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A Scenario Proposal For A Radioactive Waste Transport Accident

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ABSTRACT

Inspite of all precautions that being taken during radioactive materials transport accidents to ensure safe transportation of these materials; there is still a probability for accidents to occur which, may be accompanied by injury or death of persons and damage of property .So, in response to the increasing possibilities of accidents in Egypt, the government had prepared an emergency response plan for radiological accidents to coordinate the response efforts of all the national agencies.

Trends for use of the radioactive materials and sources inside the country for the purpose of medical diagnosis and treatment as well as in industrial applications, are increasing. The radioactive waste resulted from these activities are transported from the centres where these materials being used to the waste management facility where they are treated and finally disposed safely at disposal site.

The aim of the emergency exercise scenario is to test not only the main components of the emergency plan but also the level of emergency preparedness; that is the effectiveness with which the actions or combined actions of the different organizations involved in an emergency can be put into practice.

The motivation of the present paper was undertaken to give a scenario proposal for the radiological emergency actions taken in case of a transport accident for a radioactive waste material (type A- package) transported by a vechile from one of the medical centers to a disposal site, 40 Km northeast of Cairo.

KEY WORDS :Radioactive Waste / Transport/ Accident / Emergency

INTRODUCTION

Radioactive materials are a part of modern technology and life. They are used in medicine , industrial manufacturing in research, for generating electrical power and in a host of other ways that assist our daily lives. There are tens of millions of packages containing radioactive materials consigned each year throughout the world. The amount of radioactivity in these packages varies from negligible amounts used in consumer products to very large amounts in shipments of irradiated nuclear fuels.

In order to ensure the safety of people, property and the environment national and international transport; regulations and guides have been developed and are used by appropriate authorities in each country to control the transport of radioactive materials.

There have been no reported transport accidents with significant radiological consequences . However in spite of all the measures taken to ensure the safe transport of radioactive materials, there is still a possibility that accidents may take place . An accident resulting in a significant release of radioactive material or loss of shielding , while highly unlikely, could have considerable consequences . These consequences can be controlled or mitigated by proper emergency response actions .

The type of emergency planning and preparedness that is needed for responding to transport accidents involving radioactive materials is , to some extent, similar to that required for responding to transport accidents involving non - radioactive hazardous materials[1] .

There are variety of radiological sources within Egypt. No nuclear power reactors have yet been built, but there are two research reactors used for experimental reactor and nuclear physics research. These reactors are located in the Nuclear Research Centre at the Inshass Site, 40 km (20 miles) northeast of Cairo. There is an operating 2 MW water-moderated reactor used for experimental research ; a 22 MW Argentinean reactor starts operation on February 1998. The more powerful reactor is going to be used for isotope production. More over there is in operation an approximately (370,000 Ci) cobalt sterilization facility operates at the National Centre for Radiation Research and Technology in Cairo . The facility being used for sterilization of medical products .

Radioisotopes are used throughout the country for medical diagnosis and treatment, and in industrial applications, such as gamma radiography, as well as for research. Radioactive materials arrive regularly by plane. These radioisotopes and other radioactive sources are transported throughout the country.

Egypt has an additional unique problem--the Suez Canal. Radioactive cargoes traveling through the canal includes new and spent reactor fuel and about 1000 metric tons of uranium hexafluoride each year. Futhermore, nuclear-powered ships pass through the canal several times each year, escorted by Egyptian vessels.

PLANNING PROBLEMS & THE RADIOLOGICAL PLAN

In response to the increasing possibility of radiation accidents within Egypt or impacting the country, the government is preparing an Egyptian Emergency Response Plan for Radiological Accidents to coordinate the response efforts of the national agencies. This plan, which is have been finalized, provides information on agency roles and responsibilities during a response. The plan will also provide a basis for initiating needed training, planning for emergency public information, and developing public education efforts[2] .

Use of radioactive materials and sources is increasing within the country With this increase, it comes a need to prepare for accidents involving these materials. For years there has been an informal agreement between the National Centre for Nuclear Safety and Radiation Control (NCNSRC), which is one of the four centers operated by the Atomic Energy Authority (AEA), and the Civil Defense Authority (CDA) to cooperate in a radiological emergency. CDA currently has the responsibility for responding to all types of emergencies. The increasing use of radioactive materials and the complexity of the response required by accidents creates a need for a more formal arrangement.

