JACK RABBIT II PHASE 1 TRIALS:

TRAINING NEEDS ASSESSMENT AND ANALYSIS

Monday, April 4 – Friday April 8, 2016

National Fire Academy, Emmitsburg, MD

Final Report

August 1, 2016

PREPARED FOR:
National Fire Academy
16825 S Seton Ave
Emmitsburg, MD 21727

PREPARED BY:
McKinley Group
9210 Corporate Blvd., Suite 360
Rockville, MD 20850

This page intentionally left blank

Table of Contents

Introduction

In April and May of 2010, the Transportation Security Administration (TSA) of the Department of Homeland Security (DHS), in collaboration with the Chemical Security Analysis Center (CSAC), sponsored a series of tests called the Jack Rabbit Trials at Dugway Proving Ground (DPG), UT. In the trials, multiple releases of 1 & 2 ton amounts of chlorine and anhydrous ammonia were performed in various wind and other atmospheric conditions from release container and within a standardized outside test area.

The purpose of the tests was to study and improve understanding of rapid large-scale releases (60-90 tons) of compressed liquefied gases—specifically, toxic inhalation hazard (TIH) gases. Following the initial scientific studies, it became clear that the information gathered was important to emergency managers and emergency responders. CSAC approached the United States Fire Administration to identify the most effective routes to get information into the hands of the emergency responders. In April 2013, a workshop was conducted with stakeholders to identify distribution strategies and unanswered questions. The results of that meeting were published in a document entitled *Training Value Analysis Meeting*, available through distribution from the National Fire Academy. Some of the recommendations from the working group included:

- The need for re-assessment of planning, preparedness, and response protocols for comparable TIH and other compressed liquefied gas releases.
- The need for national communication and training strategies to reach the nation's response community with the new information learned from the tests.
- The need for additional tests and study to further refine our understanding of the risks and product behaviors that may be encountered in response to similar large-scale TIH and other compressed liquefied gas releases.

Additional questions surfaced and the need for additional scientific testing was identified. The result was a second round of testing and chlorine releases at the Dugway Proving Grounds. The first phase of the Jack Rabbit II trials was conducted in August 2015. The results of those experiments were reviewed by a focus group in April 2016, in preparation for the second phase in August/September2016.

In the second phase, experiments are being designed to answer the questions identified in previous trials. Emergency responders and scientists are now in the design phase of the experiments. The results of the experiments in the final phase will impact the emergency response community for many years to come.

The Jack Rabbit II Phase 1 Training Needs Assessment and Analysis meeting attendees were asked to examine implications of the Jack Rabbit II Phase 1 trials on the planning, preparedness and response procedures and guidelines used for handling major TIH and other compressed liquefied gas incidents and releases. The meeting attendees were then asked to recommend content related to the findings of the trials that would help the nation's emergency services community. Finally, meeting attendees were asked to recommend areas of further study for such TIH releases and possible supplemental test

procedures and measurement approaches to be considered for inclusion in the Jack Rabbit II Phase 2 trials.

Coordination between DPG Test Team and On-Site Emergency Response Capability

The Jack Rabbit tests expose workers on the grid to possible sudden and extreme contamination with chlorine and/or sodium hydroxide, both materials that require immediate rescue and decontamination with medical treatment and transportation. Emergency response/decontamination teams were available to personnel on the grid during filling and post-release resetting operations in 2015. Emergency response personnel functioned in coordination with the DPG test team providing an effective response capability. The panel distinctly supports a command post and ICS integration in alliance with current OSHA regulations, NFPA standards, and NIMS guidance for control of hazardous materials. Additionally, the need to support aerial surveillance of the the operations and releases is a top priority.

Review of 2015 Jack Rabbit II Phase 1 Trials and Findings

A full review of the Jack Rabbit tests from 2010 Jack Rabbit I and 2015 Jack Rabbit II Phase 1 was presented by Dr. Shannon Fox.

The Jack Rabbit I test program was conducted at Dugway Proving Ground, UT, in April/May 2010. It was sponsored by the Department of Homeland Security (DHS) and the Transportation Security Administration (TSA), with program oversight provided by the Chemical Security Analysis Center (CSAC). The purpose of the tests was to study and improve understanding of rapid large-scale releases (60-90 tons) of pressurized, liquefied toxic inhalation hazard (TIH) gases from a railcar. Dr. Fox provided a general overview of findings from Jack Rabbit I and the initial findings from Jack Rabbit II Phase 1, which was held in August and September 2015. He then presented what is currently planned for Jack Rabbit II Phase 2, which is to be conducted between August 29–September 30, 2016.

