OIL CONTAMINATED SITE ASSESSMENT TRAINING WORKSHOP REPORT

Baghdad, 23–27 September 2018

Includes a Summary of the Workshop and Recommendations for Follow-up Capacity Building Activities

Crisis Management Branch

UN Environment

Contents

Acknowledgements

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1. Introduction

Rapid scoping missions undertaken in 2017 by UN Environment at the request of the Iraqi Government in areas formerly occupied by the so-called Islamic State in Iraq and the Levant (ISIL) in northern and western Iraq found substantial environmental damage - notably from oil pollution - caused by the conflict. This prompted the organization of a three-day introductory workshop on contaminated site assessment (CSA) in Baghdad in January 2018 by UN Environment to support the Ministry of Health and Environment and other line ministries in addressing the conflict's pollution impacts. The main aim of this first training event was to provide an overview of international best practices on CSA[1]. The workshop also provided an opportunity to better understand existing national capacity to address the pollution impacts of the ISIL conflict and make specific recommendations to support identified needs.

This report presents the programme and details of the subsequent follow-up training activity focusing on *Oil Contaminated Site Assessment* held in Baghdad from 23-27 September 2018. It concludes with a set of recommendations for future priority activities and interventions. The training workshop responds to UN Environment Assembly resolution on 'Pollution mitigation and control in areas affected by armed conflict or terrorism' (2017), and was organized with the generous support of Norway's Oil for Development Programme.

2. Workshop Context and Objectives

The Oil Contaminated Site Assessment training workshop was jointly organized by the MOHE and UN Environment from 23-27 September 2018 over a five-day period at the Royal Tulip Al Rasheed Hotel in Baghdad's 'Green Zone'. The main objective of the workshop was to help strengthen national capacity to assess and clean-up oil contaminated sites from the ISIL conflict in Iraq. The core sessions of the workshop focused on preliminary site assessments, and detailed sampling strategies and techniques. A training needs assessment survey was also conducted prior to the workshop to better understand the technical knowledge of the participants, and tailor the training programme to their needs and work objectives.

The training also specifically intended to directly support joint teams from the Ministries of Environment and Oil in carrying out an initial field-based mapping survey of ISIL oil contaminated sites immediately following the completion of the workshop. The survey will entail fieldwork in the four conflict-affected governorates of Nineveh, Salah El-Deen, Kirkuk and Diyala during October and November 2018. This rapid field campaign aims to identify priority sites for clean-up that pose a serious risk to human health and the environment. UN Environment plans to assist in reviewing the survey findings and provide guidance on site prioritization process for detailed assessment and development of proposed site remediation.

In his opening remarks, the Honourable Dr. Jassim Humadi, Deputy Minister of Environment (Figure 1), 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. "I cannot overstate the need to strengthen the capacity of our environmental experts in assessing contaminated sites and oil activities, and to develop pollution monitoring programmes which represents not only a threat to local communities, but whose impacts will also extend for generations to come'" said Dr. Humadi.

[1] For *Introductory Workshop Report* link https://postconflict.unep.ch/publications/Iraq/Iraq_CSA_Workshop_Report_Jan2018.pdf

Furthermore, the Deputy Minister observed that "during the past few years, Iraq has undergone a transformative leap in its oil production driven by large investments. This poses a major capacity challenge for environmental staff to monitor and oversee the industry's performance, assess the current situation and extrapolate future projections."

UN Environment is guiding this mapping campaign through the provision of assessment protocols and an initial inventory of around 60 oil contaminated sites, compiled with inputs from the Netherlands based NGO PAX, and analysis of satellite images. UN Environment will also review the survey findings and provide guidance to the site prioritization process and conducting of detailed assessments.

This training was conducted by UN Environment Programme in collaboration with Spiez Laboratory of the Swiss Federal Office for Civil Protection and ALS Global Laboratory in the United Kingdom.