Four national agencies have signed the completed plan. These agencies are Atomic Energy Authority (AEA), the Ministry of Interior (MOI), which contains the CDA, the Ministry of Defense (MOD), which operates the Crisis Management Centre (CMC), and the Suez Canal Authority (SCA). AEA and CDA are the principal response agencies. A Supreme Council of Civil Defense, composed primarily of cabinet ministers, has the decision; authority in the response. One of these three agencies will serve as the lead technical agency during the emergency; this agency will coordinate the agencies' response. The designation of the lead agency will depend upon the size and nature of the response.

NCNSRC will serve as the radiological expert and coordinate all radiological monitoring. AEA personnel from the other research centers will assist with the NCNSRC monitoring efforts, if needed. NCNSRC has a counting laboratory and background radiation data from all over the country, as well as a mobile radiological laboratory. There is a network of 29 radiological monitoring stations in place throughout the country. This network is currently being expanded to 57 stations. Monitoring stations now measure ambient gamma levels, moreover, another new stations have already been installed in the network to measure ambient beta radiation and gamma levels in water . The rest of the stations are still being in the construction stage. These stations transfer their data remotely to the NCNSRC offices in Cairo and can provide an early warning of a large accident.

CDA coordinates all functions other than radiological assistance and can act on its own authority in responding to any emergencies throughout the country, without obtaining permission from the governor. CDA does not now have the technical knowledge to deal with a radiological incident by itself. The military's CMC enters the response only if CDA needs additional resources or specialized equipment and personnel that are not available from the other agencies. SCA becomes involved only if the radiological incident occurs in the Suez Canal. Their role is limited to notification.

Other agencies that may be asked to assist in the response include the Ministries of Agriculture, Interior, Health, Social Affairs, Information, Transport, Local Governing, Irrigation and Water Resources, Housing and Construction, Agriculture, and Foreign Affairs; Ain Shams Specialized Hospital; Organization for Environmental Safeguarding; Red Crescent Society; and the Meteorological Authority.

Egypt has already made arrangements for the medical care of any people who are injured and contaminated or who have received large radiation exposures. There is an existing arrangement (August 1993) with Ain Shams Specialized Hospital in Cairo to take such patients. Personnel at Ain Shams have already been trained for this task. The Institute de Protection et de Surete Nucleaire in France has agreed (July 1993) to accept more severe cases for medical treatment there.

REVIEW OF SELECTED NUCLEAR TRANSPORT EVENT CASE HISTORIES

Here given a brief review of information on 13 selected case histories of transport events. While these case histories do not generally include details of the emergency response actions they are very useful in assessing the effect of transport accidents on packages and can yield lessons which can be of value to shipper as well as carriers in reducing the frequency recurrences. In addition they provide information which may be used to set up scenario for local drills and exercises involving radioactive material transport incident emergency response[1] . More detailed information about radioactive material transport accidents can be found in the bibliography listed in this article .

1- Case History No.1 - Boston, Massachusetts, 23 February 1968

This event involved the air shipment of a 540 Kg lead/steel "pig" from warm California to frigid Boston, Massachusetts in mid- winter . The "pig" had been underwater by its shipper with a sealed irradiation canister of quartz ampoules containing mixed irradiation samples . After arrival at Boston, the "pig" was transferred to storage outdoors within a delivery vehicle where it sat for several days. Later, leakage was observed from the drain spigot, which was then surveyed and found to be contaminated.

Cleanup and survey effort then ensued to track down and remove any spread of contamination , which generally remained confined to the delivery vehicle itself .

This incident served as an early reminder of the importance of procedural quality control requirements in preparation of packages for shipment .

2- Case History No.2 - North Stonington, Connecticut, 13 February 1970

This was a single vehicle transport incident involving an unirradiated Uranium scrap shipment which occurred on Interstate Highway N0. 95 in Eastern Connecticut. The accident was caused when both left rear wheels came off the truck, causing it to veer off the highway, crashing through the guardrail . It continued on down the steep slope on the side of the roadway for several hundred meters eventually coming to rest upside down in a drainage ditch .

The driver of the vehicle suffered minor injury . The five cylindrical shipping containers each containing 95% U-235 as Uranium - Zirconium Scrap, were torn loose from their tie- down within the vehicle ; however , no release of contents took place. Leaking gasoline was in evidence but no fire occurred the speed of the vehicle was estimated to be 77 Km/h.

