NOTE: The protocol should describe your research procedures and participant population in detail. Your consent documents, data collection instruments (surveys, questionnaires, interview guides, etc.), and recruitment materials need to be submitted for review as well and should not be attached or incorporated into this protocol document.

TIPS ON COMPLETING THE PROTOCOL FORM:

- If any sections are not applicable to your research, mark that section as N/A (for not applicable)
- Keep an electronic copy of your protocol. If you submit modifications to your study at a later time, you will need to include tracked changes to all affected study documents, including the protocol.
- As you write this protocol, remove the text boxes and all instructional text contained inside the text boxes in each section. There should be no text boxes or instructional text (including these instructions) in the final version of your protocol.

STUDY TITLE:

IMPRINT Randomized Evaluation

PRINCIPAL INVESTIGATOR:

Name: Dr. E. Vincent Cross II (Contact), Mr. Dan Duggan, Dr. Dave Turcotte (Contact)

CO-INVESTIGATORS:

Name: Mr. David Coffey

VERSION/DATE:

4/24/2024

Check any **applicable** boxes in the table below – you will be asked for further detail on these topics later in the protocol:

Indicate Vulnerable Population(s) to be Enrolled	☐ Children ☐ Cognitively Impaired Adults ☐ Pregnant Women (IF the research activities will affect the pregnancy or the fetus) ☐ Prisoners (or other detained/paroled individuals)
Research has U.S. Federal government funding (e.g., NIH, NSF, other federal agencies/departments)	☒

1.0 Purpose of the study:

Charles River Analytics and our collaborators at The New England Consortium propose to develop and evaluate an Immersive Modular Preparedness Intelligent Tutor (IMPRINT). IMPRINT aims to enhance trainee performance and set operational expectations outside of the hot zone in hyper-realistic exercises that challenge physical, psychological, and cognitive capabilities through adaptive behavioral science enhanced virtual reality (VR) modules and seamlessly integrate with HAZWOPER training. The overall objective of IMPRINT Phase II is to conduct a 1-year randomized-controlled trial among regular HAZWOPER Trainees comparing protocol adherence during required hands-on field exercises for trainees who used the IMPRINT behavioral science VR training with trainees who received standard PowerPoint and video training.

We anticipate trainees and classes assigned to the intervention will perform better than those who use standard paper and PowerPoint based activities. We believe their comprehension of topics will be greater, and it is likely that they will have a greater ability to recall HAZWOPER guidelines in the field. We also anticipate after class survey results will indicate a better HAZWOPER training experience and increased levels of satisfaction with the course.

Additionally, we anticipate that trainers using the IMPRINT VR modules will find the tool more effective and engaging compared to standard PowerPoint and video-based training methods. We expect that trainers will report greater ease in delivering complex HAZWOPER concepts and that the VR modules will enhance their ability to facilitate trainee comprehension and recall of HAZWOPER guidelines. We also anticipate that trainer feedback will reflect a more positive teaching experience and higher levels of satisfaction with the training process.

Long-term benefits of participation include improvement in retention of HAZWOPER guidelines when responding to Hazardous Material (HAZMAT) disasters. We anticipate trainees and classes assigned to the intervention will perform better than those who use standard paper and PowerPoint based activities. We believe their comprehension of topics will be greater, and it is likely that they will have a greater ability to recall HAZWOPER guidelines in the field. We also anticipate after class survey results will indicate a better HAZWOPER training experience and increased levels of satisfaction with the course.

2.0 Background / Literature Review / Rationale for the study:

To successfully transfer skills and develop trainees' procedural cognitive maps VR training systems must enable full immersion into training exercises by integrating PPE, enabling 3D object haptic interaction and natural walking to support spatial skill development, and provide trainer support (Mossel et al., 2017). Research has shown significant performance benefits from VR delivered targeted mission rehearsal (Xie et al, 2021). To realize these benefits before facing real emergencies, trainees must have the opportunity to hone their skills in a controlled setting that mimics real-life scenarios as closely as possible through fully immersive exercises (Mossel et al., 2017). This immersive context driven approach is critical for skill transfer and well understood in parallel domains (Mossel, 2020). Immersion is best achieved through a combination of sensations, including haptic (tactile touch, force feedback, temperature, etc.), audio, and visual (simulated detector reads of simulated radiation). Several recent empirical assessments of VR systems demonstrate superior skill transfer when haptic immersion is integrated in a domain appropriate way (e.g., heat exposure fire training, or stress inducing stimuli for disaster response).

It is not known whether this skill transfer occurs within the HAZMAT domain, or how to best operationalize these findings within training.

3.0 Inclusion and Exclusion Criteria:

We will seek out participants who self-select to participate in the New England Consortium (TNEC) training offerings through open enrollment, including populations of any racial or ethnic background.

We will also seek out participants who are experienced trainers involved in delivering the New England Consortium (TNEC) training offerings, including trainers from any racial or ethnic background.

Participants must meet the eligibility requirements for the class. Given the class requires students to complete standardized HAZMAT training in fully suited PPE with a self-contained breathing apparatus, students must be able to speak and understand English, and not be pregnant.

The HAZWOPER certification course falls under TNEC’s open enrollment courses. TNEC offers on an ongoing basis at their training center in Lowell, Massachusetts. The open enrollment courses generally consist of 15-25 students from various employers or organizations with a variety of backgrounds. Prior to each open enrollment course, TNEC trainers review the student enrollment's business types, chemical handling information and hazard exposures. Upon this review the trainers will personalize the course to best meet the needs of the attendees.