Figure 1: Welcome remarks by Dr. Jassim Humadi, Iraq's Deputy Environment Minister, seated next to Hassan Patrow, coordinator of UN Environment's post-conflict response in Iraq.

3. Workshop Participants

Workshop participants, numbering 26 persons (Annex 1, and Figure 2) were technical staff from the Ministries of Environment and Oil, whose work responsibilities include dealing with the practical aspects of oil contaminated site assessment. Participants notably included headquarter based staff from the MOHE's oil and contaminated site technical units, and their counterpart colleagues from the seven main oil-producing governorates across the country. These included heads of units with responsibilities to plan and implement contaminated site assessment programs as well as technical MOHE staff from the governorates who typically conduct CSA site inspections and field sampling with oversight from the regional environmental offices and central headquarters. In addition, senior staff from MOHE's Central Environmental Laboratories and from the MOHE's Geographical

Information System (GIS) department, also took part in the training workshop. Oil ministry representatives included officials from the four main national oil companies as well as staff working in oil refineries. In addition, two observers from the Prime Minister's office attended the full workshop.

Participants had varied technical backgrounds including in environmental impact assessment, water pollution, waste management, site remediation techniques and action plans, occupational health and safety, and environmental sampling techniques and tools. Most had academic training in engineering, chemistry or environmental sciences. In order to facilitate effective communication and interaction between the international and national experts, simultaneous Arabic-English translation was arranged for the workshop.

At the end of the event, a package comprising four portable oil contamination air analysers and sampling tools, as well as personnel protective equipment (PPE), was handed over to the MOHE to support their oil contaminated site assessment campaign. In addition, USB sticks with copies of all the training modules and additional supporting literature and documents were handed to each participant.

Figure 2: Group photo of workshop participants and facilitators.

4. Workshop Activities

The Oil CSA workshop programme opened with a review of a typical contaminated site characterization project, and an introduction on the properties of oil and its fate in the environment. The core workshop sessions focused on sampling planning, tools and techniques, and undertaking preliminary and detailed site assessments. As the audience included professionals from different work backgrounds, many examples and case studies were used to illustrate a range of contexts and issues.

The workshop was structured around nine teaching modules and a post-fieldwork review module, plus other presentations, as summarized below. To better understand the national context, on the first day of the workshop, the head of the Environment Ministry's Oil Pollution Unit provided an overview of the state of oil pollution in the country.

Current action planning for oil contaminated site assessment in Iraq, with mapping of oil contaminated sites in areas retaken from ISIL in northern Iraq (objectives, work plan, fieldwork preparations) was shared and discussed by the participants and course instructors. In addition, a

presentation on a separate site assessment campaign for the southern region of the country where most of Iraq's oil production is concentrated completed the workshop programme (provided in Annex 2).

A training evaluation survey was administered at the end of the workshop to assess its effectiveness in meeting the participant needs. The findings from the training needs assessment and evaluation surveys are summarized in Section 5. The workshop concluded with the handover of workshop participation certificates to all the participants.

4.1 Teaching Modules and Objectives

The objectives of the ten workshop modules are described below:

Module 1: Overview of Oil Contaminated Sites - Provide an overview of the Contaminated Site Assessment Framework, with brief introductions to Risk Assessment and Remedial Action Planning.

Module 2: Properties and Fate of Oil - Develop basic knowledge of the composition of oil and what happens to it over time (weathering in different scenarios), with a contaminated soil demonstration.

Module 3: Sampling Planning and Preliminary Site Assessment - Develop basic understanding and gain practical experience of the keys steps in planning and conducting an oil contaminated site assessment including development of Conceptual Site Models, sampling design and techniques. Demonstrate the photo-ionization detectors (PID) equipment with notes on application and limitations.

Module 4: Post-Field Work Review - Provide a brief analysis and discussion on the performance of the five site assessment teams in undertaking the field simulation exercises. These exercises are based on scenarios developed by the workshop instructors drawing on real life oil contamination incidents in Iraq.