3- Case History No.3 - Harrisburg, Pennsylvania, 4 May 1970

This event was probably the very first known incident in which type B packages were subjected to a actual fire condition which was equivalent to, or greater than, the Regulatory thermal test for a type B package. Four wooden overpackas each with an empty inner US Department of Transportation Specification 55 shielded "pig" were exposed to a 2-1/2 hour fire which began after the vehicle had collided with an overturned vehicle in its pathway .

The exact temperature reached in the fire was uncertain, but was estimated to be well in excess of 800C . Detailed examination of the packages indicated only charring of the exterior of each overpack to a depth of about 4 cm with no damage at all to the inner packaging.

4- Case History N0.4 Clinton, Tennessee, 8 December 1970

This incident occurred on a major highway near Clinton. Tennessee. The driver of a vehicle carrying an irradiated spent fuel cask swerved to avoid colliding with an approaching vehicle lost control, and overturned off the roadway while attempting to negotiate a wide turn . As a result, the cask assembly was thrown into a ditch, traveling more the 30 m before coming to rest upside down in the ditch off the roadway .

No release of contents or increase in radiation occurred . Minor damage to the outer thermal insulation was suffered . The cask was recovered and subsequently returned to service after repairs . The experience gained in the accident provided a useful demonstration of the adequacy of the design standards for type B packages with respect to an actual highway accident involving a very severe impact situation .

In this incident the driver of the vehicle fatally injured due to the normal forces of impact and crushing .

5- Case History No.5 Houston, Texas, 31 December 1971

This event was and remains probably one of the most widely publicized nuclear transport incidents to date . It involved contamination which spread from a leaking package abroad a passenger - carrying civil aircraft .

An approximate 250 ml quantity of high specific activity molybdenum -99 in sodium hydroxide liquid leaked from a type B package in the course of transport by a passenger - carrying aircraft on its way from New York to Houston, Texas on 31 December 1971, The cargo hold of the aircraft became contaminated and 917 passengers had traveled abroad the aircraft on a total of 9 flights into cities before discovery of the contamination and removal of the aircraft from service two days later. The aircraft decontaminated under supervision of public health officials and returned to service after one day . Due to reported cases of contaminated luggage in different locations, the air carrier , in c0-operation with government agencies established monitoring locations in various cities . By telephone contacts and press releases, passengers who had no the aircraft during the period of its contamination were afforded an opportunity to have their luggage monitored for possible contamination .

6- case History N0.6 Baton Rouge, Louisiana, 5 April 1974

This incident involved the shipment of a type B quantity as a 1.2 TBq iridium -192 special form source in a radiography source changer device aboard a passenger - carrying aircraft . Due to an improper source exchange procedure by the consignor prior to shipment, the package, as transported, contained the source in an unshielded position , causing a high radiation dose rate to be present in the vicinity of the package. The shipment was transported by private truck to a Washington , DC airport, hence via commercial passenger carrying aircraft to Atlanta, Georgia via a second aircraft to Baton Rouge, Louisiana, then by commercial truck to the consignee . At location , the abnormal situation was first detected by the setting off of the consignee's area alarm radiation monitor as the truck backed up to the plant loading dock.

During the course of transport , passengers on the two aircraft involved , cargo handlers at the airports, employees of the consignor and local delivery carrier received unnecessary radiation exposure . The incident was investigated by two federal agencies , This incident occurred on a major highway near Clinton. Tennessee. The driver of a vehicle carrying an irradiated spent fuel cask swerved to avoid colliding with an approaching vehicle lost control, and overturned off the roadway while attempting to negotiate a wide turn . As a result, the cask assembly was thrown into a ditch, traveling more the 30 m before coming to rest upside down in the ditch off the roadway .

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During the course of transport , passengers on the two aircraft involved , cargo handlers at the airports, employees of the consignor and local delivery carrier received unnecessary radiation exposure . The incident was investigated by two federal agencies , who subsequently levied civil penalties against the consignor for non- compliance with shipper requirements .

7-Case History No.7 - Rockingham, North Carolina , 31 March 1977

This widely published event was a classic case - study of on - scene emergency co-ordination aspects of a nuclear transport incident . It involved the derailment of 24 out of 102 cars from a freight train in a remote, swampy area. Three derailed cars were carrying ammonium nitrate, and two others were each carrying two 14 tone cylinders of uranium hexafluoride on a "piggyback" trailer. Upon impact of derailed all of the cylinders broke away from their trailers and flat cars and were thrown away from the track . No releases or breaches of the cylinders occurred , although at various times some persons mistakenly believed that a radioactive release had taken place . The car carrying the ammonium nitrate catch fire and burn . One of the cylinders was adjacent to this burning car.

