

Development of Firefighting Manual Application in case of Nuclear Power Plant Fire and Lessons Learned

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***Keywords** : nuclear fire, manual app., collaboration

1. Introduction

Recent incidents in South Korea, such as the Itaewon collapse accident, Pohang apartment basement flooding incident, and Osong underground tunnel flooding accident, serve as lessons that accidents can occur unexpectedly and from unforeseen directions. Nuclear accidents cannot be exempt of possibility. According to a recent survey conducted among experts, scenarios beyond the existing nuclear accident scenarios have been suggested, such as "wildfires + radiation accidents," "North Korean missile attacks on nuclear facilities," and "nuclear accidents in China." [1]

In the early stages of a nuclear accident, the most critical factors are generally considered to be "accident information sharing" and "centralization of command structure." Furthermore, maintaining a smooth cooperative system among relevant organizations when such accidents occur will be more important than anything else.

Standard Testing and Engineering Inc is currently engaged in a national project titled "Establishment of Collaborative System among Relevant Agencies in Nuclear Accident Situations," and as part of this effort, we have developed a standard firefighting action manual for nuclear power plant fires. This manual has been developed not only in the form of a booklet but also as a smartphone application(app.), providing swift and precise instructions in the event of an accident and enabling efficient collaboration among relevant organizations.

This paper aims to describe the experience of developing a firefighting action manual smartphone app and the lessons learned from the process.

2. Methods and Results

2.1 Development of Firefighting Standard Action Manual

It has been observed that the existing "firefighting action manuals" held by fire stations located near nuclear power plants are different from one another and do not include specific actions and tactical strategies for the safety of firefighters in the event of a radioactive leakage.

The newly developed standard manual takes into account the possibility of radioactive leakage in the event of a nuclear power plant fire. It defines on-site firefighting activities in a systematic manner through five phases, focusing on action-oriented approaches. Site-specific details are included as appendices.

The firefighting manual smartphone app has been developed to enhance readability by simplifying and visualizing the text through graphics.(Fig. 1)

According to a recent survey conducted among experts, effective means for utilizing manuals are indicated as "smartphone app" (41%) and "dedicated internet websites" (33%). These findings are expected to serve as valuable references for future manual development and utilization.(Fig. 2)[1]



Fig. 1. Sample of Firefighting Standard Action Manual Smartphone App

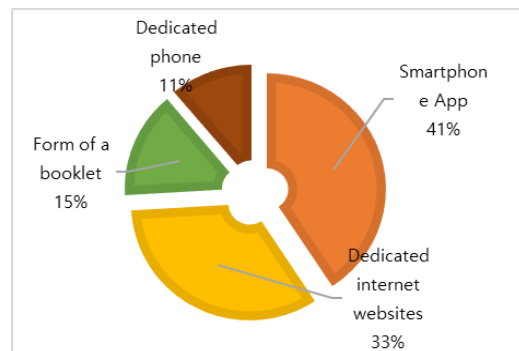


Fig. 2. Survey on Preferred Effective Means for Manual Utilization

2.2 App Development Environment

The manual app is built on Android 9.0 and iOS 16.1 platforms, compatible with most smartphones and tablets, and designed to be accessible on pc with windows 10 as well. (Table I)

With this app, there's no need to carry a separate manual; you can instantly access incident occurrence, progression stages, actions, and tasks for response through the smartphone.

Furthermore, when the manual is updated, it can be automatically upgraded to the new version, enhancing the efficiency of management.

For instance, the manual can ensure that key contact information is always up-to-date, and by utilizing the smartphone's calling feature, immediate communication can be established through phone calls.

Security issues related to smartphone use should be disclosed to all users in principle, but a method of restricting some access rights for individual users may be considered.

Table I: App Development Environment and System Requirement

App Development Environment	System Requirement
1. Web Development -Web Server: Tomcat -Language: Java, jsp -DB: Mysql	-Android 9.0 or higher -IOS 16.1 or higher -PC
2. Mobile App Dev. -Android : Java -IOS: Swift	CPU: intel i5 RAM: 2GB OS: windows10

2.3 Lessons Learned and Future Plan

The app that has been developed was pilot-tested among local firefighters, and the following opinions were presented:

“Having the manual on a smartphone is convenient and saves time.”

“The real-time updates and immediate access to crucial information enhance our response capabilities.”

“Efforts will be made to enhance readability by designing screens and graphics in a way that improves visual clarity.”

“The manual app will be made publicly available on general app stores, ensuring that anyone can utilize it. Additionally, it will be integrated with emergency disaster text messages, allowing for seamless utilization during critical situations.”

“Alternatives are necessary to prepare for communication failure, such as embedding the app within the device or utilizing alternative communication methods.”

“It has been noted that the app might not function optimally on certain devices, such as iOS tablets.”

“Additional enhancements are required to ensure usability even when wearing firefighting protective gear, including fire-resistant suits and gloves.”

“Hyperlinks and a search function will be incorporated to enable easy navigation and quick searches within the app.”

“It would be beneficial to include the capability to monitor real-time local radiation levels while on the go”

These opinions reflect positive feedback and suggest that the app is well-received among the local firefighting personnel. In the future, this smartphone app is planned to be expanded into a "collaboration manual," intended for use not only by fire stations but also by relevant organizations. Furthermore, efforts will be made to ensure that the improvement suggestions previously mentioned are adequately incorporated into the app.

3. Conclusions

As part of the project to establish a collaborative system among relevant agencies in the event of a nuclear accident, the Standard Testing and Engineering Inc has developed a standard firefighting action manual for nuclear power plant fires. This app-based manual has been developed to provide swift and precise instructions in the event of an accident, aiming to prevent initial confusion and facilitate efficient collaboration among agencies. This app allows individuals to instantly access the manual for incident occurrence, progression stages, and response steps on their personal smartphones. Furthermore, with automatic updates to newer versions in case of manual revisions, it is anticipated to bring about efficiency and convenience.

However, it appears that alternatives such as a 'stand-alone' approach for communication failure preparedness are needed. Additionally, there is a need for enhancements to accommodate the use of firefighting protective gear, including fire-resistant suits and gloves. Moreover, it is important to ensure seamless functionality across various smart devices and an optimization process that enhances screen readability and user-friendliness is also necessary. Furthermore, integrating personal location information and real-time radiation level data into this app is anticipated to greatly assist in ensuring the radiation safety of firefighters.

REFERENCES

[1] Report on Nuclear Safety Technology" in Nuclear Safety Research Program (N-STAR), p. 8, 2023.