Module 5: Radioactive Sources in Oil and Gas Industry - Identify radiation sources including Naturally Occurring Radioactive Materials (NORM), and basic radiation protection requirements for the oil and gas sector.

Module 6: Sampling Techniques and Tools - Understand how to plan and conduct contaminated site assessment campaigns.

Module 7: Link to Lab - Understand hydrocarbon sample analysis and relevant parameters and importance of data quality verification and reporting.

Module 8: Introduction to Site Clean-up - Develop basic understanding of the key steps in conducting remediation of a contaminated site.

Module 9: Risk Assessment - Understand the principles of risk assessment as a basis for guiding remediation planning.

Module 10: Status of Oil Contaminated Site Assessment in Iraq - Gain a better understanding of the current status of oil contamination and plans for field assessments in the northern and southern parts of the country.

Figure 3: Participants attending the Oil Contaminated Site Assessment Training Workshop at the conference venue of the Al Rasheed Hotel, observe a demonstration on the use of the photoionization detectors (top); participate in the oil contaminated soil experiment (centre left); and share the results of their Conceptual Site Models in preparation for the Detailed Site Assessment with the workshop instructors (centre right, and bottom).

4.2 Practical Training

The Oil CSA workshop emphasized the practical aspects of developing Conceptual Site Models to understand site dynamics and identify potential exposure pathways to inform sample collection planning, and the hands-on application of sampling procedures and techniques. This was implemented through two mornings that comprised field activities, as described below.

Preliminary Site Assessment

Workshop instructors prepared five hypothetical oil contaminated scenarios, based on the types of contaminated sites that exist in the northern governorates of Iraq following their retaking from ISIL control. These five scenarios included oil well blow-outs, industrial and make-shift oil refinery spills and a gas filling station explosion. Conducting this first assessment, using the standardized Preliminary Site Assessment Form is the initial screening step in evaluating contaminated sites.

This first site visit involves collecting basic site details including geographic coordinates, photographs and other information without taking any samples. It often involves interaction with local residents to establish the legacy, or historical details of a site and the contamination event, particularly its duration. Filling the Preliminary Site Assessment Form also requires mapping skills, including visual satellite image interpretation and use of Geographic Positioning System devices. From this initial field inspection, the Conceptual Site Model can be drawn that guides the next step in completing the assessment process.

Figure 4: The five assessment teams in the garden of the Al Rasheed Hotel, undertaking Preliminary Site Assessments (above); where individual groups collected information for each oil contaminated site scenario from 'local' informants at each of the five demarcated locations in the garden.

Detailed Site Assessment

Once the Conceptual Site Model is drafted based on information gathered during the Preliminary Site Assessment (Figure 4), and reviewed with the workshop course instructors (Figure 3), each of the five groups returned to the Al Rasheed gardens to conduct the full Detailed Site Assessment (Figure 5, below). This second assessment followed the survey design, with samples taken of soil and water, and stored in labeled vials and containers depending on the planned analysis.

Figure 5: The five assessment teams prepare their field sampling kits (top left), and in the garden of the Al Rasheed Hotel conduct Detailed Site Assessment work with collection of water and soil samples from each contaminated scenario site based on the Conceptual Site Model they previously prepared.

5. Observations and Feedback

The instructors observed that the participants were attentive and engaged during the delivery of the teaching modules, with frequent and valid questions and observations. The development of the conceptual site models and the resulting field sampling exercise also confirmed that the participants had understood the steps involved in conducting an oil CSA to the required standard.