During this incident and post- accident operation , at least 17 different agencies or organization were in some way involved . Communications and information flow appeared to emerge as one of the major problems . In its special investigation report, the US National Transportation safety Board made several conclusions relating to emergency response plans, on - scene co-ordination and hazardous material identification aspects. The overall property damage was estimated at US $ 750,000 .

8- Case History No.8 - Springfield, Colorado, 27 September 1977

This event involved the collision, the truck overturned and came to a sudden stop in a drainage culvert, causing 32 of 50 drums to be thrown from the vehicle, with 17 drums suffering lid closure failure . Of the remaining 18 drums in the vehicle , 12 also suffered lid failure . A total of 5400 Kg of yellowcake spilled from the opened drums . The two occupants of the vehicle were badly injured but survived .

9- Case History No.9 - Wichita, Kansas, 22 March 1979

This accident involved a shipment of 19,833 Kg of yellowcake being transported on a tractor trailer , in fifty - four 250 l steel drums . It occurred when the trailer wheels left the traveled portion of the interstate highway and overturned while attempting to return to the traveled portion from the soft shoulder . Both lanes of the highway were blocked the overturned vehicle . 51 of the drums were thrown suddenly through the roof of the trailer , with 22 of them suffering drum lid failures and spillage of about 800 kg of material .

10-Case History No.10 Hilda, south Carolina, 3 November 1982

This accident occurred at a highway intersection near the Barnwell, South Carolina Low- Level Waste Burial Facility when the driver of a tractor - trailer, while swerving to avoid hitting an automobile which had turned onto the roadway in front of him, lost control of his vehicle and ran off the road . The vehicle overturned as skidded a hundred meters and came to rest upside down in a drainage ditch . Two empty type B radwaste casks which had been tied down to the bed of the open trailer were torn free of the vehicle. The driver of the vehicle was trapped within and was fatally injured . The two occupants of the automobile were not seriously injured . A number of different law enforcement and emergency response organizations responded to the accident , as well as State Health and consignee/ carrier personnel . No damage was sustained to either of the casks although the forces of impact were estimated to have been quite severe. This event was rather typical of a number of other reported highway accidents , where the initiating cause of the accident was a driver having to take sudden evasive action to counter other vehicles which swerve or stop in front of the transport vehicle.

11- Case History No.11 Buenos Aires, Argentina, 24 June 1975

A Large scale fire occurred at about 7.30 Am. on 24 June in a dock used to store dangerous goods in transit at the port of Buenos Aires, Argentina . The fire involved a type B(U) package Model F79, containing a cobalt -60 source with an activity of about 2,000 ci . This package was erroneously stored (administrative error) in a place for goods in transit instead of being speedily dispatched .

The fire was detected by personnel who immediately notified the fire brigade (primary emergency group), because the fire quickly spreading . The two - story warehouse, having dimensions 340m x 30m x 10m, that was involved in the fire was built of masonry with a stone roof. The extent of the fire was about 50m x 30m x 10m . The fire involved paper and rubber bobbins, a lorry parked on the first floor and packages containing spare engines on the second floor . The package containing the cobalt source was near the lorry.

Two hours after the fire began, the main roof stone collapsed, falling on the package with the cobalt source .

When the fire ended , the emergency group put up warning signs around the type b (U) package . Then, the primary group removed the debris to permit the documentation of the event and to begin recovery .The fire protection casing withstood the fire and adequately protected the package.

12- Case History No.12 - Toronto, Ontario, Canada, 26 march 1989

This accident involved a package of 814 MBq of thallium 201 which was crushed under the wheels of a forklift in an air cargo terminal at person International Airport . The contents escaped and contaminated the floor of the cargo terminal (250 mSv/h on contact) and the forklift wheel (0.17 mSv/h on contact). The gloves of the driver became contaminated when an attempt was made to move the package. the radioactive label was only noticed at this time .

