Potential Health and Safety Concerns for Oil spill Responders Working in Proximity to Spills of Unconventional Crude Oil

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Health and safety (H&S) of on-site personnel is important to government and industry alike and applied throughout all response activities. Unconventional crude oil is transported throughout Canada by rail, road, marine and pipeline in increasing volumes. Environment and Climate Change Canada's (ECCC) Emergencies Science and Technology (ESTS) has undertaken a three-year study that reviews H&S concerns and develop tools to address identified gaps for government personnel who are required to conduct their work in close proximity to unconventional diluted bitumen (dilbit) spills.

The literature search study of H&S issues assessed the chemical composition of two dilbit crude oils Access Western Blend and Cold Lake Bitumen, their fate and behavior during a spill and potential exposure pathways for on-site responders. Overall, it was noted that the characteristics relevant to H&S of unconventional crude oils can differ from those typical of conventional crude oils primarily as a result of the small molecular weight, volatile compounds in the condensate portion of dilbit. Evaporation of the dilbit could result in the rapid transfer of 12 to 16% by weight of the mass to air within the initial 6 hours of a spill. Consequently, there is a potential inhalation and contact threat to initial responders under certain significant spill scenarios.

Recommendations for air monitoring instrumentation, chemical protective clothing, medical monitoring and decontamination protocols were put forth. The literature search study was followed by work to (1) undertake a task hazard analysis for ECCC personnel then develop safe work procedures; and (2) to update training guidance documents for on-site safety planning, including protective equipment and other tools for use by ECCC staff.

1 Objective

The objective of this paper is to summarize the information from the three-year study on potential hazards that might be encountered by ECCC personnel at an unconventional oil spill site. The tools developed may be transferable to the larger oil spill response community.

2 Introduction

ECCC and other Federal departments began a multi-year Research and Development (R&D) program in 2013 to examine specific topics related to a potential spill of dilbit crude oil on marine systems typical of those found in Northwest British Columbia. ESTS scientific staff provide operational support during an oil spill in the form of reach-back and when necessary, on-site scientific expertise. Consequently, a study was undertaken that reviews H&S concerns for its personnel who may conduct their work in close proximity to spills of unconventional diluted bitumen crude oil.

3 A Literature Review on Health and Safety at Oil Spills

An extensive literature search was carried out with the relevant H&S papers categorized into (1) public health topics, (2) oil spill response worker operational H&S and finally, (3) those papers specific to acute and chronic health effects on oil spill response workers exposed to oil spills (Lambert et al., 2015). The discussion presented here focuses on the (3) category.

Acute and chronic health effects on oil spill response workers exposed to oil spills from literature is summarized. The importance of, and challenges to, monitor chemical exposure by oil spill response workers is not uncommon in the peer-reviewed literature (Grimes and Olden, 2005; Savitz and Engle, 2010). However, the quantity of documents was significantly less than categories (1) and (2). The number of papers decreased further when the search terms were specific to unconventional crude oil such as dilbit or shale crude oil. Some findings are presented below on oil spill response worker exposure at spills of conventional oils that may be relevant to spills of unconventional crude oils.

The paper by Aven et al. (2011) reported on volatile benzene, toluene, ethylbenzene and xylene (BTEX) concentrations in air throughout the worksite for the 2010 Deepwater Horizon (DWH) incident in the Gulf of Mexico. A medium crude oil was spilled at the DWH incident. The study took place following the incident using industrial hygiene data collected during the first six months of the response and cleanup. The results show no conclusive link between the spilled oil and worker's exposure to BTEX. The conditions under which the study was carried out make apparent the challenges with doing this type of research post event. The size of the DWH worksite was considerable and often far from the wellhead.

Several papers were published on a comprehensive six year study of prolonged respiratory symptoms of fishermen who participated in the clean-up of the Prestige oil spill (Rodriguez-Trigo et al., 2010; Zock et al., 2007, 2014). Bunker C, a heavy fuel oil was released in this marine incident off the coast of Spain. Elevated respiratory effects were observed in the fishermen two years following the incident however upon re-examination at six years, the authors note that results could not detect long-term respiratory health effects in the cleanup workers.