UN Environment provided the opportunity for participants to evaluate the training workshop based on their own expectations and learning needs. Twenty-five participants in total completed the evaluation, whose feedback is categorized below under three sub-headings:

i) Meeting Learning Objectives

With respect to the training workshop meeting their learning objectives, the majority of participants recorded between 3 and 4 (from a maximum of 5), confirming that overall the course modules delivered what was expected. Notably, the specific learning objectives to i) gain an understanding of the composition of oil and its weathering over time, and ii) acquire practical experience on how to plan, design, sample, conduct and interpret oil-contaminated site assessments received the highest rating from the participants, scoring 4 or more.

ii) Rating of Training Modules

Participants rated the extent to which individual training Modules (1-10) met their individual learning needs (with score range of 1= not met to 5=fully met). Most participants scored each module between 3 and 5. The main teaching modules focusing on oil properties and fate, sampling planning, sampling techniques and tools, the link to lab and risk assessment, as well the two field assessment exercises scored the highest (4 or more). Thereby, confirming that the main emphasis of the course was well received.

iii) Overall Satisfaction

The overwhelming majority of participants (96%) expressed their overall satisfaction with the course, with 12% rating the training as excellent, 60% as highly satisfactory and 24% as satisfactory (Figure 6). Individual comments from the participants clearly reflected the value of the field exercise, the sampling planning and the introductory presentation on site remediation. Participants also expressed appreciation for the interactive and hands-on training approach.

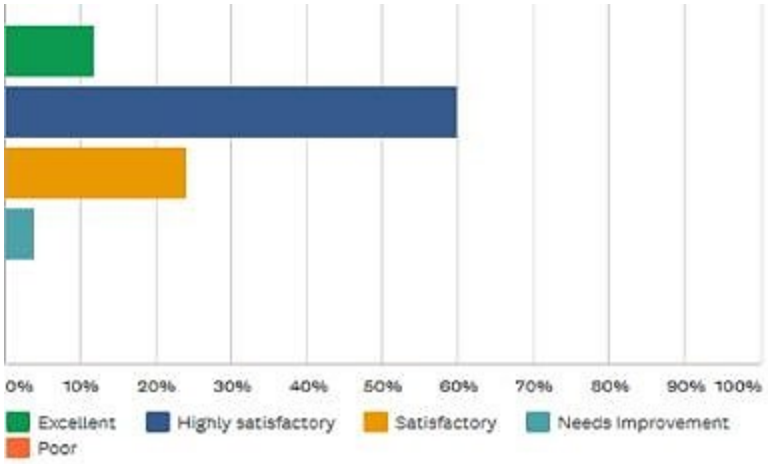

Figure 6: Overall satisfaction with the training course based on responses from 25 participants.

6. Conclusions

For most participants the five-day training workshop was successful in providing the first practical experience in preparing and conducting a systematic oil contaminated site assessment. The background material shared in the various teaching modules, plus the demonstration on the use of sampling equipment, data collection and analysis procedures, combined with the field exercises, provided an opportunity to understand the steps and challenges associated with conducting field assessments.

As a result of the training, workshop participants are now better informed and can undertake site assessments using the equipment required to conduct this work. At the same time, it is important that personnel engaged in field exercises receive regular updates and training to further refine their skills and keep abreast with the latest changes in technology and methods.

7. Recommendations

Based on the experience of the instructors and the feedback from the participants, the following are suggested focus areas for future capacity building interventions:

1. Training topics:

a) Hands-on practical training at an actual oil contaminated site, security situation permitting;
b) Laboratory hydrocarbon analytical methods and results interpretation for contaminated site assessment;
c) Use of portable gas analysers to inform soil and water sample collection procedures;
d) Use of satellite image analysis in identifying and monitoring oil spills;
e) Training in management of hazardous waste generated by the oil and gas sectors;
f) Training in mitigating flare gas pollution and associated recovery systems;
g) Remediation and clean-up of contaminated sites; and
h) Economic valuation of environmental damage from oil contamination.

2. Laboratory facilities and equipment:

a) Provision of portable equipment for on-site hydrocarbon investigations; and
b) Improve laboratory infrastructure (equipment and materials) for detailed analysis of hydrocarbon parameters.

3. Advisory support and coordination:

a) Technical review of on-going preliminary oil CSAs in northern and southern regions of Iraq; and
b) The oil CSA teams and staff of the Central Environmental Laboratory should meet on a regular basis to address gaps between field and laboratory work, and examine feasibility of setting Iraqi environmental standards for oil and gas sector.