Chemical Security Analysis Center's responsibility is to protect the homeland against threats from dangerous chemicals. The Jack Rabbit project has focused on toxic inhalation hazards (TIHs), and chlorine in particular, because there are far fewer barriers to terrorists using these chemicals than there are for others. Ammonia and chlorine make up 75% of the most widely-shipped TIHs. Because of this, Jack Rabbit I focused on ammonia and chlorine, while Jack Rabbit II Phase 1 focused exclusively on chlorine. Accidental plume releases of chlorine did not match the predictive models and the rapid, large-scale release of these chemicals had never been tested or studied.

Up to this point, there was little knowledge of the behavior of compressed liquefied gases during a large-scale release. The Jack Rabbit I trials improved understanding of these behaviors during rapid large-scale releases (60-90 ton) of TIH gases. In April 2013, a workshop was conducted with stakeholders to identify distribution strategies and unanswered questions that pertained to emergency response concerns.

Jack Rabbit test information of particular importance to emergency responders included:

- The observed spontaneous energetic release events tentatively called rapid phase transitions (RPTs) which may have an impact on responder safety and safe action options, depending on further scientific analysis of cause;
- The extent and length of off-gassing after dispersion from soil and impacted areas and its significance for responder decisions relating to when it is safe to enter the initial isolation zone;
- The observed plume dispersion information and the clarification of factors affecting dispersion, along with the potential impact of this information on responder calculations of downwind areas of exposure and protective action needs;

- The enhanced understanding of dispersion and area contamination supports the need of responders to use a risk-based decision-making process in determining the appropriate strategies and tactics;

- The observed level of reactivity of an oxidizer as it comes into contact with an organic material or other reactive materials and its impact on responder assessment of risk;

- Because the data in the initial tests was inconclusive regarding isolation zones, the need for careful structuring of the planned additional Jack Rabbit tests in order to achieve more conclusive data regarding the accuracy of the current Emergency Response Guidebook (ERG) guidelines that are used by responders to calculate the size of initial isolation zones;

- The confirmation of the current understanding in the response community of the dominant impact of wind and terrain on dispersion patterns; and,

- The dramatic graphic portrayal of initial release that is rarely seen by responders, which was deemed by meeting attendees to be very important to share in order to reinforce responder understanding of and respect for the scope of risk at such releases.

As part of Jack Rabbit II Phase, five trials were conducted in 2015 and an additional 8 trials will be conducted in 2016. In the 2015 tests, a simulated urban test grid (UTG) was used to study the effect of buildings and the reactions of chlorine with environment and surfaces. Over 60 Conex containers and mobile structures were constructed on the UTG to simulate buildings and obstacles.

The JR II Phase I trials attempted to address emergency response questions including:

- Is it safe to shelter in place in emergency response vehicles?

- What is the height at which a responder can survive (reliable vertical concentration)?

- Is it possible/advisable to drive through the chlorine gas cloud?

- Is the 1000 meter initial isolation zone in the current ERG valid?

- What is the significance of various urban barriers?

- What is the impact of long-term off-gassing?

- What is the behavior of chlorine after a catastrophic release?

- What is the behavior of the chlorine interacting with common urban materials?

Data from the 2015 Jack Rabbit II Phase 1trials has been analyzed and initial findings have been posted. Before the 2016 Jack Rabbit II Phase 2 trials begin in August, all the

data from Phase 1 will be available to all interested stakeholders, including raw data sets, videos, test records, and documentation.

Dr. Michael Sohn reviewed the results of the indoor experiments and preliminary findings comparing the difference between indoor and outdoor air quality.

Outdoors, there is a steep rise as the plume appears and peaks, and then the concentration drops precipitously. Indoors, the peak is dependent on infiltration rates; if the air changes per hour are frequent, it will diminish quickly; if they are slow, the concentration will diminish slowly.

All other things being equal, the concentration experienced breathing outside the building will be ultimately be experienced breathing inside the building; the difference is that the time frame for receiving the same concentration is shorter outside than it is inside. The perfect scenario would be to shelter in place until the concentration was lower outdoors than indoors and then evacuate. But, when is that?

