Post-Emergency Planning and Exercises: Lessons Learned from CALVEX 97

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INTRODUCTION

In September and November 1997, the State of Maryland participated in a post-emergency radiological exercise with the Calvert Cliffs Nuclear Power Plant (CALVEX 97). The exercise involved 13 local jurisdictions in Maryland, 3 local jurisdictions in Virginia, the District of Columbia and numerous Maryland State agencies. The Nuclear Regulatory Commission (NRC), U.S. Department of Energy (DOE), the Environmental Protection Agency (EPA), and the U.S. Department of Agriculture (USDA) provided training assistance and participated as players during the event.

Maryland is often referred to as "the United States in miniature" because of its unique topography This topography and diverse patterns of residential, agricultural and commercial development within 50 miles of Calvert Cliffs present many challenges to radiological post-emergency planning and operations. The Calvert Cliffs ingestion planning zone includes 13 counties in Maryland, the District of Columbia, two counties in Delaware, and 16 local jurisdictions in Virginia. The terrain includes the Chesapeake Bay, rural areas in Southern Delaware, Maryland's Eastern Shore, Virginia's Northern Neck and suburban areas around Baltimore and Washington, D.C A wide variety of food and agricultural products are produced in the region. Seafood harvesting and poultry production are major industries; numerous food processing plants are also located throughout the area. The Chesapeake Bay and Eastern Shore are well known hunting areas for deer and migratory birds. The Eastern Shore is even home to such exotic creatures as ostriches and emu, which are raised by commercial providers. Aquaculture farms and honeybee apiaries are found throughout the area.

DISCUSSION

Maryland's last ingestion pathway exercise was held in 1990. However, very few individuals involved in the 1990 exercise were available to help plan and conduct the 1997 event. Many of the "lessons learned" from 1990 were now lost to time. Exercise planners sought to increase their knowledge by observing and participating in ingestion exercises in Delaware and Virginia in 1996. These exercises provided a wealth of useful ideas and experiences that were incorporated into the preparations for CALVEX 97. Delaware and Virginia emergency management staff generously provided advice and assistance throughout the development of CALVEX 97

In the course of planning and preparing for CALVEX 97, a number of issues were noted The most significant of these included the use of Federal radiological assets for exercise planning and training, the effective use of out-of sequence demonstrations, training for local ingestion pathway jurisdictions and skills training for field sampling teams and other staff.

Use of Federal radiological assets

Maryland made great use of Federal radiological assistance while planning CALVEX 97 and training exercise participants. The USDA's emergency response staff conducted a basic ingestion pathway seminar and DOE Region I staff trained ingestion sampling teams. The DOE Washington Aerial Measurements Operations office assisted in scenario development and provided simulated aerial measurement maps. Finally, the NRC held a workshop to provide an overview of Federal response activities. This workshop also stimulated many thought-provoking discussions regarding protective action decision making.

Federal assistance not only created excellent training opportunities, but also opened lines of communication between State responders and their Federal counterparts. This enhanced communication later proved to be a significant asset during the course of the exercise. It is critical, however, to request Federal assistance early in the exercise planning and training process--preferably at least a year prior to the date of the exercise.

Out-of-sequence demonstrations

Given the great complexity of an ingestion exercise, CALVEX planners decided to maximize the use of out-of-sequence demonstrations. One of the chief complaints from local officials during the 1990 ingestion exercise was that their emergency operations centers had no meaningful involvement during the exercise. It is extremely difficult to develop a scenario that simultaneously impacts every jurisdiction within 50 miles of a nuclear power facility. Therefore, the exercise planners exercised and evaluated local ingestion pathway jurisdictions two months prior to the State-level ingestion exercise.

Local evaluations were conducted using a tabletop interview format, which allowed each jurisdiction to be meaningfully evaluated. Federal evaluators visited each jurisdiction and evaluated communications, ingestion pathway protective action implementation and emergency public information activities. Local jurisdictions praised this approach, since it allowed them an opportunity to learn as well as be objectively evaluated.

