter-sectoral collaboration between the MOHE and other ministries and agencies, especially at the governorate level, to better harness existing expertise. For example, technical staff from other ministries in the various regions can be trained by the MOHE staff to conduct or support sampling campaigns in those areas.
2. Establish external, third party review of the contaminated site assessment projects carried out by the MOHE experts to identify opportunities for continuous improvement.
3. For the MOHE, develop institutional strengthening tools such as regulatory oversight and enforcement guidelines; inspection protocols; protocol for the calculation of financial guarantees to ensure environmental protection by site operators (including socio-economic costs); protocols for inter-departmental collaboration and formal interaction among staff and management counterparts in different ministries.
4. Establish external advisory panels on quality assurance and management systems aimed at strengthening the various departments of the MOHE and to enhance inter-departmental collaboration with other ministries on environmental activities.
5. Undertake a comprehensive and comparative review of the generic assessment criteria used for contaminated site assessments in Iraq and neighbouring countries such as Saudi Arabia, UAE and Qatar, with generally similar soil characteristics as Iraq. The generic assessment criteria currently used were developed for countries with different soil characteristics.
6. At a corporate level, CEL senior management should develop a strategic plan to address the gaps between:

    a. existing laboratory equipment and the current/ future needs of the laboratory;
    b. the current staff complement, their qualification and training and the current/future needs of the laboratory;
    c. the current organizational governing documents (management system, processes, policies, procedures, standards and tools) and the future needs of the laboratory.
7. Based on the findings of the above gap analysis, the CEL should develop a prioritized Action Plan for implementation. This Action Plan will act as a blue print for funding requests, and future reports on departmental plans and priorities.

8. The CEL should familiarise itself on the accreditation process of the Iraqi Ministry of Planning and determine how the requirements are to be fulfilled. Furthermore, CEL should seek to learn from the experiences of other Iraqi laboratories which are already accredited by Iraqi legislation.
9. It is recommended that CEL carefully study the ISO 17025 requirements and determine the gaps they currently have and identify a list of measures to fulfil these requirements. Development of a laboratory management system which addresses the below list (not comprehensive) of issues is necessary including:
    - ⇒ State how impartiality is achieved and maintained to withstand scrutiny and legal challenges.
    - ⇒ State how confidentiality is achieved and secured.
    - ⇒ Define the scope of laboratory work to be covered by ISO 17025.
    - ⇒ Define clear roles, responsibilities and authorities under a governance structure.
    - ⇒ Develop and implement a management process for control and continuous improvement of laboratory processes.
    - ⇒ Ensure a stable supply of laboratory goods, certified reference material and standards as well as electricity services through appropriate procurement practices.
    - ⇒ Ensure stable temperature and humidity conditions in the laboratories, where needed.
    - ⇒ Prepare a list of all critical instruments that require preventative maintenance and spares inventory in order to ensure continuous and efficient operations of CEL.
    - ⇒ List all critical standard solutions and reference materials along with their expiry dates, in a manner that allows for timely replenishment.
    - ⇒ Establish a standardized process of development and validation of analytical procedures and instruments.
    - ⇒ Set up a searchable database (for example, using Microsoft Excel or similar) with an overview of all orders, customers, entry date, closing date, exact analytical parameters, responsible person, etc.
    - ⇒ Data entry and data transfers are carried out in a manner that eliminates human input errors. Ensure that errors in reporting of analytical results and codes are not possible.
    - ⇒ Management oversight of data quality should be strictly applied and lax peer review and supervision immediately addressed.

Annex I

Contaminated Site Assessment Workshop Training Programme

Time	Activity
	Day 1, Monday, 29 January
9:15	Welcome and Registration
9:30	Opening Remarks *Hassan Partow, Programme Manager, UN Environment* *Dr. Jassim Humadi, Deputy Minister of Environment, Ministry of Health and Environment*
9:50	Introduction of Participants and Training Team *Hassan Partow, UN Environment* Course Overview and Baseline Assessment *Hassan Partow, UN Environment*
10:15	**Module 1: Why are we here?** Overview of contaminated site assessments, Risk Assessments and Remedial Action Plan BR Ravishankar What is contaminated site assessment, its link with risk assessments and remedial action plan Key elements and considerations of CSA, RA and RAP Assessment Goals, Scope, Limitations and Constraints/Practical Challenges Q&A
11:30	Tea/Coffee Break
11:45	**Module 1: continued** BR Ravishankar Technical Considerations (staff qualification, training, orientation, equipment, tools) Non-Technical Considerations (public engagement, information dissemination, media, safety and security) Overview of Role of Contractor vs. Regulatory/Owner Oversight

