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DEPARTMENT OF ENERGY EFFORTS IN PREPARING AND IMPROVING FIRST RESPONSE CAPABILITIES AND PERFORMANCE IN THE EVENT OF A RADIOLOGICAL TRANSPORTATION INCIDENT

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ABSTRACT
It is estimated there are three million radioactive material shipments made in the United States annually. The Department of Energy (DOE) is responsible for approximately 20,000 of these shipments per year. To address the concerns expressed by states and tribes along identified transportation corridors, DOE has established the Transportation Emergency Preparedness Program (TEPP), which addresses the emergency response needs of state, tribal, and local governments. This is accomplished by meeting emergency first responders' training and knowledge needs, and by reducing the concerns of first responders. As a result, responders are better prepared to react to any radiological transportation incident. The preparation process involves conducting a Needs Assessment, improving procedures, conducting training, and may also include tabletop and/or full scale radiological transportation drills and exercises that focus on multiple agency interaction. As TEPP has evolved so too have the training and exercise capabilities that can now be offered to the response community. These include efforts to meet national trade association expectations and standards for competency for various response disciplines by providing advanced level courses. Additionally, TEPP is also now able to coordinate training and exercises utilizing high activity radiological sources. The result of these enhancements for those who have participated is a first response community better trained and prepared to manage any radiological transportation incident.

INTRODUCTION
It is estimated there are three million radioactive material shipments made in the United States on an annual basis. The Department of Energy (DOE) is responsible for approximately 20,000 of these shipments per year. As the number of radiological shipments increase due to a wider use of radioactive material, cleanup activities, etc., so does the possibility that first responders will encounter a transportation incident involving radioactive material.

To address the concerns expressed by states and tribes along identified transportation corridors, DOE has established the Transportation Emergency Preparedness Program (TEPP), which

addresses the emergency response needs of state, tribal, and local governments. This is accomplished by meeting emergency first responders' training and knowledge needs. In order to ensure responders have the appropriate knowledge and skills needed to respond safely and effectively to transportation incidents involving radioactive material, TEPP actively pursues opportunities to partner with local jurisdictions to conduct exercises involving a variety of radioactive material transportation scenarios.

Since 1998, using this comprehensive approach to prepare, thousands of responders have been given the opportunity to participate in over 30 TEPP-sponsored full-scale radiological transportation exercises and hundreds of drills.

THE PROCESS

A community approach is always used during the exercise development process. All potential response agencies are invited to participate, including hospitals, law enforcement, fire departments, emergency management agencies, community aid agencies such as the Red Cross, state and federal emergency management radiological response assets. This would include agencies from surrounding communities who may also be called upon to assist during an incident through mutual aid agreements.

Figure 1. Responder accessing a package during a TEPP exercise in Acoma, NM.

After participants for an exercise have been determined, each agency is strongly encouraged to complete the TEPP Needs Assessment, answering a series of questions designed to identify possible procedural, training, and/or equipment gaps that could affect the agency's ability to successfully respond to a radiological transportation incident. To assist in the completion of the Needs Assessment, an on-line version has been developed that is simple to use and will automatically generate the report for the response jurisdiction.

The Needs Assessment is divided into two sections, planning and training, and the flow chart (see Figure 2) follows the path of each. Even if the TEPP Needs Assessment reveals adequate planning and training, the conduct of a drill or exercise can be used to validate the jurisdiction's planning and training. If the assessment reveals needed improvement areas, TEPP has a suite of tools to aid response jurisdictions in their readiness activities. All of the tools are readily available and can be accessed on the TEPP web site at www.em.doe.gov/otem.