A peak can drive a higher toxic load for the individual than a long-term exposure to lower levels. Further, if the gas toxicity/toxic load is greater than 1, as it is for chlorine, the danger of peak outside concentration is greater than inside. This suggests that it's far more dangerous to leave an indoor setting early than it is to stay in an indoor setting too long.

This page intentionally left blank.

Recommendations for Informing the Nation's Emergency Preparedness, Planning, and Response Community

The meeting attendees discussed the content to be included in the presentation on the Jack Rabbit project to the nation's fire and emergency services personnel. It was felt that it was very important to reach everyone with the information as quickly as possible. Following the final Jack Rabbit II trials, a presentation will be created that will contain all of the information in Appendix A as well as some of the tentative results from the August/September Jack Rabbit II Phase 2 trials.

The presentation will address the following from the analysis of data derived from the Jack Rabbit project up to July 2016.

WHAT DO WE KNOW?

The current plume models for chlorine may not accurately predict its actual behavior and may not account for reactivity and other factors. Plume models have often over-predicted the downwind concentrations and under-predicted the concentrations closer to the source. They can best be used as a predictive tool for pre-incident assessment of community or facility risk (operational and strategic planning) and post-incident analysis.

When these models are used as response tools, they are most effective when used in conjunction with air monitoring and physical indicators that provide the IC with a general dispersion plume description.

We will not know the full profile for any individual incident based upon these studies. We do know the following:

- Initially, being inside is better than being outside.
- The more barriers/distance (e.g., upper floors) you can put between yourself and the released chemical, the better.
- Staying indoors may present less risk than immediately evacuating and/or evacuating after the plume contaminant passes.

During a chlorine release with high outdoor concentrations, sheltering in place is the recommended public protective action. Civilians sheltering in-place and smelling chlorine as the indoor concentration rises may leave the sheltering prematurely, thereby exposing themselves to increased concentrations.

We know that there will be infiltration over time from the outside into the inside of the structure (buildings or vehicles). The rate of infiltration is based upon a number of factors, including the structure. As the incident timeline progresses, the concentration of contaminants inside the structure may increase. The concentration indoors will continue to increase as long as the outdoor concentration is higher.

When dealing with heavier-than-air dense gas releases, increasing vertical distance may be an effective protective action option.

A combination of chemical sorption and air exchange rates will create a reduction in interior concentrations after the plume has passed. After the vapor cloud or plume passes, there appears to be no off-gassing from interior surfaces exposed to chlorine.

Tests demonstrated that liquid chlorine was present during the initial release for both the 5- and 9-ton releases. The liquid chlorine auto-refrigerated on the pad and thawed for up to 20 minutes post-release and was primarily found in the immediate area within 25 meters of the release source.

WHAT DO WE THINK WE KNOW?

Jack Rabbit II has not confirmed the accuracy of the Initial Isolation Distance, however this needs additional study and validation. (ERG cargo tank truck guidance is 600 meters, while tank car guidance is 1,000 meters.)

Initial release size and direction is driven by the energy associated with the release. Wind and terrain will eventually become the dominant factor affecting dispersion. At low winds, the initial expansion from the release will be in 360 degrees. At moderate to higher winds, the expansion area will be strongly influenced by wind direction.

Recommendations for Further Study in 2016 Jack Rabbit II Phase 2 Trials

WHAT ARE OUR GAPS?

1. Jack Rabbit II has not validated the accuracy of the Initial Isolation Distance recommendations published in the ERG, but additional study and validation is needed with a specific focus retrograde creep (upwind behavior of the plume).

2. There may be mitigation strategies that can be implemented by the civilian community to reduce their risks while sheltering in place. Some examples include:

   - Go to higher levels in the structure.
   - Look for barrier rooms such as bathrooms.
   - Shut off the HVAC.
   - Use wet towels to seal doors.

   There is a need to explore the impact these strategies may have on reducing the hazard. If they are considered to be effective, they could be communicated to the public through public service answering point or PSAP communicators, public releases, etc.

3. There is a need to further investigate the sorption of chlorine and other related chemicals in materials and surfaces used by the emergency services such as PPE, vehicles, and equipment. The results of this investigation could provide possible mitigation strategies.