Time	Activity
	Q&A
12:30	Presentation on Contaminated Site Assessment Unit (15 minutes) Ministry of Health and Environment Presentation on Contaminated Site Assessments of Mishraq and Qayarrah (20 minutes) Ministry of Health and Environment
13:30	Lunch
14:30	Module 2: Activities Before Field Campaign *Marc Stauffer with Geraint Williams and Mario Burger* Introduction on sampling planning and sampling strategies Q&A
16:30	End of Day 1
	Day 2, Tuesday 30 January
9:30	**Module 2: Activities Before Field Campaign (continued)** *Marc Stauffer with Geraint Williams, Mario Burger, BR Ravishankar* Sampling Planning (including do's and don'ts) Sampling strategies Health and Safety (PPE) Case Studies Planning / Codification exercise / quiz Q&A
11:30	Coffee/tea break
11:45	**Module 3: Activities During Field Campaign** *Marc Stauffer with Geraint Williams* Staff Orientation (including PPE demonstration) Tools and techniques Documentation Sampling quality assurance Q&A

Time	Activity
13:30	Lunch
14:30	**Module 3:** Continued *Marc Stauffer with Geraint Williams* Tools and techniques Documentation Sampling quality assurance Storage and transport Case Studies Workgroup exercises Field campaign quiz Q&A
16:30	End of Day
	Day 3, Wednesday 31 January
9:30	**Module 4: Post Field Campaign** *Geraint Williams* - Sample analysis (standard methods, types, equipment, etc.) - Laboratory analysis - Data Quality Verification - Reporting Q&A
11:30	Tea/Coffee break
11:45	**Module 5: Determination of Remedial Action Plan** *BR Ravishankar* Remediation Options Analysis Selection of Remediation Option, Scope, Limitations Establishment of Remediation Criteria Conduct of Compliance oversight by Owner/Regulator

Time	Activity
	Health and Safety Plan for the Remediation Project "Remediation film" of the Swiss Department of Defence, showing the whole process from sampling to remediation in Switzerland Q&A
13:30	Lunch
14:30	**Module 5: Determination of Remedial Action Plan** *BR Ravishankar* Group exercises in Break Out Sessions Q&A
15:30	Group Discussions: Open Q&A Session
16:00	End of Course Assessments
16:15	Closing Remarks *Representative, Ministry of Health and Environment* *Hassan Partow, UN Environment* Awarding of Certificates
16:30	End of Main Course Programme

Annex II

List of Workshop Participants

Mr. Hussein Mahlan Ammar
Environment Department
Ministry of Industry and Minerals

Mr. Rasool Ibrahim Hameed
Al Anbar Directorate
Ministry of Health and Environment

Mr. Ismail Ateia Ahmed
Al Anbar Directorate
Ministry of Health and Environment

Mr. Abdul Jabar Jomaa Ahmad
Al Anbar Directorate
Ministry of Health and Environment

Mr. Ali Hameed Azay
Diyala Directorate
Ministry of Health and Environment

Mr. Sabah Abd Allah Numan
Diyala Directorate
Ministry of Health and Environment

Mr. Harith Jaleel Rzoki
Diyala Directorate
Ministry of Health and Environment

Mr. Samir Ahmad Manhal
Baghdad Directorate
Ministry of Health and Environment

Mr. Jasim Ali Nawar
Baghdad Directorate
Ministry of Health and Environment

Mr. Sabah Khlaf Hassan
Baghdad Directorate
Ministry of Health and Environment

Ms. Rehab Taher Ahmed
Northern Directorate
Ministry of Health and Environment

Mr. Mohammed M. Hamed
Northern Directorate
Ministry of Health and Environment

Mr. Ismael Ibrahem Mohammed
Northern Directorate
Ministry of Health and Environment

Mr. Ahmed Hbeeb Mohammed
Kirkuk Directorate
Ministry of Health and Environment

Mr. Adnan Khaleefa Kuhdair
Salahaddin Directorate
Ministry of Health and Environment