The oil tanker incident Hebei Spirit occurred in the waters off the Republic of Korea coast and released crude oil to the marine environment. A study (Noh et al., 2015) showed that the oxidative stress in nearby residents participating in the cleanup was detected up to one year after exposure to the oil spill. Extent was proportional to the duration of the exposure to the oil spill cleanup. The author does not present information on the relationship to measured airborne chemical data. In a report by Gwack et al., (2012) the acute neurologic and respiratory health effects on more than 3000 military personnel surveyed, and who responded to the incident was correlated to length of time they worked at the incident and proper use of personal protective equipment.

In summary, this small sample from the literature included here demonstrates that any correlation between an oil spill response worker's potential exposure by respiratory and/or skin contact to chemicals released from the oil spill is dependent upon many factors. The volume and area of the spill, the oil's chemical composition, fate and behaviour of the oil, proximity to large pools of oil, duration of the worker's time on site and access to and use of, personal protective equipment are a few of those factors.

4 Health and Safety Concerns at a Dilbit Spill

The intent of the scoping study by ESTS was to address the knowledge gap of information on occupational H&S issues for ECCC response workers to spills of unconventional crude oils by undertaking the following:

- Identify and characterize potential hazards, exposures and risks that might be encountered in doing such fieldwork;

- Review current work practices and safety procedures; and,
- Provide recommendations for any additional precautions and control measures that may be warranted.

The following paragraphs are summarized from the literature study and report (Murphy and Almosnino, 2015). The study used information identified with a criteria-based scientific screening process applied to available grey and white literature sources.

An understanding of the physical and chemical properties of bitumen, condensate, synthetic crude oil, dilbit and synbit is critical to a subsequent discussion of responder health and safety. Density and vapour pressure are important physical properties of any crude oil and were reviewed to better understand their implications on responder health and safety. The bitumen is blended with condensate (dilbit) or synthetic crude oil (synbit) to achieve a viscosity suitable for transport through pipelines. Condensates used in dilbit and synthetic crude oil are dominated by predominately low molecular weight hydrocarbons. These have a high vapour pressure, are very volatile and easily evaporate to air. The ratio of bitumen to condensate is approximately 3:1 for dilbit and 1:1 for synbit. When blended, a typical density for dilbit is 0.936 g/mL and for synbit is 0.940 g/mL. Once spilled, the light molecular weight hydrocarbons will immediately begin to evaporate. The density of the remaining spilled crude oil will consequently increase with time. The ECCC report (2013) provides detailed physical and chemical information on two dilbit crude oils and is the source for the subsequent points. First, pan evaporation test data, using Access Western Blend (AWB) and Cold Lake Blend (CLB) dilbits were compared to an Intermediate Fuel Oil (IFO 180). Within 6 hours AWB and CLB lost 16% and 12% of their mass respectively to evaporation which increased to 19% and 16% of their mass respectively over 24 hours. The IFO 180 lost only 2% to evaporation over 24 hours. Further, chemical composition data displaying the n-alkane and biomarker distribution in AWB for the fresh (0 weight % mass loss) through to a W4 (26 weight % mass loss) crude oil shows an almost complete loss of the light n-alkanes up to C_{13}. Finally, Polycyclic Aromatic Hydrocarbon (PAHs) data (Figure 3-8 in ECCC (2013)) shows a near total mass loss in the naphthalene concentration (25 µg/g oil) between fresh AWB and the W4 weathered crude. This near total loss is not typically seen in conventional crude oil and the 25 µg/g may evaporated to air. Combined, all the data demonstrates a potential for inhalation exposure with elevated levels of volatile organic compounds (VOCs) in air during the initial response period. Exposure modelling results predict a potential scenario where some individual compounds may even exceed American Conference of Governmental Industrial Hygienists (ACGIH, 2015) workplace safety values. A risk of a crude oil explosion and fire is also present as a consequence of the volatiles in air which may result in the presence of an enriched atmospheric air and volatile hydrocarbon mix resulting in an environment with a potential hydrocarbon explosive limit. In a fire scenario, inhalation exposure may include hydrocarbons as well as combustion by-products.