4. There is a need for some guidance to ICs on the assessment of plume movement and dispersion in large multi-story buildings and in below-grade structures (e.g., subways). Considerations include location of air intakes (ground vs. roof), location of mechanical room floors, ability to isolate and control HVAC flows, common plenums, etc.

5. There is a need to provide additional information and guidance on chlorine response scenarios involving auto-refrigeration behaviors. A lot of information already exists, but that information needs to be captured for the response community.

6. There are questions that need to be answered regarding the use of photo-ionization detectors (PIDs) with 11.7 eV bulbs. What is the field application for PIDs at catastrophic releases of liquefied chlorine or compressed liquefied gases or toxic inhalation hazard (TIH) materials? Test the field application of PIDs at large-scale releases of liquefied chlorine by answering the following questions:

   - Does current PID technology provide useful data to support the emergency responder's efforts to protect the community at the large-scale releases of chlorine gas?

- Does PID technology offer a practical means of detecting chlorine below Immediately Dangerous to Life and Health (IDLH) conditions?

- Does current PID field technology prove to be resilient to repeated exposures to low concentrations (50ppm or less) of chlorine?

7. The phenomena of spontaneous energetic releases called rapid phase transitions (RPTs) was observed at the Jack Rabbit I trials within several minutes after the release and continued for an extended period of time (90 minutes) afterwards. RPTs were not tested for in the 2015 Jack Rabbit II Phase 1 trials. Further study in the 2016 Jack Rabbit II Phase 2 will be required to determine factors affecting risk assessment and response.

    - What is the force/power of the RPTs?

    - What are the source conditions?

8. The expertise currently available for indoor infiltration studies needs to be applied to studying chlorine penetration rate and concentrations inside vehicles. A comparative analysis of a vehicle that is running with interior environmental systems activated and a vehicle that is not running should be considered. The following conditions are being proposed:

    - Vehicle that is running with moderate rpm with interior environmental systems activated.

    - Vehicle that is running with moderate rpm with interior environmental systems shut-off.

    - Vehicle that is not running with interior environmental systems shut-off.

This will provide data so a recommendation can be made as to whether or not the engine should be turned off and it will also provide infiltration rates for common vehicles.

9. There is a need to observe and document the behavior of the chlorine plume from altitude via an unmanned aerial system providing HD digital imaging to determine the degree to which plume direction and visible plume density is effected by wind. Additionally, there is a need to allow aerial surveillance of the the operational area and release site as it would enhance situational awareness and safety for personnel.

Appendix A:
Recommended Key Points for Responders

Jack Rabbit Project

Part 1

Every year, many chemicals and hazardous materials are stored and transported around the nation. Many of these products present a problem to responders if a spill or accident occurs. The hazard to responders increases when dealing with liquefied gases. To effectively ship gaseous products, many of these gases are liquefied by one of several methods, including cooling or compression to reduce container size and thus shipping costs. Although there is a tremendous savings in transportation and storage costs, the process of liquefying a gas is not without its hazards.

The two most common liquefied gases transported by rail and highway today are chlorine and anhydrous ammonia. Although these gases have several specific hazards, the greatest concern is that of inhalation. In fact, they are classified as Toxic Inhalation Hazards (TIHs) and have been responsible for many injuries and deaths when involved in accidents.

Accidents are rare. However, when they do occur, victims in the area of a release of a Compressed Liquefied Gas can be exposed, injured, or killed. Emergency responders must fully understand the behavior of compressed liquefied gases in order to provide the appropriate protective actions. Historically, emergency managers, investigators and educators have studied the effects of incidents and accidents to see the effects of these accidents and the behavior of the gases released during an accident.

In April and May of 2010, the Transportation Security Administration (TSA) of the Department of Homeland Security (DHS), in collaboration with the Chemical Security Analysis Center (CSAC), sponsored a series of tests called the Jack Rabbit Trials at Dugway Proving Ground, UT. In these trials, multiple successive releases of 1-ton amounts of chlorine and anhydrous ammonia were performed in various wind and other atmospheric conditions from a standardized release container and within a standardized outside test area.

The purpose of the tests was to study and improve understanding of rapid large-scale releases of Compressed Liquefied Gases—specifically toxic inhalation hazard (TIH) gases—from a railcar. Some of the issues identified and of interest to emergency responders include:

- Are the airborne models of plumes and plots accurate?
- Are there measures that emergency responders can take to minimize their risks during a response to an incident involving liquefied gases?