Laboratory and field sampling operations were also conducted out-of-sequence to save time and not delay State-level sample planning and decision making activities. Field sampling, which included water and milk samples, occurred the day prior to the laboratory demonstration. These samples were then used during the laboratory demonstration, so that laboratory staff could realistically demonstrate the processing of samples.

Local jurisdictional training

Most of the local jurisdictions involved in CALVEX 97 had little or no ingestion pathway experience. State and utility staff offered several ingestion pathway seminars for all jurisdictions. Many jurisdictions were unable to attend these seminars due to other commitments. Ultimately, State and utility staff visited most local jurisdictions to provide individual training to emergency management, public information, agricultural and health department staff members.

Local government training was made easier through the use of a standardized training package State and utility staff developed a computer-based presentation that was loaded on a laptop computer and taken to each jurisdiction. This ensured consistent training among all jurisdictions. The training package was continually refined and was later used in other ingestion jurisdictions in Maryland.

Skills training

Since ingestion activities are usually evaluated only every six years, exercise planners noted that participants needed practice on critical skills such as sample collection and data plotting and analysis. State and utility staff provided extensive training in the months before the exercise, with generally positive results. For future exercises, Maryland plans to train and internally evaluate ingestion-specific activities every three years instead of every six years. This will ensure a trained cadre of staff and will help maintain interest and enthusiasm for ingestion response activities.

After months of intense training and local out-of-sequence evaluations, the State-level portion of CALVEX 97 was held on November 18-20, 1997. The exercise began on the evening of November 18 with "plume phase" response activities. The exercise continued on November 19 as the State Ingestion Pathway Coordinating Committee convened to consider deposition data and develop protective actions for relocation, re-entry, ingestion and long-term recovery. Field sampling activities were also demonstrated on November 19. The State emergency operations center demonstrated implementation of protective action decisions on November 20, and laboratory operations were evaluated.

Although State officials had developed rather detailed procedures for post-accident activities, many lessons were learned through exercise play. Some of these lessons were protective actions for unconventional ingestion pathways, State and Federal interactions during protective action decision making, development and dissemination of ad hoc protective action areas and the impact of a recent environmental crisis on the decision making process.

Unconventional ingestion pathways

As previously noted, the Calvert Cliffs ingestion pathway contains a wide variety of food and agricultural activities. Maryland's decision-makers were confronted with several unusual but critical ingestion pathways. Marine life and migratory birds presented special challenges for protective action decisions and implementation.

Maryland's seafood industry is a vital part of its economy. Protective action implementation is complicated, however, by several factors. First, the Commonwealth of Virginia controls the southernmost portions of the Chesapeake Bay. Any protective action involving seafood will require close coordination between the two states. Second, it is impossible to prevent the movement of some types of marine life Potentially contaminated fish, for example, would be difficult to conclusively sample and isolate. Crabs and oysters are more stationary and would be far easier commodities to sample and control.

Maryland's Eastern Shore also relies on migratory bird hunting as a significant part of its local economy. Migratory birds present interesting challenges. Though it is possible that birds could be directly contaminated by a radiological accident, it is more likely that these birds would ingest contaminated forage or feed in local fields. Officials then face the difficult task of sampling birds and determining exactly where they may have ingested contaminated material. If migratory bird refuge areas are determined to be radiologically contaminated, it is imperative that States all along the birds' flyway communicate the potential risk. Ingestion of migratory birds can be managed by notifying the public not to consume migratory bird meat until it has been determined to be safe. These same challenges also apply to wild game such as deer. Natural resources officials can more easily monitor potential ingestion of deer meat through existing deer checking stations.

State and Federal interactions

During the exercise, staff from the NRC, EPA, USDA and DOE participated in the evaluation of field data and the development of protective actions. This participation allowed all parties to experience the challenges of integrating Federal assets into a State's post-accident response. Although State and Federal personnel did not always agree in their assessments of data, they worked together effectively. This was largely due to the communication and working relationships established while jointly planning and training for the exercise.

Development and dissemination of ad hoc protective action areas

When protective actions are determined for areas beyond the 10 mile "plume" planning zone, they must be defined using geographic features or other boundaries. Maryland officials quickly realized that the most effective way to determine specific protective action areas was through a coordinated effort of State and local agencies. Local officials would define specific protective action areas using technical information and assistance provided by State agencies. This

increased communication between State and local agencies and gave local officials a direct interest in the protective action decision process.