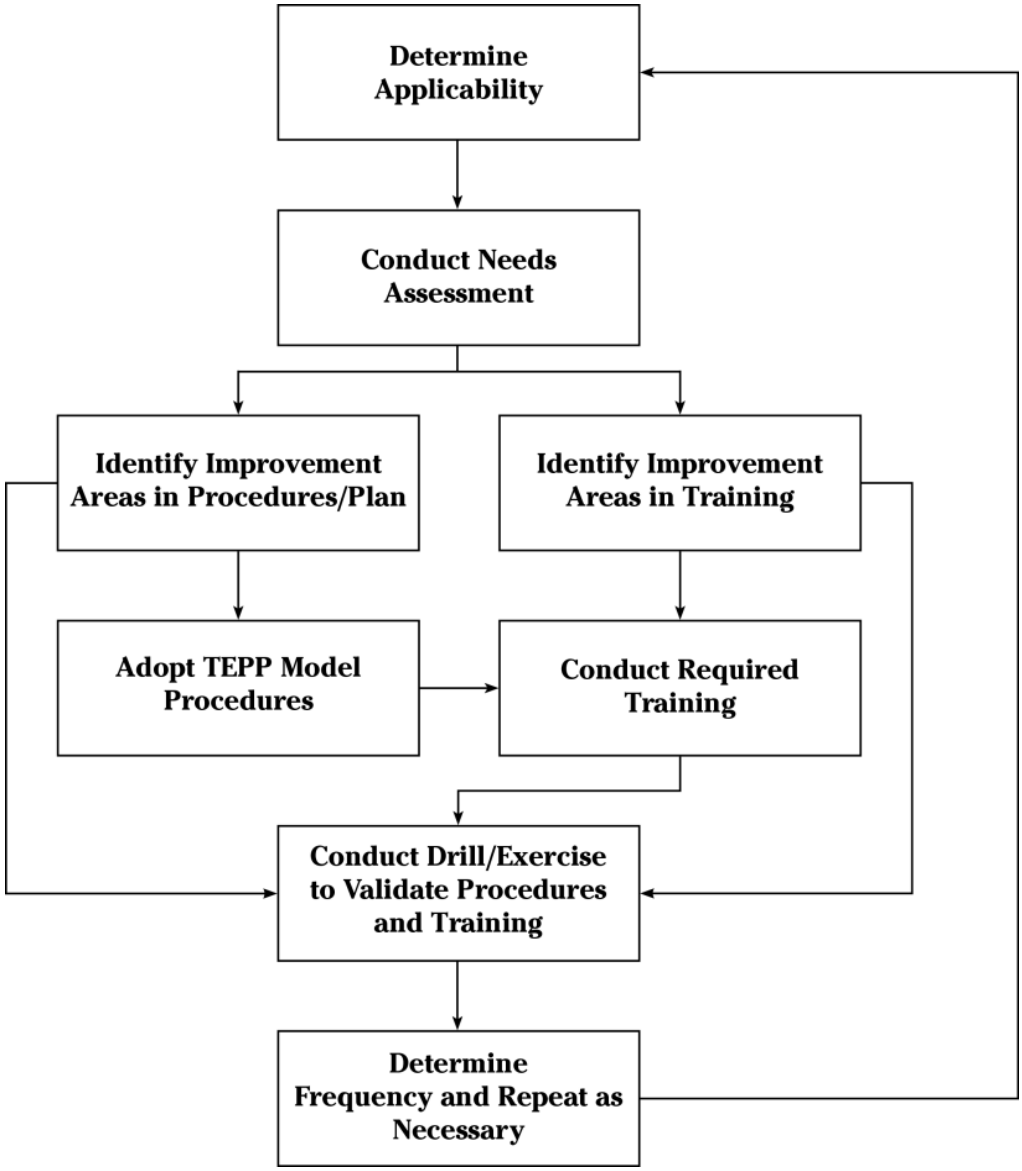

Figure 2. Flow chart showing TEPP Needs Assessment process.

TEPP has developed six model procedures to assist the response jurisdiction in modifying their existing standard operating procedures. The procedures are not all-inclusive, but were developed to meet the minimum national guidance for responding to a radiological transportation incident. The procedures are designed for use by trained and qualified emergency responders, and

additional procedural requirements may be implemented according to appropriate state, tribal, or local requirements. They include:

- Emergency Medical Services Procedure for Properly Handling and Packaging Potentially Radiologically Contaminated Patients
- First Responder Procedure for Transportation Accidents Involving Radiological Materials
- Hazardous Materials Incident Response Procedure
- Medical Examiner/Coroner Procedure on the Handling of a Body/Human Remains that are Potentially Radiologically Contaminated
- Model Recovery Procedure
- Radioactive Material and Multiple Hazardous Materials Decontamination Procedure

In addition to the procedures listed above, TEPP has developed the Model Planning Annex that provides a basic structure and annotated guidance for preparing a transportation addendum to an existing emergency plan at the county level. This model annex assumes the user has an existing comprehensive Emergency Operations Plan, along with a Radiological Emergency Operations Plan.

