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Implementation of Emergency Response Training and Skills Improvement for Emergency

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Abstract

In the transport of radioactive materials, proper responses are required to accidents and emergencies, such as an earthquake and tsunami, to prevent the leakage of radioactive materials and always ensure safety no matter what happens.

Nuclear Fuel Transport (NFT) was unloading LLW containers from the LLW transport vessel, Seiei-Maru, when the Great East Japan Earthquake struck on 11 March 2011. Although the tsunami hit the port 30 minutes after the warning was issued, the vessel was, for the most part, successfully evacuated out of the port thanks to regular shore leaving training.

Since NFT has been providing land and maritime transport of radioactive waste and nuclear materials, we have incorporated a variety of activities to integrate the lessons learned from the earthquake in order to enhance safety against not only natural disasters but also accidents. Here, we provide a description of these activities.

Introduction

Figure 1 shows the nuclear fuel cycle in Japan. NFT is involved in most of the transportation in the backend of the nuclear fuel cycle. The transport categorized into two main types: maritime transport using special-purpose vessels and land transport using special-purpose vehicles. Through our appropriate equipment maintenance and enhancing our technologies and capabilities required for our safe operations, we have been maintaining our safety transportation record, without any accidents, since our first transportation held in 1978.

In the transport of radioactive materials, an appropriate response is required to address an emergency, such as earthquake and tsunami, to prevent any leakage of radioactive materials and always ensure safety no matter what happens. Therefore, NFT periodically conducts emergency response exercises. Especially, after the Great East Japan earthquake hit Japan in 2011, emergency response manuals have been developed and improved using the lessons learned from this disaster, and training has been further enhanced.

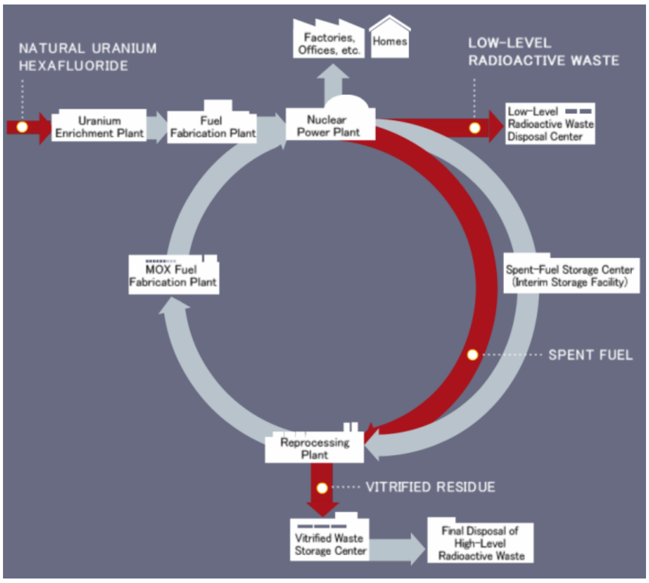

Figure 1. Nuclear fuel cycle in Japan

Basic Training Policy

NFT needs to promptly respond to an emergency in circumstances where time, personnel and equipment are limited. Therefore, conducting training exercises enables us to prepare for natural disasters, accidents and other such situations by verifying and improving both tangible and intangible measures.

Training Plan

NFT's annual training plan is formulated and reviewed in management meetings to incorporate the previous year's results and give due consideration to upcoming developments. We conduct the following specific and comprehensive training and integrated exercises.

Table 1. Emergency response training

Training	Frequency	(a)Regulatory requirement (b)voluntary training		Postulated accident
		(a)	(b)	
Emergency Shore Leaving Training	more than 1 per year since 2011	○		Large scale earthquake occurs during the loading, triggering a tsunami warning
Onboard Training Activity	2 per year since 2005		○	Damaged cask in the hold during maritime transport
Carrier Towing Training	1 per year since 2006		○	Carrier is not able to run by its own power, due to engine trouble
Notification and Communication Training	More than 1 per year since 2001	○		A marine accident (Fire, collision…)
Public Media Training	more than 1 per year since 2012		○	Various cases
Integrated Emergency Response Exercises	basically 1 per year since 2014		○	Various cases

Training

1. Maritime Transport

1.1. Emergency Shore Leaving Training [1]

Emergency shore leaving is efficient way of securing safety once a tsunami warning is issued.

Through this emergency shore leaving training at every port utilized, we have confirmed the effectiveness of our emergency evacuation procedure manual and improved our skill level.

＜Training Scenario＞

I. Large scale earthquake occurs during cargo loading, triggering a tsunami warning
II. Initiate preparations to execute emergency evacuation procedures after receiving the tsunami warning
III. Switch cranes to emergency power in case of a power system failure
IV. After switching to the emergency power system, we return nuclear materials to the transport vehicles, and then the vessel leaves the port

＜Result＞

Using this drill, we have confirmed that we are able to safely evacuate our vessels from port in a sufficiently shorter period of time than it takes a tsunami to arrive at the coast, and our manual is effective.