Inhalation exposure by responders is a concern. When preparing site safety plans the inhalation risks are higher at the initial site entry, the first day and if a fire is ongoing, then is expected to decline over time as the light hydrocarbons either evaporate to air or are consumed in a fire and after the fire is suppressed, when the burn by-products have deposited to the surface. Contact exposure of unprotected skin is a second potential route of attack for responders. Some non-polar compounds, particularly in a condensate, can result in localized skin irritation. Many chemicals present in crude oils, such as benzene, may result in skin permeation or damage under certain conditions. A risk of skin exposure would increase with proximity to the spilled crude oil and length of time working on site. No single reference with comprehensive chemical composition data for dilbits and synbits is readily available. The 5-year average BTEX concentrations for AWB are 0.28, 0.48, 0.05 and 0.36 volume % respectively and for CLB BTEX concentrations are 0.23, 0.39, 0.05 and 0.32 volume % respectively. The Condensate Blend (CRW) used as the diluent in the heavy crude blending has 5-year average BTEX concentrations of 0.81, 1.53, 0.18, and 1.28 volume % respectively (Crude Quality, 2015). The BTEX in dilbit is proportionally derived from its diluent condensate. Benzene is a known skin permeating compound (ACGIH, 2015). In an initial assessment, a catastrophic release of fresh dilbit involving large volumes into a confined location may result in localized inhalation risks from airborne concentrations as well as increased risk of direct contact with skin permeating benzene. However, a review of the available BTEX chemical composition data for AWB and CLB, taking into consideration evaporation rates, exposure pathways and the role of different responder groups, chemical permeation risk is low but not zero for all potential dilbit spill scenarios.

Ingestion and injection are the final routes of attack or exposure. For the purpose of this paper, it is assumed that the site safety plan will address best preventative practises for worker hygiene. As such, the potential for exposure by ingestion or injection of unconventional crude oil at a spill is assessed to be low and will not be considered further.

5 Personnel Protective Measures

A discussion of general personnel protective measures to be considered by initial responders is included for site safety planning and for the information of others. Dilbit spills have the potential to release significant volatile hydrocarbons which will rapidly evaporate to air. Personnel should be equipped with air monitoring instrumentation. Table 1 lists examples of portable deployable air monitoring instrumentation for consideration by initial oil spill responders.

Table 1 Examples of Air Monitoring Instrumentation for Oil Spill Responders

Instrument	**Technique**	**Function**
Portable, direct reading, real-time volatile organic hydrocarbon (benzene) meter with toxic gas sensors for hydrogen sulphide, carbon monoxide, explosive vapour and oxygen levels		
Rae AreaRae	Photo-ionization detector (PID)/multi-gas	Real-time VOC and specific gases
Rae MultiRae+	PID/multi-gas	Real-time VOC and specific gases
Rae ppbRae	PID	Real-time VOC
Rae MultiRAE RDK	PID/multi-gas	Real-time VOC and specific gases
Foxboro TVA 1000A	PID /Flame ionization detector (FID)	Real-time volatile organic carbon (VOC) in air FID provides improved capability for detection of alkane VOC

One should note that some spill scenarios may require the deployment of an extensive array of air monitoring and sampling instrumentation. Some examples of potential air monitoring objectives are provided below in order of increasing complexity from equipment appropriate for the initial response to a scenario where a comprehensive air monitoring science plan is required.

- *Portable, direct reading, real-time particulate monitors (PM) set for a known PM size. Portable instruments capable of measuring less than 10µm or 2.5µm is recommended*
- *Portable instruments for additional on-site screening of potential low probability contaminants in air*
- *Air sampling and detection instrumentation suitable for low concentration*

The choice of type and level of chemical protective clothing and respiratory protection is a function of several factors as listed in USEPA/OSHA levels A to D. Chemical protective clothing (CPC) selection and use requires advanced planning. Appropriate CPC for any hazardous material response including a crude oil spill has to be assessed prior to going on site. Personnel have to be trained to don, doff and function while wearing the garment. To select appropriate CPC suggested steps are provided below:

- Collect and review as much information as possible about the circumstance of the incident. Safety data sheets (SDS) are often the initial source of information. Crude oil SDS may be limited by the generic nature of the information contained within;
- Assess if there is a realistic or significant risk of;
    - An unknown chemical scenario at this dilbit spill, and
    - The presence/absence of any skin permeating chemical compounds above detection limits;
- Assess the compounds in dilbit against chemical permeation data;
- Consider the application or how the responder is likely to come into contact with any spilled dilbit crude oil;
- Consider user comfort and fit as CPC can increase the chance of slip, trip and fall as well as the danger of heat or cold stress on personnel; and,
- Degradation data, penetration data, sizing with other protective equipment (e.g. hardhats) and compatibility with CPC used by other responders are other factors to assess.