Once the jurisdiction has addressed weaknesses that were identified in their plans and procedures, they will need to address any gaps in training. To assist agencies with responder training, TEPP worked in partnership with the states and tribal nations to develop the Modular Emergency Response Radiological Transportation Training (MERRTT) program. MERRTT has a modular design, consisting of 16 concise, easy-to-understand modules, 5 textbook exercises, and 5 hands-on practical exercises. This design allows a jurisdiction to integrate the modules into their existing hazardous material training or to use as a stand-alone training program. MERRTT addresses the training concerns of states, tribes, and local jurisdictions. It provides fundamental knowledge for responding to transportation incidents involving radioactive material and builds on training in existing hazardous materials curricula. The material is designed to meet the training needs of persons serving in fire service, law enforcement, emergency medical service, emergency management, public works, or on a hazardous materials team.

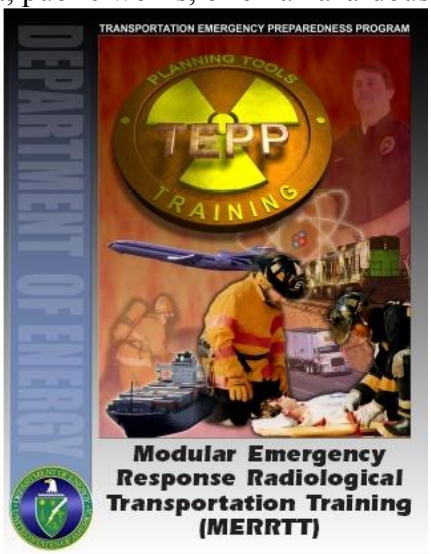

Figure 3. Cover of MERRTT student study guide.

The MERRTT program is flexible and intended as a qualified instructor delivered training program. Designed in modular format, the materials include student manuals, instructor guides, and viewgraphs to facilitate delivery. A MERRTT "Go-Kit" provides training aids to enhance MERRTT training and contains a radiation detection device, miscellaneous radiation sources (e.g. smoke detector), a Type A package and inner container, radiation labels and placards, and a copy of the Emergency Response Guidebook. MERRTT has also been approved by the Continuing Education Coordinating Board of Emergency Medical Services for Continuing Education Hours (CEH). Medical CEHs are awarded for each module and hands-on practical exercise completed.

Once a jurisdiction addresses all of its identified planning and training weaknesses, an exercise is conducted to validate the planning and training. To assist in validating a jurisdiction's planning and training, TEPP uses the Department of Homeland Security Exercise and Evaluation Program (HSEEP) process in preparing its drills and exercises. To begin the exercise process, an initial planning meeting is held with participating agencies where exercise objectives are agreed upon, and Department of Homeland Security (DHS) sanctioned activities and criteria are chosen. Next, a mid-term planning meeting is conducted to review and finalize the exercise scenario package. Scenario planners also coordinate details such as selection of realistic props, including: wrecked vehicles; smoke generators or propane-generated fire props; moulage supplies for victim role-players; positioning of roadblocks to ensure unwanted traffic stays out of the exercise scene; and purchasing of lunches for players during the after-action debriefing. Prior to the exercise, TEPP-sponsored controller/evaluator training is offered, and briefings are conducted for both controllers/evaluators and players.

Figure 4. Responders at a TEPP exercise extinguish a simulated transportation fire involving radiological materials.

In some cases, first responders participate in coached and walk-through drills prior to full-scale exercises that enable them to perform specific response functions with hands-on use of equipment while receiving step-by-step guidance from qualified controllers/instructors on proper

response actions and techniques. These drills include: scene size-up and hazards assessment; set-up and operation of a decontamination corridor; scene surveys and mapping; and the packaging and transfer of a contaminated patient. Tabletop exercises are sometimes conducted in advance of the evaluated exercise to give participating agencies an opportunity to discuss their procedural response steps and communication protocols in a no-fault environment.

After TEPP conducts an exercise, players are given an opportunity to self-identify problems, after which controllers and evaluators meet to review and evaluate all objectives, activities, and criteria. TEPP assists communities in the development of an After-Action Report (AAR) in accordance with DHS criteria. While TEPP personnel can make recommendations on the best way to correct identified findings, the final corrective action report is the responsibility of the host jurisdiction. Lessons learned are shared with other jurisdictions through the DHS process.