Dissemination of protective action areas proved to be a more daunting task. The Maryland Department of the Environment (MDE), which hosts the Ingestion Pathway Coordinating Committee, maintains a sophisticated geographic information system (GIS) which is a highly effective tool for defining protective action areas. Ideally, MDE staff could develop GIS maps that could then be transmitted electronically to emergency management customers. However, State and local emergency managers are still in the early phases of using GIS and do not generally possess compatible GIS hardware and software. During the exercise, hard copy maps were developed and delivered by courier to the State emergency operations center. Although this method is not technologically sophisticated, it was effective due to the proximity of the State emergency operations center to MDE. Maps will be transmitted electronically in future exercises as GIS equipment becomes more widely available.

The impact of the pfiesteria crisis

In the summer of 1997, Maryland experienced a significant environmental crisis when the microbe Pfiesteria piscicida caused a number of large fish kills in Chesapeake Bay tributaries. Pfiesteria also caused symptoms such as skin lesions and short-term memory loss among some humans who came in contact with waters containing the microbe. Pfiesteria soon dominated the news in the Baltimore and Washington area during August and September 1997.

Seafood sales and water recreation, so vital to Maryland's economy, dramatically declined. State agricultural officials estimate that losses by commercial fisheries, the charter boat industry, recreational fishery and tourism totaled nearly $127 million, while seafood dealers suffered an estimated $43 million loss (Baltimore Sun, June 10, 1998). These losses even though none of the individuals affected by pfiesteria came in contact with the microbe by consuming seafood. State officials made every effort to reassure the public that Maryland seafood was safe, but with only moderate success.

Maryland's key decision maker in a radiological emergency, the Secretary of the Environment, was deeply involved in the pfiesteria crisis. This pfiesteria experience was referred to frequently when discussing protective actions for foodstuffs. The public's reaction to pfiesteria seemed to serve as a clear indicator of how the public would react to the prospect of radiologically contaminated food. In light of this experience, ingestion protective action decisions during CALVEX 97 tended to focus solely on identification and embargo of contaminated food. State decision makers felt that few retailers or food processors would be willing to handle food that had been even slightly contaminated.

CONCLUSION

CALVEX 97 provided Maryland with an excellent opportunity to prepare for the many challenges of post-emergency radiological response. Plans and procedures are now being adjusted to reflect lessons learned before and during the exercise. The exercise left Maryland with renewed confidence in its ability to manage long-term radiological emergency response and helped solidify working relationships between the State and supporting Federal responders.

The Russian French Collaboration in the Radiological Post-Accidental Area

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INTRODUCTION

In 1990, the Nuclear Safety Institute from the Russian Academy of Sciences (IBRAE-RAN) and the French Institute for Nuclear Safety and Protection (IPSN) signed an agreement for promoting common technical studies dealing with the management of abnormal, or post-accidental radiological situations. Along a linked process, this Ministry EMERCOM of the Russian Federation and the French Secretariat General of the Interministerial Committee of General Nuclear Safety signed an umbrella agreement in 1993 dealing with the administrative specific issues of such situations. In such a technical and administrative framework, the implementation of large scale table top exercises has been made possible. The objectives of these exercises were mainly to test decision making processes with the associated expertise. Field exercises on the same subjects also have been organised.

DISCUSSION

The first exercise of the series took place in June 1993 in Saint Petersburg. Three one-day periods have been simulated respectively one month, one year and five years after a release.

The contaminated region of Briansk was chosen as the concrete case to be dealt with. The local public authorities were fully participating to the game with the common expertise of IBRAE and IPSN. A dedicated satellite link with the IPSN Emergency Centre in Fontenay-aux-Roses near Paris was operated. This exercise provided specifications on the necessary databases to be set up for relevant expertise as well as the computer tools to be developed for providing relevant answers to concrete questions coming from real situations.

The right way to simulate and to characterise radiological situations was clarified as well as their sanitary impact. Particular computer tools such as "Paris" code are concrete, common IBRAE/IPSN results coming from this exercise (see OECD workshop in Zurich, September 1995).