The accident caused considerable disruption to activity in the cargo terminal . The area was cordoned off and emergency response personnel from the shipper were called in to assess the situation clean up the radioactive materials . Due to the nature of the terminal floor (rough concrete with oil and grease) , it was decided as a temporary measure , to allow the remaining contamination to decay under a lead plate in the cordoned - off areas. This allowed terminal activity to resume . The forklift wheel , as well as the contaminated gloves, were removed and stored. portions of the floor were later removed by the terminal owner despite the negligible hazard . There was no significant radiological risk to the public nor to the transport workers.

The accident illustrates the importance of training transport employees in the correct response to accidents involving radioactive cargo and the disruptive effect of accident with even small activities of radioactive material .

13- Case History No.13 Montreal, Quebec , Canada 23 May 1989

A shipment of nine 48Y cylinders containing uranium hexafluoride (UF_6) residue was involved in a sea accident on a journey from Europe to Canada via the ports of Rotterdam, the Netherlands and Montreal, Canada. During a mid- Atlantic storm, three UF_6 cylinders which were inadequately secured insider a 40-foot closed freight container mounted on the deck of the ship, broke loose and damaged the freight container and two other neighboring freight containers. Valves were broken off two of the cylinders. The radioactive material residue escaped and contaminated the deck of the ship, other equipment and cargo in the neighboring freight containers. A section of the dock area was also contaminated when the freight containers were unloaded in the port of Montreal. Over three weeks , the deck of the ship, UF_6 cylinders, freight containers and cargo were progressively decontaminated to acceptable levels. The dock area was the last to be completed . Some of the damaged freight containers had to be scrapped. There was no significant radiological risk to the public nor to transport workers . The accident was caused by the improper stowage of the UF_6 cylinders within the 40-foot freight containers.

The accident prompted a change to in preparation for transport procedures of the shipping company . Port authorities also modified and improved their emergency response procedures .

SCOPE OF THE PROBLEM

Inspite of all the measures taken to ensure the safe transport of radioactive materials there is still a possibility that accidents may occur[2-4] . An accident which lead to a significant release of radioactive material or loss shielding could have considerable consequences . These consequences could be controlled or mitigated by proper emergency response actions .

The following list gives examples of basic operations or tasks associated with the implementation of an emergency response plan , for which the use of drills and exercises may be relevant :

1- Communications
- notification (national)
- notification (international authorities, in the event of a transboundary accident)
-communication procedures

2- Initial communication response
- safe evacuation and assembly of plant personnel
- accounting for plant personnel

3- radiological monitoring
- availability and correct functioning of equipment
- in plant surveys
- initial rapid environmental monitoring
- ingestion pathway monitoring
- sample collection and analysis
- data assessment
- trend monitoring

4- Off - site exposure assessment
- source term evaluation
- meteorological data evaluation
monitoring data evaluation
projected dose estimation
correlation of in - plant and environmental data

5- Personnel dose assessment and control
- dosimeter processing
- dose assessment
- issuing of work permits
- specific radiation protection measures

6- Off - site protective
- provision of advice for decision - making
- control in the public sector
- distribution of radioprotective prophylactic drugs
- sheltering procedures
- evacuation procedures
- access and egress control
- establishing evacuee reception centres
- agricultural controls

7- Medical service
- first aid
- screening of potentially exposed persons
- treatment of contaminated and / or highly exposed persons

8- Accident analysis
- status of main safety systems and fission products barriers
- accident classification
- possible corrective actions
- possible actions to mitigate release of radioactive materials

9- Public information
- prompt warning of the public
- activating a public information centre
- maintaining information to the public
- prevention of public alarm

10- Administration
- activating emergency control and co-ordination centres
- record keeping
- implementation of special security arrangements
- shift staffing
- logistics support

11- On -site recovery measures
- emergency rescue
- fire - fighting

- use of respiratory protection equipment
- access control to affected plant
- damage assessment and repair

This scenario should reflect the nature and time sequence of events and condition that must be postulated in order to exercise the relevant sections of the scenario.

Test of Individual and Organizational Response Exercise

Description

On day early morning , a vechile transporting radioactive waste material consist of highly active empty $^{99}{}_{m}TC$ generator capsules (type A package) (30 packages) were moving on a public road from one of the nuclear medical centers in Cairo to a disposal site 40 Km northeast of Cairo . Suddenly a car emerged from side road and blocked its way . In an avoidable collision the driver of the vechile was injured and fell unconscious on the road .