For communities that would like to conduct exercises without the direct involvement and planning assistance offered by DOE, TEPP provides Drill-In-A-Box scenario manuals online that cover a variety of transportation accident scenarios. These scenarios, which are streamlined for easy implementation, are currently being modified to incorporate DHS-compliant objectives, activities, and criteria. They include:

- Spent Nuclear Fuel
- Low Specific Activity Material
- Soil Density Gauge
- Radiopharmaceuticals
- Radiography Device

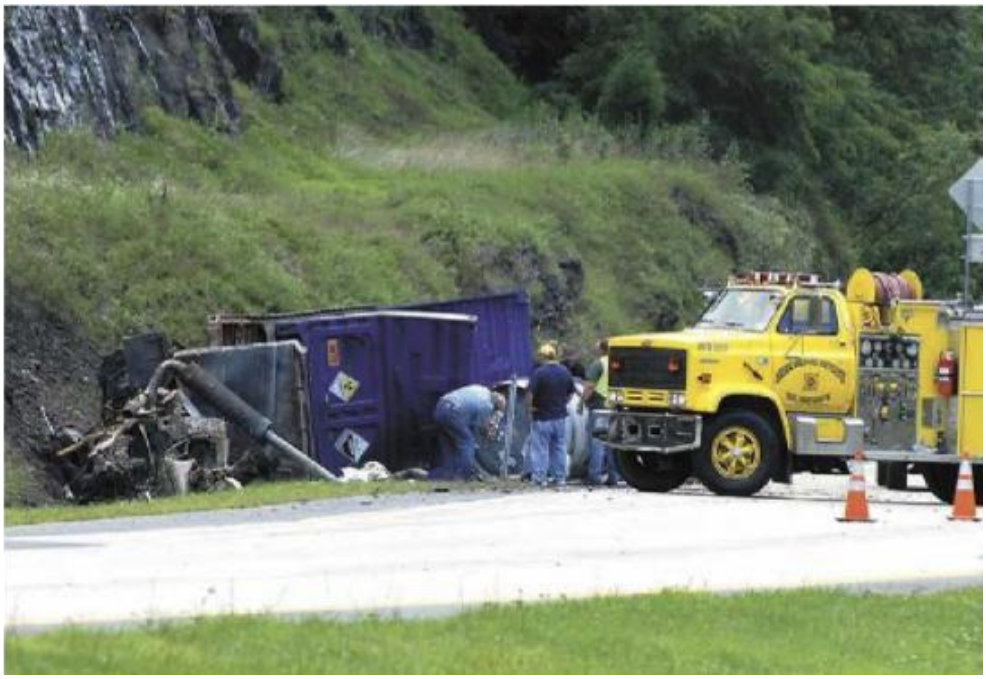

Figure 5. Fire Department responders from Beckley, WV were glad they went through MERRTT training before responding to an actual event involving uranium hexafluoride.

While exercises help measure how well prepared a community is to respond to a radiological incident, the true test of preparedness has been experienced several times by agencies called upon to respond to actual radiological transportation incidents. In May 2009, twenty-six firefighters from the Beckley, West Virginia Fire Department participated in two-day MERRTT classes. Only three months later, in August 2009, these same firefighters responded to a tractor-trailer fire involving 36,000 pounds of uranium hexafluoride. Afterwards, an officer for the fire department credited TEPP training for helping his department respond calmly, quickly determine that no release of material had occurred using survey instrumentation, and stop an unnecessary evacuation that had been ordered for a nearby town.

In 2008, response agencies in Indiana responded to a transportation accident involving a radiography source after participating in TEPP training. Later the same year, hazmat teams in Idaho responded to a radiological incident and release of contamination at a fixed facility after participating in a TEPP exercise. The Idaho Regional Hazmat Team also credited the TEPP training and exercise program for helping them respond successfully.

EVOLUTION

Key to the success of these programs is an ongoing process to ensure current, relevant, and accurate material. This revision process always includes input from state and tribal nation partners. And as TEPP has evolved over the years, so too have the training and exercise capabilities that can now be offered to the response community.

MERRTT was originally designed to meet the Occupational Safety and Health Administration's Hazardous Waste Operations and Emergency Response training requirements found in the Title 29 of the Code of Federal Regulations 1910.120(q), as they relate to a safe response to a radiological transportation incident. MERRTT has always been intended as a compliment to other hazardous materials training provided by an employer or as part of the standard training curriculum for volunteer responders. The procedures and training in the program are intended as guidance for the development of standard operating procedures specific to their own respective agencies.