Age Limits
Min Age: 18 Years Max Age: N/A (No limit)

We will be targeting participants who participate in TNEC training offerings. Given the training takes place in Massachusetts we will use Massachusetts demographics to set our inclusion targets.

	American Indian or Alaskan Native	Asian	Black or African American	Hispanic or Latinx	Native Hawaiian or other Islander	Multiple Race, Non-Hispanic	White	Unknown
Percent	.01	9	9.9	20.5	0	0	56.7	0

4.0 Sample Size:

According to The New England Consortium, during the pandemic they have trained approximately 15-25 people per class once a month.

Our study follows two stages. First, we will conduct a Pilot consisting of 2 months with one month serving as a case and the other month serving as the control. The Pilot will be used to indicate effect size. (30-50 participants)

Our study will also include the main evaluation, consisting of 6 randomly selected courses that receive the IMPRINT VR intervention and 6 randomly selected control courses. (180-300 participants)

This creates a sample of approximately 300 participants.

5.0 Recruitment and Screening Methods:

Recruitment process: Given participants opt into training we will use a convenience sampling frame. Recruitment will consist of including the term, "Virtual Reality Immersive Activities", to the existing course title and course link. The current open enrollment advertisement is available through this link: https://tnectraining.org/training/schedule-register/

Screening process: N/A

6.0 Research Locations:

The evaluation will take place on site at The New England Consortium (TNEC) training center at Wannalancit Mills, as part of the University Massachusetts Lowell Campus. The facility is well equipped with the space necessary and standard equipment provided for training. The site is located at the heart of Lowell, offers shuttle bus service, state-of-the-art fiber optic cable and HVAC, and 7 elevators and 4 loading docks enabling easy access for trainees of any background, disability status, or socioeconomic status, and has the ability to host and maintain a VR exercises for evaluation.

In addition to the Wannalancit Mills location, the evaluation will also take place a various offsite locations where TNEC has been contracted to deliver the 40-hour HAZWOPER training.

All required permissions and approvals are already obtained to conduct this research at TNEC.

7.0 Multi-site Research (research that involves external collaborating institutions and individuals):

N/A

8.0 Procedures Involved:

The standard TNEC 40-hour workbook will be used in both the intervention and control classes.

In the intervention, trainees will be provided with an Oculus VR headset to complete virtual reality modules based on activities covered in the TNEC 40 hour course workbook. In control classes, trainees will complete all of the activities following standard practice which includes filling out sheets, reviewing 2D photographs, and reviewing slides. VR modules will last no longer than 1-5 minutes in length, which is a comparable length to the time allowed for students in control classes to complete their assigned tasks. There will be no differences in content provided between cases and controls. We are examining the effect of a difference in delivery mechanism and interaction with the content to enhance retention, understanding, and performance.

VR modules will be provided intermittently throughout the 40 hour course. Each course is required to be 40 hours in length by the OSHA standard.

All evaluations and assessments of trainees will take place at the same sequence between cases and controls.

Outcomes measured include student accuracy on the TNEC HAZWOPER performance instruments including; 1) the 40 Hr HazWoper Course Workbook, 2) the Toxic Properties Activity, 3) The New England Consortium Health and Safety Training Survey, 4) System Usability Scale (SUS), 5) Occupational Self-

Efficacy Scale - Short Form (OSS-6), 6) iGroup Presence Questionnaire (IPQ), 7) Flow State Scale (FSS), 8) UX for VR Questionnaire, and 9) NASA-TLX

We will first run a two-month pilot to estimate ICC, the intracluster correlation coefficient. We will use ICC to determine effect size for the following 12-month study (see Figure 10). Using this calculation, we will determine expected effect size from the more extensive 12-month portion of the evaluation effort.

Prior to analysis of the 12-month effort, we will use matching techniques based on trainee and trainer characteristics. We will use pretest matching criteria based on trainee cohort population characteristics and prior knowledge ascertained through pre-HAZWOPER training registration information.

We will match cases and controls using Euclidian distance between intervention and control samples rather than propensity score matching to find the best match to mitigate risk of confounding due to low sample size following the guidance of Dr. Gary King (King, G. and Nielsen, R., 2019. Why propensity scores should not be used for matching. Political Analysis, 27(4), pp.435-454.). We will compare how these modules enhance student performance across TNEC HAZWOPER performance instruments including; 1) the 40 Hour HAZWOPER Course Workbook, 2) the Toxic Properties Activity, 3) The New England Consortium Health and Safety Training Survey, 4) System Usability Scale (SUS), 5) Occupational Self-Efficacy Scale - Short Form (OSS-6), 6) iGroup Presence Questionnaire (IPQ), 7) Flow State Scale (FSS), 8) UX for VR Questionnaire, and 9) NASA-TLX

We will compare how these modules enhance performance through a t-test.

Intervention VR modules will be based on the existing activities within the 40 Hour HAZWOPER Course Workbook and the field exercise including:

Module 1 Duration: 5 Minutes	Activity 3-A What’s on the Site?

<table>
<tr>
<td>Instrument</td>
<td>3.1 CHEMICAL HAZARDS - 3 • Pg 4

ACTIVITY3-A
WHAT'S ON THE SITE?