The thirty packages were damaged to the extent that their outer packaging was destroyed .With the radioactive waste material fell from the vechile, rolled away and stopped in the vicinity of the driver . The thirty packages were damaged to the extent that their outer packing were destroyed; 4 out of these packages having activities of (200 MBq) had their radioactive material vials ejected from their shielding and subsequently broken .

Organization

In the following is the summary of team roles and responsibilities for a scenario in case of radiological emergency for transport accident for a radioactive waste material :

Team No 1: **Response Initiator**
This team plays the role of local police officer in charge who gets initial notification on an accident .

Team No.2 : **First Responders**
This team plays the role of the local police team that is first on the scene (1 regular policeman) .

Team No. 3 : **Emergency Medical Responder**
First Aid Team responsible for providing first aid and all necessary steps for rescue of the injured driver .(3 participants possibly 1 medical practitioner).

Team No.4 : **Emergency Manager**
This team is in charge of all emergency operations . It is also responsible for coordinating public information

Team No.5 : **Radiological Assessor**
Teams : Environmental Survey Team
Personal Monitoring / Decontamination Team
These teams are responsible for area (environment) and personal survey , isotope identification, clean up operations and for dose assessment

In order to provide guidance on managing the actions to mitigate the consequences, limit exposure to the public and emergency workers , limit the spread of contamination , recover the radioactive material and / or clean up in emergency involving radioactive materials; the emergency manager should immediately asses the radiological and non radiological situation based on information from response initiator and the on scene controller . Based on this assessment, initial response actions to mitigate the consequences should be implemented and appropriate protective actions being taken . The response actions in any accident can be divided into three phases , the initial phase , the accident control phase and the post emergency phase . However in any actual accident many of the response action on the accident control phase may be commenced in the initial phase of the accident[4,7,8] . The event consequences are given in the following :

Step 1

Obtain briefing about the accident from the Response Initiator and any other person already involved in the management to the emergency e.g. (On Scene Controller , Radiological Assessor if already at scene) . Through Response Initiator alert/ activate any other need responders .

Step 2

Initiate a personal log to record the critical actions and decisions made during the emergency, including:
- time activated
- persons called and time of call
- emergency responder units at the scene, time contacted and time arrived
- decisions on protective actions, including changes from previous decisions
- decisions on other response actions
- major changes to the situation and time

Step 3

Assess the initial information gathered about source, intensity .

Step 4

If required the Radiological Assessor could alert the source owner (if known). Obtain additional information on the hazards related to the source and update advice to the people at the scene if required .

Step 5

Designate the senior official on the scene as On- Scene Controller and establish communication with the scene . Provide initial instructions to the On- Scene Controller

Initial instructions should address the following considerations, as applicable :
- rescue injured persons first

- fight conventional hazard (e.g fire) first
- confine the source or contamination
- set security perimeter at a safe distance (300 m around)
- isolate people who may be contaminated
- protect emergency workers
- perform radiological survey
- limit the spread of contamination

Determine weather the event is serious enough or has a sufficient public interest to warrant sending a national level On - Scene Controller to assume overall control.

Step 6

If not already done, dispatch all necessary necessary emergency responders to the scene . Inform them what radiological hazards may be present . Brief them on personal protective actions .Determined in cooperation with the On - Scene Controller, if additional relevant and necessary resources may be required as :
- other emergency response service (firemen, police , medical responders, etc.)
- regulatory authorities
- emergency staff
- other departments within the Atomic Energy Organization (e.g. waste management, clean up teams, heavy equipment supplier)

Step 7

Ensure that the On - Scene Controller is informed of resources contacted, which could arrive the scene .

Step 8

Get regular reports from the On- Scene Controller on :
- status of the conventional hazards
- status of the radiological hazards
- public safety
- recommended and implemented protective actions

Step 9

Based on monitoring results and recommendations from Radiological Assessor reassess protective actions . Make decisions on additional protective actions for the public and instruct the On-Scene Controller if needed .

Step 10

Ensure that Radiological Assessor monitors contaminated or potentially contaminated people and that, if required based on the advice from the Radiological Assessor, they are sent by appropriate means to Ain Shams Specialized hospital . If so, notify the hospital that contaminated or potentially contaminated patients are being sent, and arrange for radiological support to the hospital .

Step 11

Inform the media and the public as required in cooperation with On- Scene Controller. The public has a right to know the facts, and the media has a legitimate interest in telling the public about these . The truth about a radiation emergency is almost certain to be less alarming than the exaggerated ideas that will circulate in the absence of public understanding based on factual public announcements .