Based on a review of the chemical compounds in AWB and CLB dilbit crude oil, the risk of contact with an unknown or skin permeating chemical is lower especially after the first 24 hours. A scenario requiring level A CPC at a typical dilbit spill such as a marine or open environment is unlikely. A level "B" or a splash suit is not as well defined as the level A suit. Level B has no associated design and performance standard. Level B loosely implies protection from liquid splash of the entire person. A boot, glove and hood may or may not be integrated into a B suit. At a spill of dilbit, the light condensate fraction poses the greater initial H&S threat to responders. When preparing the site safety plan for an incident involving dilbit, it is reasonable to assess if the requirement for chemical splash protection can best be met with a Tychem, Nomex or other material. Protective footwear and gloves are the most likely CPC to come into contact with any contamination and are typically the most important piece of CPC.

The process to choose the type and level of respiratory protection would follow steps similar to the selection of CPC. Detailed instructions can be found in the CSA Z94.4-11 standard, *Selection, use and care of respirators* (CSA, 2011). OSHA/NIOSH grants assigned protection factors (APF) to respirators. An APF is a number which can be used to calculate the expected reduction in the inhaled airborne concentrations of a substance by donning a respirator, assuming exposure only to that substance, and use under ideal conditions by an individual who has been fit tested. The goal of respiratory protection use is to ensure that airborne contaminant concentrations inside the mask result in occupational exposures that are below occupational exposure limits for the jurisdiction. In the case of Canadian federal jurisdictions key limits are Threshold-limit values (TLV) and time-weighted average (TWA) (ACGIH, 2015) and immediately dangerous to life and health (IDLH) values found in NIOSH guides (NIOSH, 2006).

Medical surveillance of field personnel is common and a requirement in most site safety plans. Medical surveillance in the safety plan may need to consider biological monitoring of responders potentially exposed to an inhalation or contact threat especially during the initial days of the incident when condensate is more likely to be present. One option is the determination of the concentrations of S-phenylmercaptic acid or t,t-muconic acid in urine. Decontamination of personnel should also be considered in the site safety plan for a dilbit incident. Finally, modifications to operational procedures are an alternative means to minimize potential contact by personnel with spilled dilbit and should be reflected in a site safety plan.

6 Hazard Assessment and Safe Work Procedures

An assessment of potential hazards was carried in accordance with requirements of Part 19 of the Canada Occupational H&S Regulations (CCOHS, 2009). Hazards considered in the assessment were those likely to be encountered by ECCC personnel travelling to, or on site at a dilbit or synbit crude oil spill. Incidents involving a rail, pipeline or marine spills were included in the hazard assessment. A critical task inventory of thirty-one deployment tasks associated with ECCC deploying on-site to a dilbit or synbit incident was established. For example within the seven travel tasks, they range from vehicle travel by maintained roads to helicopter travel. There are twenty-one on-site tasks ranging from climbing up and down ladders, to walking along docks, to working near spilled chemicals, and to working in remote locations. Potential hazards for each task were listed and reviewed with consideration given to the role of ECCC staff at a spill. Control measures are steps that can be taken to minimize or eliminate the hazard at the source. Reasonably expected control measures were categorized into three groups titled personal protective equipment, safety devices and supplies as well as, personal emergency equipment (Murphy and Almosnino, 2016).

A few observations are discussed based on a review of the completed Hazard Assessment Summary Matrix. When developing the critical task inventory and hazard assessment for a dilbit or synbit crude oil incident, we did not note a significant difference in the process used to compile the critical tasks as compared to the existing critical tasks for a conventional crude oil incident. This implies that the critical task inventory and hazard assessment process is flexible and can be adapted to new or evolving work related jobs. Rail, pipeline and marine spill scenarios resulted in only a few changes to the critical task inventory. In other words, the majority of critical tasks necessary to enable ECCC personnel to carry out their job at a rail or pipeline or marine incident are similar. However there are some exceptions. For example, a critical task of working near live rail lines has a high probability at a rail incident and much lower probability at a pipeline or marine incident. The critical task inventory and hazard assessment process was an opportunity for ESTS to re-assess the risk (probability and impact) of potential hazards at a dilbit and synbit incident. For instance, chemical exposure and fire/explosion are two hazards associated with working near spilled or burning fuel or chemicals. These exist at conventional and unconventional crude oil spills. During the re-assessment process for dilbit and synbit, the probability of chemical exposure and fire/explosion in localized areas is greater than most conventional crude oil spills.