Purpose: To start developing a list of clues that can be used to decide if hazardous chemicals are present on site. To get you thinking about what you need to know in order to work safely on site. To stress the importance of information and knowing where to get it.

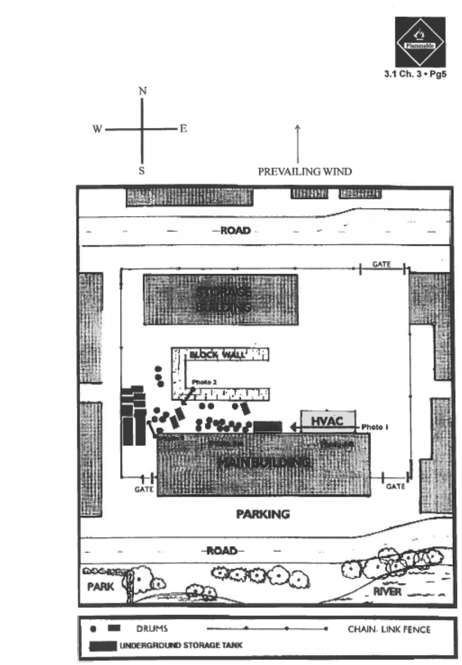
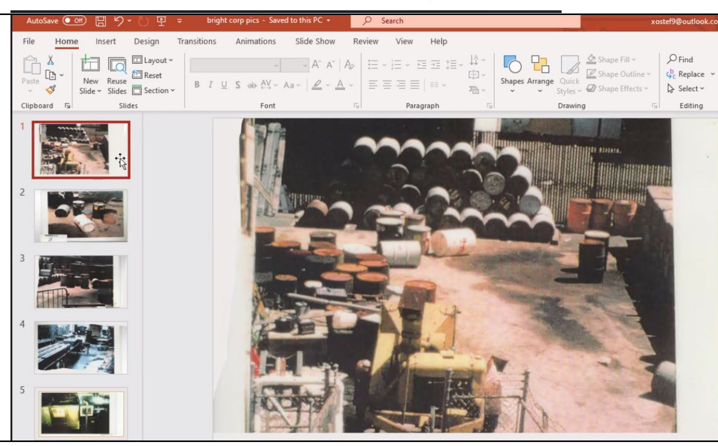
Task: As a group, answer questions 1-3 using the following information: the site description below, the site map on pg. 5, and the photographs in your site packet. Numbers on the site map correspond to photo numbers. The arrows indicate the direction from which the photo was taken.

Site Description: Bright Corporation was a small metal plating company located on a 2 acre site. It operated between 1955 and 1992. The company was engaged in plating and painting of small metal parts. A lead acid battery manufacturer occupied the site between 1992 and 1995. The site has been abandoned for six months.

1. What clues suggest that chemical hazards may be present?

2. What else would you like to know about this site before entering?

3. Where would you go for this information?</td>
</tr>
<tr>
<td>IMPRINT Intervention (Virtual Environment)</td>
<td></td>
</tr>
</table>

Control Part A	
Control Part B	
Module 2 Duration 5 Minutes	Activity 11-A Controlling the Site

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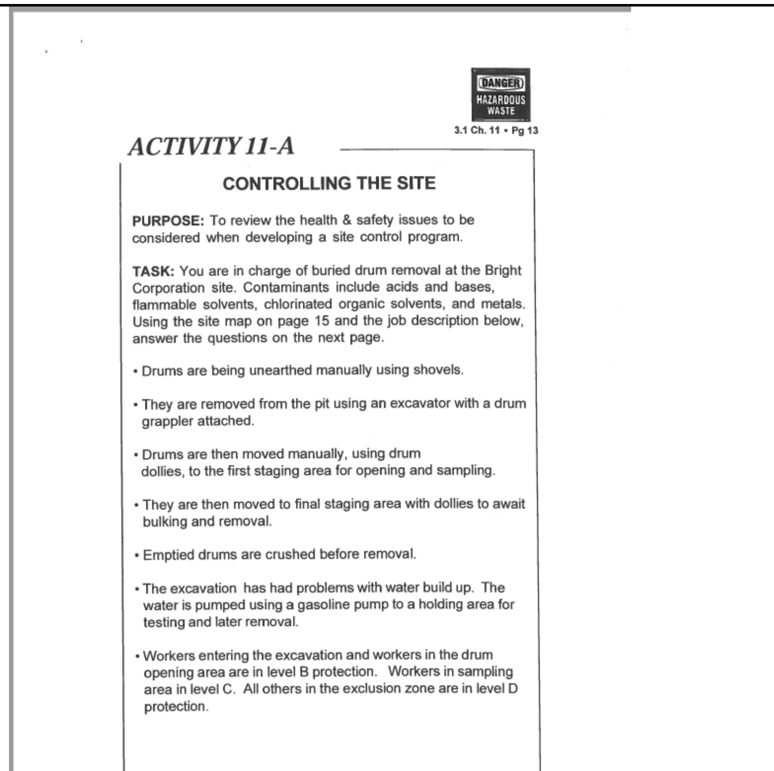

DANGER
HAZARDOUS WASTE

3.1 Ch. 11 • Pg 13

ACTIVITY 11-A

CONTROLLING THE SITE

PURPOSE: To review the health & safety issues to be considered when developing a site control program.

TASK: You are in charge of buried drum removal at the Bright Corporation site. Contaminants include acids and bases, flammable solvents, chlorinated organic solvents, and metals. Using the site map on page 15 and the job description below, answer the questions on the next page.