- Are there protective actions that can be recommended during an incident to help responders and victims minimize the risk of exposure?

In June 2013, the National Fire Academy hosted a meeting of stakeholders and interested parties to discuss the design and development of future tests and methods to answer the above questions. In addition, the group developed recommendations to disseminate the lessons learned to the Emergency Response community.

DHS, TSA, and the Unites States Fire Administration (USFA) developed the criteria for a new round of experiments called Jack Rabbit II Trials during a focus group meeting. The first groups of releases were conducted in August 2015. The second round of trials is scheduled for August/September 2016.

Following the next and final rounds of trials, the intent is to develop lessons learned and recommendations to the emergency response community. The impact of the information released is envisioned to influence future development of educational programs, recommended practices, and operating procedures for responders nationwide. Included in the developed materials would be videos, lectures, and other training products.

Jack Rabbit Project

Part 2

As discussed in Jack Rabbit Coffee Break Training Part 1, the Jack Rabbit Trials provided information and science regarding the sudden release of liquefied gas products due to a failure of the container. One of the recommendations of the working group was to prepare a bulletin to responders highlighting the information gathered. The following information is a list of items that we think we know at this point.

- Initial isolation zone of ERG is validated.
- Wind is validated as the dominant factor affecting dispersion. At low winds, the initial expansion from the release will be in 360 degrees. At moderate to higher winds, the expansion area will be strongly influenced by wind direction. Topography is another primary factor, especially when dealing with heavier than air gases.
- The phenomenon of some movement of the vapor upwind in low wind conditions was observed and will require additional study to determine factors affecting response. The working group has described this movement as retrograde creep.
- Responders may need to learn how to consider more complex data regarding conditions in order to better use the ERG to make correct calculations for protective actions downwind. Further study is recommended to determine how responder assessment of additional factors such as whether unusual weather patterns or topography features should affect decisions about protective actions downwind.
- A phenomenon of spontaneous energetic releases tentatively called rapid phase transitions (RPTs) was observed and will require additional study to determine factors affecting risk assessment and response.
- The phenomena of longer periods of off-gassing in the initial isolation zone area was observed and will require additional study to determine factors affecting risk assessment and response.

New scientific experiments are currently being designed to gather more information and evaluate the effects on emergency responders. As additional information is gathered, new training products will be developed for emergency responders. For further information, please contact Mr. Wayne Yoder at the National Fire Academy. He may be reached at 301-447-1090 or by email at wayne.yoder@fema.dhs.gov.

Jack Rabbit Project

Part 3

In August 2015, the second round of Jack Rabbit trials was conducted at Dugway Proving Grounds in Utah. You may recall that the Jack Rabbit Trials were scientific experiments designed to answer questions about the sudden release of liquefied gas products. These questions arose from the study of accidental releases of Toxic Inhalation Hazard (TIH) materials in events like the train derailment in Graniteville, South Carolina.

First responders need to know if there are any protective measures that they or victims in the release area can take to protect themselves from the effects of toxic gas inhalation. The following observations may be useful in a release event.

- Plume modeling programs should be used as decision-support tools in the emergency response toolbox. They have strengths and limitations that must be brought into the assessment equation. We believe that current plume models do not always accurately predict the actual behavior – do not always account for reactivity, toxic load equivalent – often over-predict the downwind concentrations and under-predict the concentrations closer to the source.
- Being inside a structure is initially better than being outside. The scientific studies show that staying indoors may present less risk than immediately evacuating and/or evacuating after the plume/contaminant passes.
- There will be infiltration over time from outside into the structures (buildings or vehicles). The rate of infiltration is based upon a number of factors, including the tightness of the structures.
- As the incident timeline progresses, the concentration of contaminants inside the structure may increase. The concentration indoors will likely continue to increase as long as the outdoor concentration is higher.
- When dealing with heavier-than-air dense gas releases, moving to higher areas in the building may be an effective protective action option.
- Tests demonstrated that liquid chlorine could be found under the test conditions for the 5- and 9-ton releases. The liquid Cl_2 was persistent for up to 20 minutes and was primarily found in the immediate area within 25 meters of the release source.