Mr. Muntaser Najee Abdullah
Salahaddin Directorate
Ministry of Health and Environment

Mr. Ammar Salem Mahjob
Nineveh Directorate
Ministry of Health and Environment

Mr. Omer Waadallah Sulman
Nineveh Directorate
Ministry of Health and Environment

Ms. Rasha Raad Salman
Technical Directorate
Ministry of Health and Environment

Mr. Adnan Yas Khdher
Babel Directorate
Ministry of Health and Environment

Mr. Mahmmod Khalid Mahmmod
Technical Directorate
Ministry of Health and Environment

Mr. Qassim Taha Kudhair
Babel Directorate
Ministry of Health and Environment

Mr. Imad Ali
Technical Directorate
Ministry of Health and Environment

Mr. Taha Ali Hussein
Babel Directorate
Ministry of Health and Environment

Mr. Talal Hussein Hasan
Technical Directorate
Ministry of Health and Environment

Mr. Hussein Khalaf Hassan
North Oil Company
Ministry of Oil

Mr. Mustafa Salim Rashid
Technical Directorate
Ministry of Health and Environment

Mr. Kareem Hamdullah Ali
Directorate of Studies, Planning and Follow up
Ministry of Oil

Mr. Mohammed Fadhil Abed
Technical Directorate
Ministry of Health and Environment

Mr. Luay Sadeq Mohammed
Technical Directorate
Ministry of Health and Environment

Mr. Firas Shehab
Technical Directorate
Ministry of Health and Environment

Ms. Saja Mohammed Al-Rubayi
Technical Directorate
Ministry of Health and Environment

Mr. Emad Ali Saleh
Technical Directorate
Ministry of Health and Environment

Ms. Dhamia Fahad Nuaman
Technical Directorate
Ministry of Health and Environment

Mr. Azad Jalil Taher
Kirkuk Directorate
Ministry of Health and Environment

Mr. Yasser Ahmed
Mine Action Directorate
Ministry of Health and Environment

Mr. Omar Amer Hussein
Technical Directorate
Ministry of Health and Environment

Mr. Ahmed H. Mahaedof
Technical Directorate
Ministry of Health and Environment

Mr. Esam Khdeer
Ministry of Foreign Affairs

Mr. Humam Luay
Ministry of Foreign Affairs

Technical Session on Chemical Weapons Participants

Colonel Mahmood Delli
Manager, Iraqi CBRN Department, Iraqi Civil Defence Directorate
Ministry of Interior

Mr. Luay Sadeq Mohammed
Technical Directorate
Ministry of Health and Environment

Mr. Talal Hussein Hasan
Technical Directorate
Ministry of Health and Environment

Ms. Saja Mohammed Al-Rubayi
Technical Directorate
Ministry of Health and Environment

Mr. Yousif Muayaad
Department of
International Environmental Relations
Ministry of Health and Environment

Dr. Muneer Kadhim Muhisn
Ministry of Science and Technology

Dr. Mohammed Abdel-Salam Qassim
Ministry of Science and Technology

Technical Session on Radiation Contamination Participants

Dr. Bushra Ahmed
Director General, Radiation Protection Center
Ministry of Health and Environment

Mr. Haider Hussein Hady
Radiation Protection Center
Ministry of Health and Environment

Mr. Lazem Shuyya
Radiation Protection Center
Ministry of Health and Environment

Mr. Ahmed Saleh Al-Jobouri
Radiation Protection Center
Ministry of Health and Environment

Mr. Yousif Muayaad
Department of
International Environmental Relations
Ministry of Health and Environment

Central Environmental Laboratory Review Participants

Mr. Sabah Obaid Al-Shujairi
Director

Mr. Sarmed Abd Ul-Ameer Naser
Assistant to Director

Ms. Noor Yaseen Salih
Quality manager

Dr. Muayad Abbood Qaban
Organic Chemistry Laboratory Manager

Mr. Ahmed Khudhair Kadhim
Chemical Routine Laboratory Manager

Ms. Nada Abdulqader Hamdan
Bacteriological Laboratory Manager

UN Environment Workshop Facilitation Team

Dr. Mario Burger

Mr. BR Ravishankar

Dr. Marc Stauffer

Mr. Geraint Williams

Mr. Hassan Partow