- Drums are being unearthed manually using shovels.
- They are removed from the pit using an excavator with a drum grappler attached.
- Drums are then moved manually, using drum dollies, to the first staging area for opening and sampling.
- They are then moved to final staging area with dollies to await bulking and removal.
- Emptied drums are crushed before removal.
- The excavation has had problems with water build up. The water is pumped using a gasoline pump to a holding area for testing and later removal.
- Workers entering the excavation and workers in the drum opening area are in level B protection. Workers in sampling area in level C. All others in the exclusion zone are in level D protection.
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</tr>
<tr>
<td>IMPRINT Intervention (Virtual Environment)</td>
<td></td>
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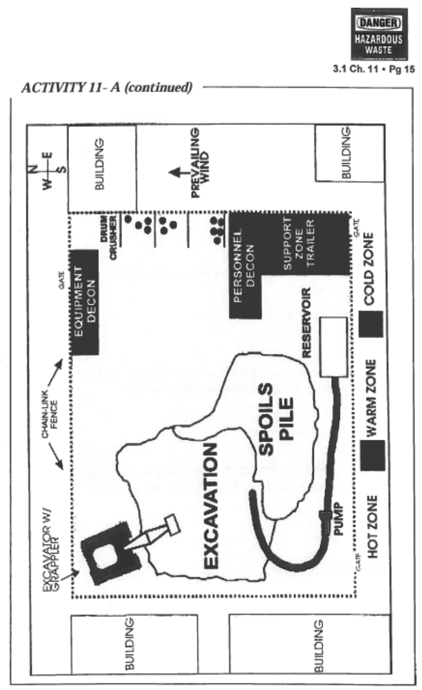
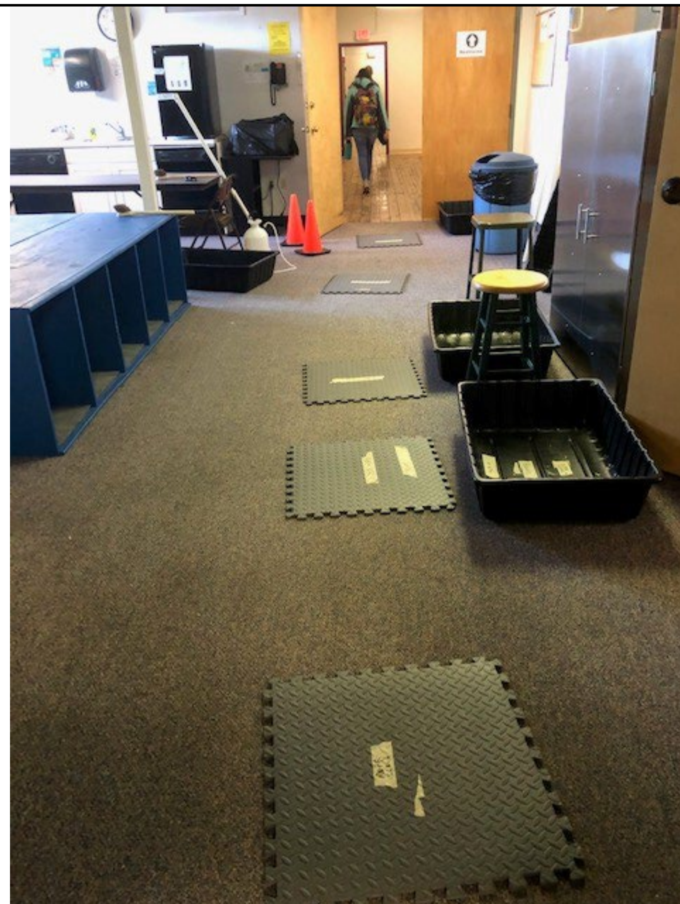
</table>

Control	
Module 3 Duration 3 Minutes	Decontamination Line Ordering and Field Exercise

Instrument (field training exercise/ evaluation)	
IMPRINT Intervention (Virtual Environment)	

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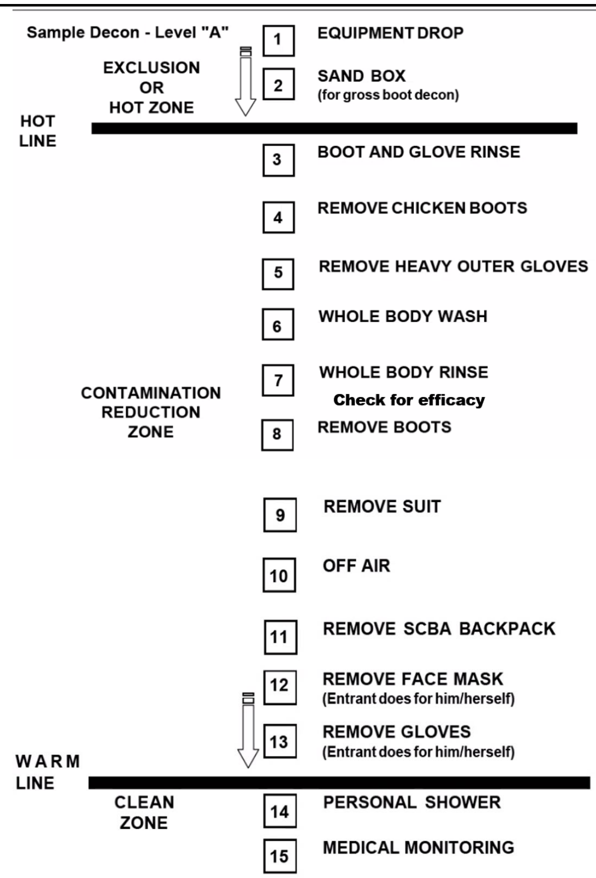