4. Field assessments

a) Conduct detailed site assessment campaign of priority oil contaminated sites in: i) areas retaken from ISIL; and ii) southern Iraq.

Annexes

Annex 1: List of Workshop Participants

No.	Participant Name	Gender M/F	Company	Email
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	Dr. Matthew Richmond	M	UN Environment, Geneva, Switzerland	matthew.richmond@un.org
	Mr. Hassan Partow	M	UN Environment, Geneva, Switzerland	Hassan.partow@un.org

Annex 2: Workshop Programme

Time	Activity	Location
	Day 1: Sunday, 23 September	
08:45	**Welcome and Registration**	Al-Rasheed Conference Room
09:00	**Opening Remarks** *Hassan Partow, Programme Manager, UN Environment* *Dr. Jassim Humadi, Deputy Minister of Environment*	
09:15	**Introduction of Participants and Training Team** *Hassan Partow* **Course Overview and Baseline Assessment**	
09:40 10:05 11:00	**Module 1: Overview of Oil Contaminated Sites** *Geraint Williams* • Overview of Contaminated Site Assessment Framework • Risk Assessment • Remedial Action Plan • Examples **Module 2 (Part I): Properties and Fate of Oil** *Matthew Richmond* • The properties of crude oil and its derivatives • Short overview to oil and its behaviour in the environment • Contaminated soil demonstration • Factors that affect oil weathering on and below ground **State of Oil Pollution in Iraq** *Mr. Luay Al-Mukatar / Manager of Chemicals Management Department, Environment Ministry*	
11:30	**Tea/Coffee Break**	
11:45	**Module 3: Sampling Planning and Preliminary Site Assessment** *Marc Stauffer* • Overview / Recapitulation Preliminary Site Assessment & Sampling planning • Sampling strategy • Spill Assessment form • Sampling plan including quality assurance • Setting marks / flags according to sampling strategy • Mapping (Google Maps / Earth or specialized programs) • Codification • Labelling • Health, Safety and Security • Tools, Containers • Transport and Storage • Q&A	Al-Rasheed Conference Room
13:00	**Lunch**	
14:00	**Module 3: Sampling Planning and Preliminary Site Assessment** (continued) *Marc Stauffer, Matthew Richmond* **Introduction to field exercise and oil spill scenario** • Fieldwork considerations: restrictions, scale-down, assumptions, and sampling objective (in this case: delineate extent of contamination)	Al-Rasheed Conference Room

	• Definition of the scenario (site location, recent weather regime, access, topography, site legacy, spill source and volume, land use etc.) **Introduction to the photoionization detectors (PID)** *Geraint Williams* • Practical uses, application, limitations, pitfalls • Q&A	
16:00	**End of Day 1**	
Day 2: Monday 24 September		
08:45	**Recapitulation Day One**	Al-Rasheed Conference Room
9:00	**Preliminary Site Assessment** - **FIELD EXERCISE** *Marc, Geraint, Matt, Mario, Hassan* Participants, in 5 groups of 5, carry out the following work: • Spill Assessment form • Visual observation and photographic documentation • Interviews with locals / officials (as per scenario) • Geo-referencing and use of site maps • Handheld-measurements "quick & dirty"	Al-Rasheed Garden
11:00	**Tea/Coffee Break**	
	Sampling Planning – OFFICE WORK Participants, in same groups above, carry out the following work: • Raw contaminated site model (pre-printed plans handed out by us) • Possible exposure pathways • Define sampling strategy according to objective (typically in this case: systematic random sampling strategy) • Develop and draw **sampling plan** and codification (pre-printed tables and plans handed out by us) Prepare labels and containers / bags / equipment according to codification	Al-Rasheed Conference Room
13:00	**Lunch**	
14:00 14:45 15:30	**Module 4 (Part I): Post-Fieldwork Review, Learnings from Preliminary Exercise** *Marc Stauffer & UNEP Observers* • Post-fieldwork review of reconnaissance mission with feedback from UNEP "observers" **Module 5: Radioactive Sources in Oil and Gas Industry** *Mario Burger* • Introduction to sources, NORM and basic radiation protection • Q&A **Module 6: Sampling Techniques and Tools** *Marc Stauffer* • Recapitulation on Sampling Techniques and Instruments • Review of planned field exercise for Day 3 • Q&A	Al-Rasheed Conference Room
16:00	**End of Day 2**	
Day 3: Tuesday 25 September		
08:45	**Recapitulation Day Two**	Al-Rasheed Conference Room
9:00	**Detailed Site Assessment** - **FIELD EXERCISE** Carrying out of the actual sampling mission as marked on the same location as on Day 2, in 5 teams of 5 participants	