Field teams DO NOT provide data to the public but may provide phone number for contacting Emergency Manager. Field teams may explain WHAT they are doing and WHY

Step 12

When the source and the contamination, if present, have been confined, coordinate source recovery and clean up activities . It may be necessary at that point to consult with the Radiological Assessor on the best options and on additional resources required It may also be necessary to designate another On-Scene Controller to allow part of the emergency response services to return to their normal duties.

Step 13

Reassess the situation whenever there is any major change of status of the emergency

Step 14

Initiate and supervise rehearse of the planned course of action before actual recovery

Step 15

Once the emergency is over ·

- obtain dose assessment from the Radiological assessor
- ensure continued medical follow - up of people sent to Ain Shams Specialized hospital
- inform all organizations which have been activated that the emergency is under control.

Step 16

Insure that all actions, decisions and/ or recommendations have been registered . Save all records, maps, status boards, etc.

Step 17

Reconstruct the accident, evaluate the response and sum up lessons learned . If needed, and update the response plan accordingly Prepare final report about the accident

It has to be notified that the emergency will be terminated when :

1 The source material has been returned to the normal controlled condition

2 There are no potential further abnormal exposures

3. The radiological consequences in items of health effects on those exposed have been properly dealt with

DISCUSSION

The objectives of this type of scenario will help to provide a means to determine if there are any response deficiencies . It will provide groups sharing in this exercise scenario with means to measure response capabilities . Since there is an element of risk with real life responses, risks associated with exercises should be minimized . As with all response activities safety should be first last and always with exercises as well .

This accident scenario and response can be used as a model for the proper handling of such incidents . Each group involved in the response action reacted promptly and new its part well .

REFERENCES

1) IAEA Safety Series No. 87, Vienna 1988

2) IAEA Safety Guide : Emergency Response Planning and Preparedness For Transport Accidents Involving Radioactive materials (Edition 1996) .

3) M. Salama etal, ANS Sixth Topical Meeting on Emergency "Preparedness and Response Sanfrancissco, California, April 22-54 1997 .

4) IAEA Safety Series No 73, Vienna (19973)

5) IAEA Safety Series No 91, Vienna (1989)

6) IAEA Safety Series No 109 Vienna (1994)

7) IAEA - TECDOC- 413, IAEA, Vienna (1987)

8) Dot / RSPA / MTB - 79/8, USDOT, Washinghton, D.C, U.S.A (1975)

BIBLIOGRAPHY

1. A.W. Grella, Accident Experience with Type B Packaging in the United States of America, IAEA-SM-147/19, IAEA, Vienna, Austria, 1971 .
2. A.W. Grella, A Review of Five years (1971-1975) Accident Experience in the USA Involving Nuclear Transport, IAEA - SM- 10/5, IAEA, Vienna, Austria, 1976.
3. US dept. of Transportation, Radioactive material Transportation Information and Incident Guidance , Dot/RSPA/MSB/4, 1982 .
4. E.L. Emerson and J.D. McClure, Radioactive Materials (RAM) Transportation Accident / Incident Data Analysis Program SAND82 - 2156, Ttc - 0385, Sandia national Laboratories, Albuquerque, NM 1983 .
5. C.B. Killian, Emergencies in Transit , a paper from the proceedings of the Conference of Transportation of radioactive Materials, University of Virginia, Oct. 26-28, 1969, PB 189506, NTIS , Springfield VA, 1968 .

6 D.F Cronin , Single Vehicle , Wreck on Interstate Highway- February 1970, from proceedings of PATRAM , 71 CONF - 71080 (Vol.1) Pg 167, 1971.
7 J.M. Chandler , The Discovery and Return to Service After a Transport Accident of the Spent - Fuel Shipping Package for the Peach Bottom Atomic Power Station, proceedings of PATRAM, 74 CONF-740901-p2, pg 1027, 1974.
8. National Transportation Safety Board, Special Study of the carriage of Radioactive Material by Air, NTSB-AAS-72-4, Washington Dc, 1972.
9. G.B. Johnston Report on Sea Accident and Montreal Contamination Incident involving UF_6 Cylinders - May 23, 1989 . Unpublished report in the files of the Atomic Energy Control Board, Ottawa, Canada.
10.G.B. Johnston, report extracted from the files of the Atomic Energy Control Board of Canada .