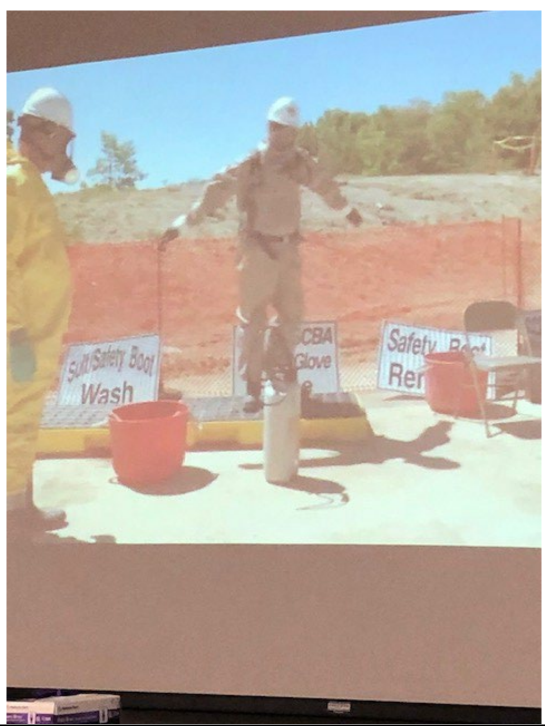

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<tr><td>Module 4</td><td>Visual Inspection Checklist</td></tr>
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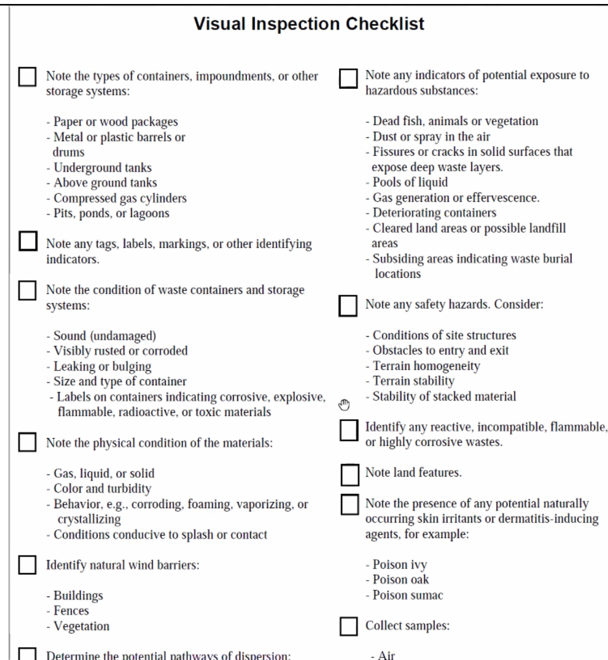
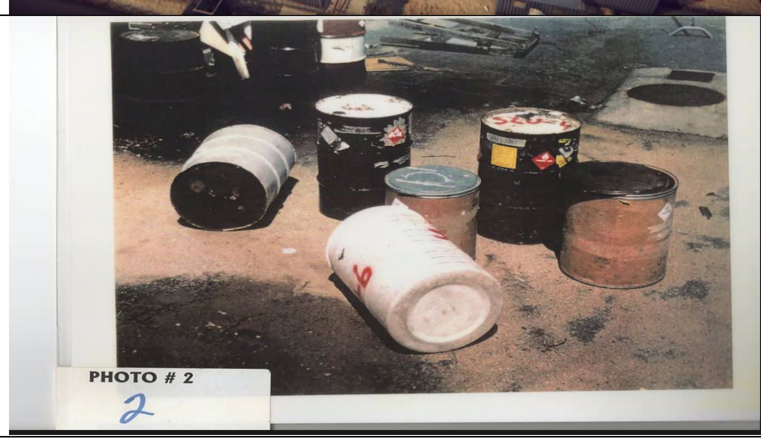
<tr><td>Instrument</td><td>
Visual Inspection Checklist
☐ Note the types of containers, impoundments, or other storage systems:
- Paper or wood packages
- Metal or plastic barrels or drums
- Underground tanks
- Above ground tanks
- Compressed gas cylinders
- Pits, ponds, or lagoons
☐ Note any tags, labels, markings, or other identifying indicators.
☐ Note the condition of waste containers and storage systems:
- Sound (undamaged)
- Visibly rusted or corroded
- Leaking or bulging
- Size and type of container
- Labels on containers indicating corrosive, explosive, flammable, radioactive, or toxic materials
☐ Note the physical condition of the materials:
- Gas, liquid, or solid
- Color and turbidity
- Behavior, e.g., corroding, foaming, vaporizing, or crystallizing
- Conditions conducive to splash or contact
☐ Identify natural wind barriers:
- Buildings
- Fences
- Vegetation
☐ Determine the potential pathways of dispersion:
☐ Note any indicators of potential exposure to hazardous substances:
- Dead fish, animals or vegetation
- Dust or spray in the air
- Fissures or cracks in solid surfaces that expose deep waste layers.
- Pools of liquid
- Gas generation or effervescence.
- Deteriorating containers
- Cleared land areas or possible landfill areas
- Subsiding areas indicating waste burial locations
☐ Note any safety hazards. Consider:
- Conditions of site structures
- Obstacles to entry and exit
- Terrain homogeneity
- Terrain stability
- Stability of stacked material
☐ Identify any reactive, incompatible, flammable, or highly corrosive wastes.
☐ Note land features.
☐ Note the presence of any potential naturally occurring skin irritants or dermatitis-inducing agents, for example:
- Poison ivy
- Poison oak
- Poison sumac
☐ Collect samples:
- Air</td></tr>
<tr><td>IMPRINT Intervention (Virtual Environment)</td><td></td></tr>
<tr><td>Control</td><td>
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<tr><td>Module 5 Duration 5 Minutes</td><td>Chemical Properties</td></tr>
</table>