The second exercise was a bilateral contribution to the KOLA exercise organised by EMERCOM in May and June 1995, under the auspices of the Department of Humanitarian Affairs of the United Nations (UN/DHA). Three one-day periods have been also simulated respectively three days, fifteen days and one month after a major release. The Russian public authorities were again fully involved, both at the Federal level and at the blast level. A story expertise was provided by IBRAE and IPSN, including the results coming from a team of thirty experts working for the three days in the IPSN Emergency Centre. A common French Ministry of Interior/IPSN team was airborne on the site with all the necessary communication links. At the opportunity of this exercise, the lessons learned from the Saint Petersburg exercise were used and strengthened.

A third exercise was played in October 1996 around the Saclay site located in the South of Paris. This exercise lasted two full days. The emergency phase resulting from a simulated accident occurred in the research reactor Osiris was played during the first day. The second day was dedicated to the management of the accident consequences seven days after the releases. In this exercise, IBRAE prepared the main part of the scenario regarding its environmental and sanitary part. For this exercise also, a "generator" of simulated activity measurements was developed ; it was named "Enveloppe". It aimed to be used by the field monitoring teams. It was highly appreciated and showed clearly that the main problem of the radiological monitoring was not only to make the measurements but also to define what to do with them.

Based on the current results of this close collaboration, and, for IPSN, the knowledge acquisition related to the management of contaminated territories, a French process has been launched after the Becquerel exercise.

This working process aims to define and to propose concrete and operational arrangements which could be implemented during or after a nuclear accident with radiological consequences.

These arrangements are supposed to be complementary to the standard emergency countermeasures, (i.e., sheltering, evacuation and iodine prophylasis) if decided and implemented, which are not sufficient to deal with a recovery phase with taking into account all the social, economic, environmental and sanitary impacts of such accidents.

This process is structured with regular meetings of four groups The members of these groups are mandated representatives of the different concerned ministries, of the main nuclear companies and of expertise organisations. These four groups work on the following topics:

1. Radiological characterisation of a contaminated environment. This group reviewed the current French situation (means, organisation and practices). It made recommendations along different items such as radiological units to be used, measurements and sampling procedures establishing, results transfer means. A particular issue was pointed out, as already mentioned, about the necessity to foresee a clear planning for using the results of a radiological monitoring, with emphasis on the specific problem to correct a decision

making results based only on a release prognosis with real data probably much different from the prognosis. This group has recommended a specific exercise to validate its work and its proposal, to be played in 1999.

2. Medical and sanitary policy. This group has based its work on the assessment of the dosimetric impact made with dedicated tools as ASTRAL (see again OECD meeting in Zurich, September 1995). It implements a classical risk analysis method from different typical scenarios. It made proposals concerning population typology establishing and arrangements for preparing a relevant sanitary policy based on epidemiological data to be gathered according a logical and pre-established procedure.

   One priority of this group is to study what we call "grey" situations where doses to the population are significant while remaining below international recommended intervention levels.

3. Compensation and civil liability. This group made progress establishing concrete procedures for emergency compensation and compensation during the recovery phase. Links have been foreseen between insurance company and the French public authorities to co-ordinate their respective roles in this area. A validating table top exercise is foreseen during the first part of 1999.

4. Contaminated environment recovery. This group is federating the work of the three other groups. During a first step, it established a data base of the currently available technical intervention processes for decontamination. But it is not enough. Establishing the criteria for setting up a recovery strategy taking into account the contaminated scene data, the accident data and, mainly, the local decision making becomes the basic objective. Therefore, post-accidental preparedness and planning are no more the practical aim ; but this one would be to find the right method to suggest the active management of the situation by the local population, its representatives the local authorities.

CONCLUSION

In conclusion, it could be underlined that the Russian-French collaboration in the post-accidental management area has learned, at least to the two involved countries, that the so called "recovery phase" could have chances to be dealt with successfully by considering not only the implementation of technical radiological countermeasures but also, and mainly, the definition and the implementation by the different involved social bodies of a whole strategy aiming to make the situation understandable then possibly acceptable.