While it is important to maintain the MERRTT program to be consistent with established federal regulations, OSHA is not the only source of emergency response guidance. Consensus standards such as National Fire Protection Association (NFPA) 472, "Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents," and NFPA 473, "Standard for Competencies of EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents," go beyond the fundamental requirements found in the OSHA regulations.

Though not mandated by law, these consensus standards can be more current than federal regulations since they typically undergo routine updating as part of a scheduled revision cycle. They also address in-depth the technical hazards faced by responders, response techniques, personal protective equipment, monitoring capabilities, training, and expected competencies of various levels of emergency responders. As these standards have evolved, so too have the various TEPP training programs.

The NFPA 472 and 473 standards provide a comprehensive listing of minimum competencies for individuals that respond to hazardous materials or weapons of mass destruction incidents. In an effort to evaluate the effectiveness and validity of the MERRTT program, TEPP formed a Task Group to evaluate the competencies that were directly related to radioactive material knowledge or response. The Task Group included state and tribal emergency management representatives, health physicists, and other pertinent stakeholders. The goal was to determine if MERRTT already addressed those competencies or if material should be added to the program to ensure conformity with both of these NFPA standards.

ADVANCED LEVEL TRAINING

Between the federal regulations and the consensus standards, there are four general categories or levels of emergency responders:

- First Responder Awareness Level
- First Responder Operations Level
- Hazardous Material Technician Level
- Hazardous Material Specialist Level

MERRTT training was intended to meet the Awareness and Operations Level training found in the OSHA regulations, as it pertains to radiological response. With regards to the NFPA standards, these are outlined in the Awareness and Operations Level "Core" competencies. Addressing the Hazardous Material Technician and Specialist Level competencies found in the standards require more hours of training than are currently part of the two-day MERRTT course.

It was this gap that led to the decision to develop and offer the Technician Level Modular Emergency Response Radiological Transportation Training (TMERRTT) and Radiation Specialist Training programs.

The 8-hour TMERRTT program is aligned with the specific radiological competencies listed in NFPA 472. The training includes a pre-test to verify responder knowledge and understanding of the actions necessary for radiological response. The course content includes advanced level training on radiological instrument operation, detector selection, and their limitations. In addition to the classroom training, students using the incident command system participate in three field drills. In preparation for the exercises students establish an incident command staff, assign positions, and develop objectives for each of the three field drills. Upon completion of the incident command structure, students discuss the field drill radiation safety plan, address protective clothing considerations, and the process for mapping the scene. Using radiological instruments they then demonstrate how to conduct both radiation and contamination surveys, establish control zone boundaries, as well as explaining and demonstrating contamination controls and decontamination methods.

The Radiation Specialist training program was designed to meet the expectations outlined in Chapter 18 of NFPA 472: Competencies for the Hazardous Materials Technician with a Radioactive Material Specialty. Technicians with a radioactive material specialty are responders expected to have the ability to manage the control of radiation exposure and conduct hazards assessment at an incident involving radioactive materials. They are expected to provide a higher level of technical support to the incident commander and other hazardous materials technicians.

This 40-hour training program is very in-depth and explores the scientific principles about the nature of radioactivity as it relates to the underlying technical performance of radiological detection instruments, the results of medical effects, exposure control methods, decontamination techniques and instrument operations. Completion of the program provides the technician with a radioactive material specialty the knowledge and skills necessary to safely perform assigned duties at a radiological incident.

Figure 6. Radiation Specialist class exercise in Louisville, KY.

While classroom lecture is an important and necessary component of all TEPP training, first responders tend to learn the most during hands-on practical training. The fundamentals are essential, but the practical exercises are what reinforce and confirm the didactic training. Both of these training programs require an environment for practical exercises that can simulate real world situations. The host facility must be able to accommodate a minimum of three drills that can be conducted simultaneously. These may include, but are not limited to:

- A multi-story building or multi-room facility where high activity sources can be hidden, such as a fire department drill tower or a multi-room warehouse
- A high bay or enclosed area where a decontamination tarp can be set up and where patient rescue handling can be simulated
- A large open parking lot or roadway where a mock accident scene can be set up

When it comes to training first responders, there is no substitution for reality. Vital to the effectiveness of the TMERRTT and RST programs is the use of high-activity radioactive sources. The traditional MERRTT course utilizes "live" radioactive sources in the form of naturally occurring sources, consumer products, and exempt button sources. Though radioactive and capable of producing a detector response, they are none the less non-hazardous sources of radiation.