Instrument

3.1 CHEMICAL HAZARDS - 3 • Pg 38

ACTIVITY 3-B

USING THE NIOSH GUIDE: CHEMICAL PROPERTIES

Purpose: To learn to how to look up information in the NIOSH Pocket Guide to Chemical Hazards. To help students recognize when chemicals have hazardous properties.

Task: Using the NIOSH Pocket Guide, fill in the table on page 41. (Write "NA" if the chemical property does not apply.) Do not look up each chemical yourself. Have each group member look up a couple of chemicals, then share the results. Answer the following questions about each chemical.

1. Does the chemical present a fire/explosion hazard ?

2. Is the chemical likely to form high vapor concentrations ?

3. Is the vapor/gas lighter or heavier than air ?
   (Remember : the molecular weight of air is 29. See page 30.)

4. Do you have any other concerns about the chemical ?

Continued on the next page

3.1 Ch. 3 • Pg 39

ACTIVITY 3-B (continued)

Chemical	CAS#	Form (solid, liquid or gas)	Vapor Pressure (mmHg)	Molecula Weight	Flash Point (°F)	LEL (%)
Arsenic						
Toluene						
Methyl Ethyl Ketone						
Sulfuric Acid						
Acrylonitrile						
Ammonia						
Sodium Hydroxide						
PCB's						
Sodium Cyanide						
Perchloro-ethylene						

<table>
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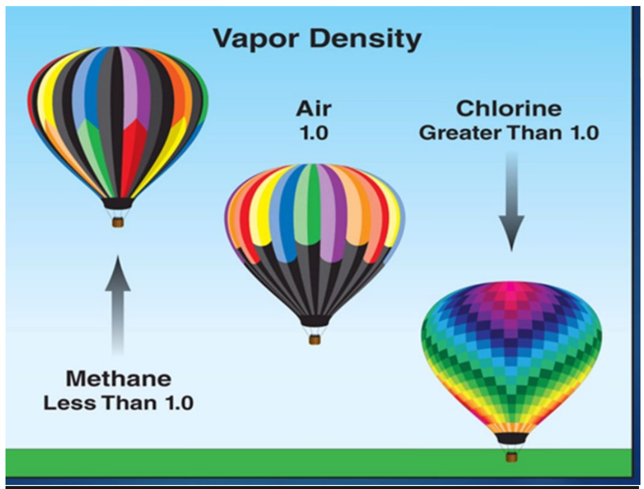