Jack Rabbit Project

Part 4

Scientists and emergency responders have studied the results of the Jack Rabbit I trials extensively. As in most scientific studies, as questions are answered, new questions are identified that require additional testing and evaluation. One such observation was that of spontaneous release of energy from the ground exposed to liquid chlorine. These pressure releases were thought to be the result of a rapid conversion of a liquefied gas product back to a gas due to the vapor expansion ratio. Scientists have termed this phenomenon rapid phase transition or RPT. RPT has been studied as it relates to liquefied natural gas (LNG), but has not been studied extensively in the case of liquefied chlorine. The phenomenon in the case of a liquid chlorine release has been observed after 30 minutes or more during a release scenario in the Jack Rabbit 1 trials.

The significance for emergency responders is that responders may be in a hazard zone conducting offensive operations within that period of time. Incident Commanders must know that the risk may exist, and must consider the potential in their risk assessment.

Because of the risk to responders, further studies have been scheduled for the follow-on experiments now known as Jack Rabbit 2 trials. The following is a list of the issues that will be studied:

- RPTs were seen in JR I within several minutes of the release being stopped, and continued for an extended period of time (90 minutes) afterwards.
- At a minimum, responders need to have a general explanation of RPT.
- RPT has been observed for, and potentially can continue for, an extended period of time (90 minutes).
- The amount of energy released from an RPT needs to be measured.
- The source conditions that are conducive to an RPT have not been identified and require further study.

As additional tests are conducted and information obtained, that information will be developed into bulletins and training programs for emergency responders.

For further information, please contact Mr. Wayne Yoder at the National Fire Academy. He may be reached at 301-447-1090 or by email at wayne.yoder@fema.dhs.gov.

This page intentionally left blank.

Appendix B:
Jack Rabbit II Meeting Agenda

April 4–8, 2016

Meeting Goals

1. Assess lessons learned from the Jack Rabbit II tests and their potential impact upon emergency planning and response protocols for large-scale TIH and other liquefied gas releases.
2. Develop for consideration recommendations on emergency response and preparedness gaps that could possibly be integrated into the Jack Rabbit II-B tests.
3. Develop national communication and training strategies to disseminate the Jack Rabbit I and II findings and observations to the nation's emergency planning and response communities.
4. Outline the content that is appropriate for first responders and other emergency response personnel to be included in a presentaion that is portable and functional for use in a classroom, conference room, small-group session, or other assemblies of emergency response personnel.

Meeting Work Schedule

Day / Time	Agenda Topic
Day 1, Mon., April 4	
9:00 am	Wayne Yoder, NFA Hazardous Materials Training Specialist, presents a brief orientation to Project Jack Rabbit and the reason for this meeting.
9:20 am	Participant Introductions
9:45 am	Dr. Dennis Onieal: Welcome
10:00 am	Break
10:15 am	Greg Noll presents meeting expectations and rules of engagement.
10:30 am	Jack Aherne presents on the history of the Jack Rabbit project.
12:00 noon	Lunch
1:00 pm	Shannon Fox, Ph.D., presents an overview of the Jack Rabbit I and II projects.
2:30 pm	Break
2:45 to 4:00 pm	Andy Byrnes presents an overview of Jack Rabbit II emergency response tests, process and initial findings / results.

Day / Time	Agenda Topic
Day 2, Tues., April 5	
9:00 am	Dr. Michael Sohn presents on: • Overview of his test parameters • Findings and observations • How does this compare to what our current body of knowledge tells us ref: effectiveness of sheltering in place? • Guidance and recommendations to the emergency planning and response communities
10:00 am	Break

Day / Time	Agenda Topic
Remainder of Day 2	All participants discuss ramifications of Jack Rabbit II field test results for the development and/or enhancement of emergency planning, and response protocols for chlorine. Develop consensus agreement on the ramifications of the Jack Rabbit II test and test results for the following: • Update and revision of current risk-based response procedures for large-chlorine-release scenarios • Any changes to NFPA standards and recommended practices • Any OSHA updates and/or interpretations impacting hazardous materials response, planning, and/or prevention efforts • Any new NIMS ICS requirements changes or typing system changes impacting hazardous materials training requirements Develop consensus agreement on the ramifications of the Jack Rabbit II test and test results for the following: • New hospital/medical hazardous materials systems requirements • Any state and major metro fire training methodology evolutions impacting training guidance, such as integration of portions of hazardous materials awareness/operations training into firefighter I, II, and III curricula • New hazardous materials planning guidelines consistent with emergent new integrated hazardous materials/multi-hazard risk assessment protocols and new response capability assessment techniques All participants develop a list of recommendations for experimental methods and areas for further study in Jack Rabbit II-B trials.
Day 3, Weds., April 6	
Morning	Discussion to review and refine the recommendations for experimental methods and areas for further study in the Jack Rabbit III trials. Develop for consideration recommendations regarding the Jack Rabbit III tests and study that might be needed to refine our understanding of TIH and other Compressed Liquefied Gas large-scale releases and to develop revised response and planning protocols and procedures.