13:00	**Lunch and return**	
14:00	**Module 4 (Part II): Post-Field Work Review, Learnings from Detailed Sampling,** *Marc Stauffer & Observers* Post-field Analysis: Office Work	Al-Rasheed Conference Room
16:00	**End of Day 3**	
Day 4: Wednesday 26 September		
08:45	**Recapitulation Day Three**	Al-Rasheed Conference Room
9:00	**Module 7: Link to Lab** *Geraint Williams* • Sample analysis (standard methods, types, equipment, etc.) • Laboratory analysis (total petroleum hydrocarbons, polycyclic aromatic hydrocarbons, gas chromatography (GC)-flame ionization detector / GC-mass spectrometry / comprehensive two-dimensional GC, chromatograms, forensic analysis) • Data Quality Verification • Reporting • Q&A Summary and Wrap up	
11:30	**Tea/Coffee break**	
11:45	**Module 2 (Part II): Properties & Fate of Oil** *Matthew Richmond* • Soil strata influence on penetration • Factors that affect oil weathering (arctic, tropical & desert conditions) • Oil weathering in water (fresh and marine) • Q&A	Al-Rasheed Conference Room
13:00	**Lunch**	
14:00	**Module 8: Introduction to Site Clean-up** *Matthew Richmond & Geraint Williams* • Oil-related environmental impact / remediation actions • Determining clean-up specifications • Clean-up technologies and tools for remediation • Site remedial action plan • Certification of clean-up and site closure • Ongoing monitoring and management • Impacts from response activities (e.g. soil compaction, invasive spp) • Non-technical considerations incl. public engagement, information dissemination strategies, and media relations.	Al-Rasheed Conference Room
15:30 16:00	**Case study** Environmental remediation of contaminated oil site e.g. Bono Creek, Nigeria **Group Discussions: Open Q&A Session** **End of Day 4**	
Day 5: Thursday 27 September		
08:45	**Recapitulation Day Four**	Al-Rasheed Conference Room
9:00	**Module 9: Risk Assessment** *Geraint Williams* • Risk assessment framework including Total Petroleum Hydrocarbons Criteria Working Group (TPH CWG) • Conceptual site models • Generic & Detailed Quantitative Risk Assessment	

9:45	• Common mistakes in Conceptual Site Model/Generic Quantitative Risk Assessment (CSM/GQRA) • Mapping of suspected pollution sites in Iraq (Louise Schreyers, Hassan Partow) **Module 10: Status of Oil-Contaminated Site Assessment in Iraq** *Mr. Waleed Al-Mihyawi, Head, Oil Pollution Unit, Environment Ministry* Action Planning for Oil-Contaminated Site Assessment in Iraq • Mapping of Oil-Contaminated Sites in areas retaken from ISIL in Iraq (objectives, work plan, fieldwork preparations) • Assessment of Oil Contamination in Southern Iraq (objectives, work plan, fieldwork preparations) **Discussion and Q&A**	
11:30	**Tea/Coffee Break**	
11:45	**Discussion and Certificate Presentation** *Hassan Partow, Matthew Richmond, Geraint Williams* **End of Course Assessment & Workshop Closure**	Al-Rasheed Conference Room
13:30	**Lunch**	