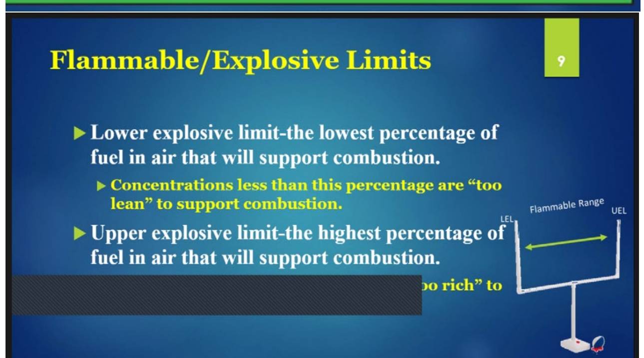

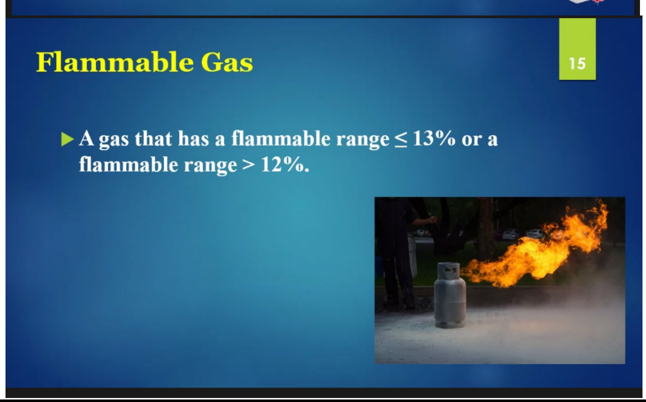

</td></tr>
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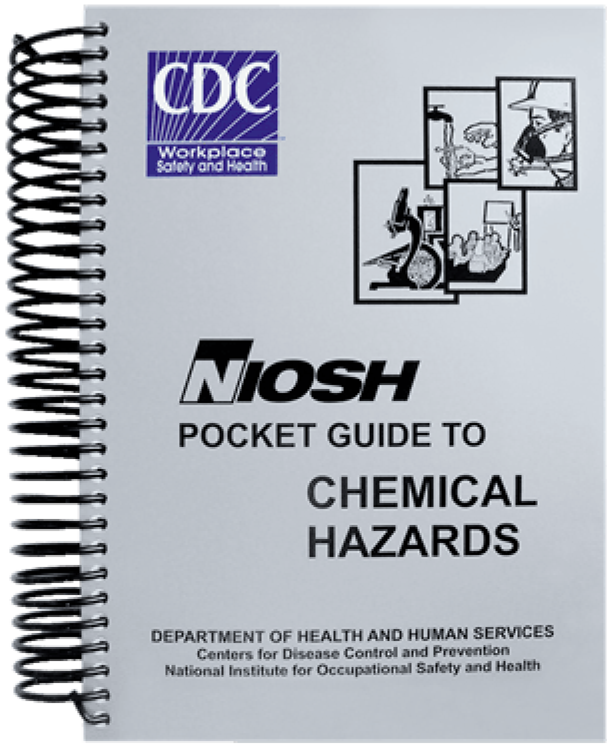
Materials for both Intervention and Control	

9.0 Research with Vulnerable Populations

N/A

10.0 Incomplete Disclosure or Deception:

N/A

11.0 Consent Process:

Prior to enrollment in the study students and trainers will be presented with informed consent documentation. Informed consent will take place online or in the classroom. Storage of informed consent will be saved on a secure server used to host sensitive information where a password is required for entry and/or decryption or in locked cabinet file.

Students will have the opportunity to contact TNEC or the researchers directly with any questions prior to registering for the course and consenting to the study.

12.0 Research with Children – Parental Permission, Child Assent, and Other Considerations:

N/A

13.0 Waiver of Participant Signature on Consent Form:

N/A

14.0 Waivers and Alterations of Consent Information:

N/A

15.0 Financial Compensation:

Trainees will have the opportunity to be entered into a $50 gift card raffle with the completion of the post course survey.

They will NOT receive any type of rights for discoveries, patents or products developed from this research.

There is no more than Minimal Risk to participants.

16.0 Audio/Video Recording/Photography

N/A

17.0 Potential Benefits of this Research:

No benefits are promised. Some benefits might include an improved training experience and improved retention of training concepts.

We anticipate trainees and classes assigned to the intervention will perform better than those who use standard paper and PowerPoint based activities. We believe their comprehension of topics will be greater, and it is likely that they will have a greater ability to recall HAZWOPER guidelines in the field. We also anticipate after class survey results will indicate a better HAZWOPER training experience and increased levels of satisfaction with the course.

Long-term benefits of participation include improvement in retention of HAZWOPER guidelines when responding to Hazardous Material (HAZMAT) disasters. We anticipate trainees and classes assigned to the intervention will perform better than those who use standard paper and PowerPoint based activities. We believe their comprehension of topics will be greater, and it is likely that they will have a greater ability to recall HAZWOPER guidelines in the field. We also anticipate after class survey results will indicate a better HAZWOPER training experience and increased levels of satisfaction with the course.

18.0 Risks to Participants:

There is a slight chance of injury through falling when walking or moving through the room during the tasks performed. There are additional risks when using virtual reality equipment or engaging in a virtual environment. These risks are infrequent, but may include motion sickness, disorientation, and dizziness. The experimenter will explain how you can take breaks during the experiment to prevent or relieve these potential risks, and you will be allowed to stop a task, and if necessary, exit the virtual environment by removing the virtual reality goggles at any time if you begin to feel discomfort or other undesirable sensations.

This research is no more than minimal risk. The level of risk is expected to about the same as risks of daily life or a working with protective equipment used throughout training.

19.0 Provisions to Protect Participant Privacy and Data Confidentiality:

Data collection during training sessions will include written notes of observed activities, with a follow-up interview to gain greater context. A demographic survey will be administered at the end of each data collection session for all participants to collect information, such as age, sex, ethnicity, and race.

We will make every attempt to not collect identifiable data, but we will also review and de-identify all data. Participants will be assigned a unique, anonymous identifier linking them to their data. To protect participant confidentiality, all paperwork that could be directly linked to the participant personally (such as a signed consent form or payment documentation forms) will be stored in the investigators' locked filing cabinets. All other data will be de-identified (i.e., identified by code rather than with personal information) and stored in a locked cabinet (different from the cabinet where data that could be linked personally to the participant is stored) or on a computer where a password is required for entry and/or decryption. The study data will be stored on a password protected and encrypted network storage drive that only the Principle Investigator and research team can access. This system is currently in use and has been used in previous studies for storage of human subjects study files. Only properly trained study staff who require data access for the purposes of completing the study will receive a password or key.

Data will be stored for 5 years and transferred through VPN secured server.

20.0 Data Monitoring Plan to Ensure the Safety of Participants:

Data will be monitored monthly by the PI(s) given the frequency of the course. At that time the safety of equipment will be evaluated and VR Headsets will be cleaned.