Day / Time	Agenda Topic
12:00 noon	Lunch
Afternoon	All participants discuss strategies on how best to reach the nation's emergency preparedness, planning, and response communities with the new information, including specific recommendations as appropriate for NFA and other Federal hazardous materials training partners.
Day 4, Thurs., April 7	
Morning	Discuss and refine recommendations for Informing the nation's emergency preparedness, planning and response community of needed information regarding the results of the Jack Rabbit II trials. Further refine the plan for controlled distribution of a standardized message to the hazardous materials response community.
12:00 noon	Lunch
Afternoon	Outline the content that is appropriate for first responders and other emergency response personnel to be included in a presentation that is portable and functional for use in a classroom, conference room, small-group session, or other assemblies of emergency response personnel.
Day 5, Fri., April 8	
Morning	Review of NFA's courses within the hazardous materials curriculum to identify locations within course content where insertion of Jack Rabbit information would be appropriate.
11:00 am	Meeting adjourns.

APPENDIX: C

Participant List
Jack Rabbit II Phase I Training and Analysis Assessment Meeting
April 4 – 8, 2016

Dr. Denis Onieal, DHS / FEMA / Deputy US. Fire Administrator
Dr. George Famini, Director, DHS / S&T / Chemical Security and Analysis Center
Dr. Shannon Fox, Program Manager, DHS / S&T / CSAC /Jack Rabbit Program Manager
Dr. Michael Shon, Physical Scientist, DHS / S&T/ Lawrence Berkley Laboratory (LBL)
Ms. Janis McCarrol, CDR, P.E., USPHA, Technical Hazards Division, DHS / FEMA
Mr. Tom Warnock, DHS / FEMA / CSEPP
Mr. Stephen Hughes, DHS / FEMA / CSEPP
Mr. Mike Mykerski, DOD, US Army Chemical Activity CSEPP
Mr. Jack Aherne, Director, DHS / TSA
Mr. William Shoonover, Director, DOT / PHMSA
Mr. Aaron Mitchel, Director, DOT / PHMSA
Ms. Shakira Mack, Senior Program Analyst, DOT / PHMSA
Mr. Mark Maday, Manager, Hazardous Materials, Union Pacific Railroad
Ms. Robyn Brooks, Director, Health, Environment, Safety and Security, Chlorine Institute
Mr. Andy Byrnes, SME, Professor, Utah Valley University / Emergency Services
Mr. David Matthew, SME, Trainer, Retired Fire Chief Officer
Mr. Jack McCartt, SME, Retired Fire Chief Officer, Advanced Technical and Educational Consultants
Mr. Richard Edinger, SME, Deputy Fire Chief, Chesterfield County Fire & EMS
Mr. Robert J. Ingram, SME, WMD Branch Chief, Center for Terrorism and Disaster Preparedness, FDNY
Mr. Greg Noll, SME, Facilitator, South Central PA Task Force Program Manager
Mr. Scott Gorton, Manager, DHS/TSA
Mr. Joseph Giese, Test Control Officer, US ARMY/ATEC
Mr. Damon Nicholson, Test Control Officer, US ARMY/ATEC
Mr. Fred Scaffidi, Transport Dangerous Goods Directorate/Transport Canada
Mr. Jason Poulin, Chemist - Emergency Response Advisor/Transport Canada
Ms. Alison Butko, Engineering Research Officer, Transportation of Dangerous Goods/Transport Canada
Ms. Tagenine Alladin, M.Sc., Scientific Research Advisor, Transport Canada
Mr. Wayne Yoder, Training Specialist, DHS / FEMA / USFA / NFA
Ms. Susan Hernandez, Instructional Systems Specialist, DHS / FEMA/ USFA / NFA
Ms. Karen Kent, Instructional Designer, McKinley Group
Mr. Clint Walsh, Project Manager, McKinley Group
Mr. Max Kronberg, Technical Writer, McKinley Group