Moreover, we have improved our skill level by repeatedly conducting drills. We also have continued to improve both the tangible and intangible aspects quick shore leaving.

Figure 2. Emergency shore leaving training

1.2. Onboard Training

NFT has formed an Emergency Response (ER) team with our subcontractor so that we may execute a quick initial response when an accident occurs during maritime transport.

Through our onboard training, we have improved our skills for boarding the vessel from a tug boat, checking the condition of casks in the hold, and communicating with the emergency headquarters in Tokyo.

＜Training Scenario＞

I. Accident occurs during maritime transportation. Emergency headquarters decides to dispatch the ER team to the accident site
II. Board the ship from a tug boat
III. Put on protective clothing
IV. Environmental inspection of the hold (measurements of radioactivity, contamination, and dust)
V. Check any damaged casks (visual inspection, specific radiation survey, and decontamination)
VI. Recover any damaged casks and prevent contamination from spreading

※Keep in timely and close contact with the captain and emergency headquarter

＜ER team members＞

- Leader
- Cask specialist
- Radiation control specialist
- Liaison

＜Result＞

Through this training, we were able to verify that our emergency response procedures were appropriate.

Even though NFT has had no previous experience, it is important that such training be periodically conducted. Therefore, NFT conducts this training twice a year, and we have improved our capability to respond to an emergency.

Meanwhile, we have found that close communication between the ER team and emergency headquarters is important. Thus, we have prepared several high-tech communication tools. (e.g. telephone, internet, etc.)

Figure 3. Onboard training

2. Land Transport

2.1. Carrier Towing Training

For land transport of spent fuel(SF)/high-level radioactive waste(HLW), we use special-purpose vehicles (carriers; see Figure.4). In the event a carrier is not able to run under its own power due to engine trouble or other malfunction, we will use another carrier to tow the broken-down carrier to a safe location.

The objectives of carrier towing training are:

・ Verify the validity of recovery procedures

・ Verify equipment validity

Overall length	12m
Width	3.2m
Height	1.8m
Vehicle weight	33.7ton
Maximum loaded weight	135ton

Figure 4. Spent fuel/high-level radioactive waste transport vehicle (carrier)

＜Training Scenario＞

I. Engine stops due to a problem with the hydraulic pressure system, and the carrier cannot run under its own power

II. Another carrier is arranged for towing, and both carriers are connected by a special emergency unit

III. Towing carrier tows disabled carrier to a safe location

＜Features＞

・ There are varieties of conditions along the routes with straight, curve, sloped and other types of roads. Thus, the tow method must be changed in response to the conditions (Figure5).

・ At the place where SF/HLW is loaded, it is not possible for the towing carrier to tow the disabled carrier due to the narrow space. In such cases, another type of special-purpose pushing equipment is required (Figure 6).

＜Results and Findings＞

We confirmed as following;

・ Under all conditions such as sloped roads, curved roads and pushing the carrier in the last stage, our emergency unit executed the tasks properly and in a safety manner.

Other findings from this training include:

・ Verification of the validity of a recovery procedure for using an emergency unit to connect both carriers and the number of hours required for towing

・ Necessity of the desire to keep improving skills through repeated training in connecting two carriers using the emergency unit within a limited space