Safe Work Procedures for a rail, pipeline and marine dilbit or synbit spill were developed to address the identified critical tasks and potential hazards. The Safe Work Procedures listed each potential hazard for that task with the corresponding recommended protective action. An example of one of the Safe Work Procedure developed for ECCC is included for the purpose of demonstrating the content and approach used. The Safe Work Procedure example for a potential chemical exposure by ECCC staff in a typical oil spill response for “working near spilled chemicals or fuel at a rail setting” is provided in Table 2.

In the process to develop the critical task inventory, undertake the hazard assessment and develop the Safe Work Procedures it was necessary to make some assumptions such as, when traveling by commercial aircraft and/or boat that the aircraft and boat were suitably equipped with all required safety devices and would have their own H&S protocols. Finally, Safe Work Procedures are itemized lists and intended to help with the subsequent development of detailed safety standard operating procedures, to identify hazard specific training, to aid in guidance of necessary medical monitoring of personnel as well as verify fitness to work.

Table 2 Hazard Assessment and Safe Work Procedures

Potential Hazard	Recommended Protective Measures	
	Type	**Control**
Chemical exposures – ambient atmosphere	Personal Protective Equipment Safety Devices and Supplies	Respiratory protection Gas (VOC, benzene) detector
Chemical exposures - contents	Personal Protective Equipment Safety Devices and Supplies	Chemical protective gloves Field safety boots Chemical boots or covers Protective eyewear Face shield Chemical impervious coveralls Respiratory protection Sanitizing wipes Gas (VOC, benzene) detector
Fire or explosion	Personal Emergency Equipment Personal Protective Equipment Safety Devices and Supplies	Portable fire extinguisher Respiratory protection Chemical protective gloves Field safety boots Nomex clothing Chemical impervious coveralls Gas (VOC, benzene) detector
Item	Additional Information	
Engineering Controls	• Engineering controls and safe work practices should be implemented to minimize potential personnel exposure.	
Chemical protective gloves	• Use Nitrile gloves if low / no exposure to fire or explosion hazards. A recommendation is to use Nitrile heat resistant gloves if exposed to fire or explosion hazards.	
Gas (Volatile hydrocarbons, benzene) detector	• Must be able to provide instantaneous concentration data for benzene, carbon monoxide, hydrogen sulphide, sulphur dioxide, combustibles, and oxygen. A recommendation is the RAE Systems that is PID equipped with appropriate sensors, or equivalent device.	
Chemical protective clothing or coveralls (see Forsberg, 2014)	• A recommendation is DuPont Tychem ThermoPro or equivalent if exposed to fire or explosion hazards or DuPont Tychem hooded coveralls or equivalent if low / no exposure to fire or explosion hazards.	
Nomex clothing	• Nomex shirts and pants should be worn if Tychem ThermoPro coveralls are worn.	
Respiratory Protection (see ACGIH, 2015 and NIOSH, 2006)	Recommendations only are provided. • For work in atmospheres that are oxygen deficient (<18%), or where work will take place for 15 minutes or longer where ambient carbon monoxide concentrations exceed 400 parts per million, a supplied air respirator must be used. • Use full-face respirator where maximum ambient airborne benzene concentrations exceed 5 parts per million. • Half-face respirator maybe suitable where maximum ambient	

	airborne benzene concentrations do not exceed 5 parts per million (10x the ACGIH (use current 8 hour time-weighted average occupational exposure limit)). • Use filter cartridges providing protection against chlorine dioxide, sulfur dioxide, organic vapors, ammonia, hydrogen chloride, methylamine, formaldehyde, chlorine, hydrogen sulfide, hydrogen fluoride, and particulates. Suitable cartridge is multi-acid gas / Organic Vapour / R100 cartridge (oil mist resistant), or equivalent. This cartridge type is also suitable for exposure to fire smoke (but not elevated carbon monoxide), ambient dusts, fumes and gases from metal cutting.