21.0 Long-term Data and Specimen Storage and Sharing:

We will make every attempt to not collect identifiable data, but we will also review and de-identify all data. Participants will be assigned a unique, anonymous identifier linking them to their data. To protect participant confidentiality, all paperwork that could be directly linked to the participant personally (such as a signed consent form or payment documentation forms) will be stored in the investigators' locked filing cabinets. All other data will be de-identified (i.e., identified by code rather than with personal information) and stored in a locked cabinet (different from the cabinet where data that could be linked personally to the participant is stored) or on a computer where a password is required for entry and/or decryption. The study data will be stored on a password protected and encrypted network storage drive that only the Principal Investigator and research team can access. This system is currently in use and has been used in previous studies for storage of human subjects study files. Only properly trained study staff who require data access for the purposes of completing the study will receive a password or key.

Data will be stored for 5 years and transferred through VPN secured server

22.0 Qualifications of Research Team to Conduct the Research:

Dr. Cross completed his Ph.D. at Auburn University in the Human-Centered Computing lab with a focus on understanding how the design of user interfaces impact situational awareness and mental workload for operators attempting to control a team of unmanned ground vehicles. He is a Senior Research Scientist at Charles River Analytics and is a proven user experience (UX) leader with research interest in Human-Computer Interaction (HCI) and Human-Artificial Intelligence and Teaming (HAIT). He was previously the NASA Human Research Program (HRP) Risk of Inadequate Human-Computer Interaction Discipline Scientist. In this role Dr. Cross was responsible for facilitating research that would address gaps crewmembers being to safely and efficiently use technology to perform missions' tasks associated with long-duration missions. In this role Dr. Cross was also a SME for the Commercial Crew Program ensuring requirements were properly addressing standards in the NASA-STD-3001 VOL 2. While at NASA, his research explored how the design of user interfaces impacted crew's ability to recognize critical information such as faults or low consumable information.

Mr. Duggan is a Software Engineer and serves as the XR Development Lead for the Human Center Intelligent Systems (HCIS) Division at Charles River Analytics, Inc. He has a background in Computer Science and Software Engineering with a focus on Virtual and Augmented Reality development, collectively known as Extended Reality (XR). As Technical Lead on a number of XR development projects, he has created XR applications for fields as varied as industrial design, medical training, and distributed mission planning; he was responsible for overseeing the software development lifecycle, including requirements analysis, software design, implementation, testing, and deployment. Many of these applications were built using the VIRTUOSO SDK (VSDK), a free and open source solution for simplifying XR development that he created. He will utilize VSDK to accelerate the development of IMPRINT, providing a basis for naturalistic interactions and haptics as well as enabling IMPRINT to run on a variety of hardware solutions for a more flexible product. As the XR Development Lead for the HCIS Division, he recommends best practices, aid in device selection, and maintain expertise across XR technology and domains.

Thomas Eastbrook is employed by the New England Consortium (TNEC), based at the University of Massachusetts – Lowell, as the project director with TNEC responsible for the operations of TNEC's Hazardous Materials and Emergency Response training program in New England. He has more than 23 years of worker health and safety training experience during which he has made an important impact on thousands of students by providing accurate, clear, and comprehensive information about workplace hazards and the best practices for protecting workers from those hazards. As a trainer he has used the evaluation process – including course evaluation sheets, program evaluation, and trainer evaluation, including his own – to continuously improve his training methods. He has followed closely best practices in adult and popular education and has constantly adjust his approach with each class of workers that he trains. He keeps up on latest developments in occupational health and safety, environmental, and public health practice and policy, attend seminars, professional trainings, and conferences, and bring back ideas and concepts to enhance and stimulate my training. Most significantly, he enjoys being a part of a community of trainers who create a positive environment of mutual learning from one another in order to provide the best possible training experience for students.

Dr. Turcotte has collaborated on many environmental health projects and in-home intervention research projects within low-income diverse communities. Dr. Turcotte is currently Principal Investigator (PI) for an $700,000 U.S. Department of Housing and Urban Development (HUD) Healthy Homes Technical Studies Program grant that gathers environmental and health data in low-income, homes of asthmatic children and older adults to assess the health outcome impacts of comprehensive interventions and the sustainability of these interventions. Dr. Turcotte is also Co-Principal Investigator on the Massachusetts Department of Public Health's Reducing Older Adult Asthma Disparities (ROADD) study which overall goal is to improve asthma control and reduce urgent care utilization for older adults with asthma through asthma home-visiting interventions that integrates the clinical care with the home-based intervention using a team-based approach that includes a home visiting community health worker, visiting nurse and primary care team to study participants. Dr. Turcotte was also PI on three U.S. Department of Housing and Urban Development (HUD) funded projects, including a $750,000 Healthy Homes Technical Studies grant to conduct multifaceted interventions with CHWs in the homes of older adults with asthma and COPD to evaluate their effectiveness in improving health outcome and reducing asthma triggers, as well as $875,000 Healthy Homes Demonstration Program and $425,000 Asthma Intervention in Public and Assisted Housing grants that gathered environmental and health data in low-income, homes with asthmatic children and assess the health outcome impacts of comprehensive interventions. These projects have also evaluated cost and technical effectiveness, sustainability, impact of remediation and educational interventions on health, behavior, exposure, and safety. Dr. Turcotte was also a co-Investigator on and managed several EPA and HUD funded projects focusing on mitigating negative environmental health impacts facing low-income populations. Dr. Turcotte's interdisciplinary background and experience working with multidisciplinary research team on environmental health projects targeting low-income older adults with asthma and COPD make me well suited to make positive contributions to the proposed study. In addition, Dr. Turcotte's past success managing complex, multifaceted projects and familiarity with the target community will be an asset to the research team.

23.0 References