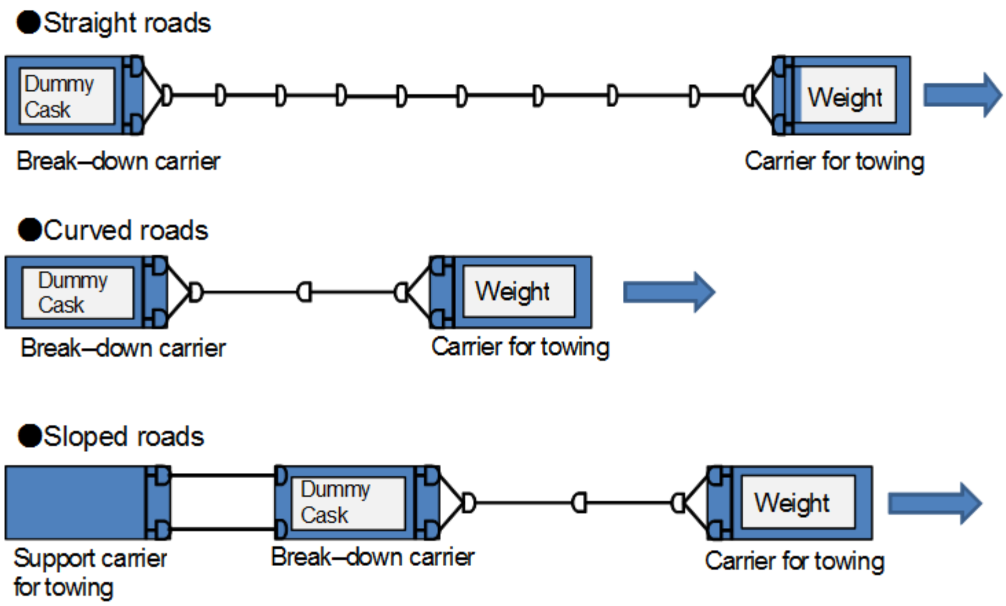

Figure 5. Various carrier towing connections

Figure 6. Carrier towing and pushing

3. Other Training

3.1. Notification and Communication Training

So that information is communicated promptly and accurately among the relevant parties during an emergency, we periodically conduct notification and communication training with the relevant parties and regulatory organizations.

＜Training Scenario (ex: fire in hold of transport vessel)＞

I. Fire breaks out in the hold. No crews are injured.

II. Crew tries to extinguish fire, but fails. They evacuate from the hold.

III. Emergency water inundation system activates.

IV. Radiation monitoring system alarm activates in the hold.(Alarm threshold >10μSv/h)

V. Nuclear operator determines that there is a high probability of radioactive material leakage of from a cask.

VI. The fire is extinguished and the radiation control specialist verifies cask safety.

VII. As a result of checking the casks, they are confirmed to be safe.

＜Result＞

At the early stage of our training, we were not able to achieve the goal of sharing information among the parties concerned within the targeted time because of the inappropriate manner of communication.

Through these experiences, we identified improvements, such as reviewing procedures and using checklists, and we were able to promptly and accurately share information among the relevant parties.

On the other hand, we found that each individual’s understanding of the information differed depending on his degree of proficiency. We need to conduct an overall review of the training to further improve our skills and the understanding shared among the relevant parties.

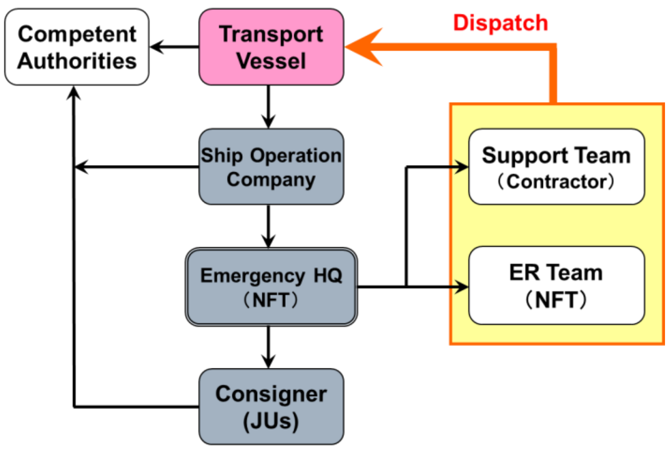

Figure 7. Flow of communication

3.2. Public Media Training

So that we may providing the necessary information promptly and accurately to the media and public during an emergency, we had a third-party expert, who has experience and knowledge about public relations during an emergency response, conduct a seminar for improving our emergency response capabilities by drafting a manual as well as a list of anticipated questions and answers (Q&A).

The purpose of the public media training is to verify and review our manual in conjunction with other training.

<Training activities>

- Gathering information
- Preparing press statements and Q&A responses
- Sharing information among the relevant parties
- Holding a press conference jointly the relevant parties

3.3. Integrated Emergency Response Exercises

Integrated emergency response exercises are a combination of different types of training, during which we execute all emergency response activities at the same time.

A blind training scenario is used so that nothing is presented to the trainees in advance. This type of training helps us to improve our ability to make appropriate judgments and take the proper action at the right time.

Review of Training Results

We review the results of each training exercise to identify not only areas for improvement, but also good practices to be recognized. Thus, the identified areas lead to both tangible and intangible improvements.

Conclusions

We confirmed the following through our training:

- Validity of our procedures and equipment
- Improvement the skill levels year by year
- Estimated time for each activity to bring an accident under control
- Matters identified for future review

In an emergency, we are required to take all the possible measures to resolve the situation. To improve such skills, training is not only the best way, but it is the only way. Accordingly we have to continue to improve our skill levels for emergency response through such training.

References

[1] Kota Saikawa, Fuminobu Makino, Akihiko Matsuoka, Rikio Nakaya, "Emergency Response Procedures and Trainings for Nuclear Material Transport Vessels against Earthquakes and Tsunamis", The 17th International Symposium on the Packaging and Transportation of Radioactive Materials (PATRAM 2013 August 18-23, 2013, San Francisco, CA, USA)