7 Training Course

An awareness and introduction training courses were developed to meet the requirements of ECCC's Risk Analysis and Hazard Prevention Directive (ECCC, 2015). The awareness level course is an abridged version of the more comprehensive introduction course.

A summary of the introduction course is provided. The twelve (12) lecture format modules require approximately ½ day of lecture style instruction. In addition to the lecture modules, the training course will include a table top exercise with the objective to complete a site safety plan consistent with the typical role of the participants at an incident. Each group's role on-site, their typical arrival time on site and the potential for either airborne or dermal contact differs. The ability to recognize and assess hazards within the context of one's role at a spill is critical to site safety planning. For the benefit of the reader, the twelve (12) lecture modules and learning objectives for the introduction level course the "Protection of H&S in Dilbit/Synbit Spill Field Work" are listed as follows:

1. *Conventional vs. Unconventional Oils* - to develop an understanding of the differences between the terms "conventional oil" and "unconventional oil";
2. *Oil Sands and Bitumen* to be able to distinguish the general composition of oil sand from bitumen based on a list of components;

3. *Chemical Composition of Dilbit and Synbit* - to better understand the meaning of a "diluent" and the reason it is present in unconventional oils;
4. *Effect of Dilbit / Synbit Chemical Composition on Spill Behaviour* - to improve knowledge of the chemical composition of diluents and how the addition of diluent affects the health and flammability risks associated with dilbit and synbit spills;
5. *Effect of Dilbit / Synbit Chemical Composition on Fire and Explosion Risk* - with the objective to better understand the relationship between the presence of diluent and the evolution of light hydrocarbons from spilled unconventional oil and how the ignition of spilled dilbit or synbit alters the air emissions from the spilled material and the associated inhalation exposure risks;
6. *Effect of Dilbit / Synbit Chemical Composition on Health Risk* - to improve the understanding of the manner by which the passage of time, weather conditions, original diluent concentration in the oil solution and environmental temperature affect emissions of light hydrocarbons from spilled unconventional oil and the relationship of this to inhalation exposure risk;
7. *Health-Based Exposure Limits for Air Contaminants* - the objective is to introduce the applicable occupational exposure limit such as "ACGIH" and "AEGL";
8. *Air Contaminant Concentrations at Unconventional Oils Spills* the objective is to present air quality information from recent incidents as well and guidance on how to set up an air quality monitoring safety plan at a spill site;
9. *H&S Protective Measures at Unconventional Oils Spills* - to explain the concept of hazard zones such as the Red (alternate terms are exclusion and hot zones), Yellow (or contamination reduction or warm zones) and Green (or support or cold zones) Zones at a spill site, and what levels of personal protective equipment are required for operations in each zone;
10. *Respiratory Protection at Unconventional Oils Spills* - with a goal to improve understanding of

air purified respiratory protection, what an “Assigned Protection Factor”(APF) is for a respirator and the APF values for three different types of respirators;

11. *Basics of Self-Contained Breathing Apparatus* – with a goal to improve understanding of self-contained breathing apparatus respiratory protection; and,
12. *ESTS Hazard Assessment and Safety Procedures Documents* – an overview of the hazard assessments and safety procedures developed for ESTS as a case study.

8 Conclusions

A 3-year long project was undertaken to study potential H&S issues that might be encountered by ECCC personnel at an unconventional crude oil spill. The initial work included a literature review primarily using data from the chemical composition of two dilbit crude oils Access Western Blend and Cold Lake Bitumen, their fate and behavior during a spill and potential exposure pathways for on-site responders. The study reported that characteristics relevant to H&S of unconventional crude oils can differ from those typical of conventional crude oils. The small molecular weight, volatile compounds in the condensate portion of dilbit could rapidly evaporate transferring 12 to 16% by weight of the mass to air within the initial 6 hours of a spill. As a consequence, there is a potential inhalation and contact threat to initial responders under certain significant spill scenarios.

To address the results and knowledge gaps reported in the study, the subsequent phase of the H&S project was to develop the necessary procedures and training material to address the gaps and minimize any risk to ECCC personnel. A critical task inventory and task hazard assessment was carried out. Safe Work Procedures were prepared based on the task hazard assessment and are used to assist with protective measures for on-site response. Finally, a basic awareness level and more detailed introduction level training courses were developed to facilitate knowledge transfer and education of ECCC personnel.

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