One of the goals and intent of the TMERRTT and Radiation Specialist programs was to create an exercise environment that posed a real, but controlled, radiological hazard. The sources utilized

allow the responders to experience an environment capable of producing radiation levels in excess of 2 millirem per hour up to 15 feet away from the actual sources themselves. This legitimately simulates an incident scene where a source may have become a potential radiation hazard as a result of a transportation accident. It then requires the students to assess the scene for the real potential radiological threat and determine appropriate response actions necessary to accomplish the mission objectives assigned by the incident commander.

Using high-activity sources enables the instructors to demonstrate the effectiveness of distance and different types of shielding at reducing radiation levels. It also provides a real opportunity to demonstrate correct instrumentation use as well as instrumentation failure.

Figure 7. Students participating in a practical exercise surveying for high activity radioactive sources in Louisville, KY.

The expression on a student's face is priceless as they watch their own radiological survey meters fail to detect high radiation levels when used in a radiation field above the detectors design capabilities. It is in that moment that they see and learn firsthand that radiation instrumentation, like all of the hazardous material detection instrumentation, has its limitations. Understanding the intended operational range of any instrument and its potential for failure is one of the most important training objectives for any hazardous material training course. This training objective cannot be accomplished as effectively using simulated sources or simulated instrumentation response.

While there are other training programs available to first responders that include the use of high-activity sources, only TMERRTT and the Radiation Specialist Training courses offered by TEPP were designed and intended to be offered as on-site training for responders anywhere in the nation.

The activity level of sources needed for the TMERRTT and Radiation Specialist courses require a radioactive material license from the Nuclear Regulatory Commission or equivalent state radiation authority When possible these sources can be provided by the state or locally from an organization such as a university or medical center. When the state or host agency does not have access to the necessary material, TEPP Central Operations may be able to help provide sources. TEPP assistance will depend on fees and individual state requirements and reciprocity agreements regarding the use of licensed radioactive sources.

Figure 8. Pennsylvania Department of Environmental Protection Bureau of Radiation Protection emergency response vehicle participating as one of the practical exercise rotations during a Radiation Specialist class in Harrisburg, PA.

Another benefit of the Radiation Specialist classes is the opportunity to partner with state radiation authorities, local businesses, and institutions that use radioactive material. Field trips have been arranged with radiopharmaceutical production companies, industrial radiography firms, and even a nuclear power plant control room simulator training facility. During classes that were held in Georgia, Kentucky, and Pennsylvania, emergency management and state radiation authorities participated in exercise drill rotations. By bringing in their response assets, the students have a perfect opportunity to learn and interact with the state agencies. It also builds trust and understanding between the state representatives and the responders who will be called upon to respond, manage, and mitigate a radiological incident scene.

CONCLUSION

The overall goal of the U.S. Department of Energy's Transportation Emergency Preparedness Program is to address the emergency response needs of state, tribal, and local governments. This is accomplished by meeting emergency first responders' training and knowledge needs, and by

reducing the concerns of first responders about responding to any incident involving DOE radiological materials shipments. One highly successful method of achieving this goal is by partnering with communities to conduct drills and exercises.

Preparing to conduct an exercise is a comprehensive process that can be as useful as the conduct of the exercise itself. The preparation process involves conducting a Needs Assessment, improving procedures, conducting MERRTT training for response agencies, and may also include conducting hands-on coached drills for specific field response activities, and/or tabletop drills that focus on multiple agency interaction. The conduct of an exercise validates the training and procedures, and gives responders an opportunity to respond to a realistic simulation. The post-exercise process identifies areas for improvement, and corrective actions that will help agencies improve their response to radiological transportation incidents.

In addition to this, TEPP has employed an ongoing effort to meet federal regulations, national trade association expectations, and standards for competency for various response disciplines by providing advanced level courses. TEPP is now able to coordinate training and exercises utilizing high activity radiological sources. The result of these enhancements for those who have participated is a first response community better trained and prepared to manage any radiological transportation incident.