Normal Transportation Test Results for KJRR-F Fresh Fuel Transportation Cask

Gil-Eon Jeong [a*], Yun-Young Yang [a], Kyoung-Sik Bang [a]
[a]*Radwaste Transportation and Storage Research Team, Korea Atomic Energy Research Institute, Daejeon 34057, Republic of Korea*
[*]*Corresponding author: gejeong@kaeri.re.kr*

1. Introduction

KJRR-F PSAR [1] "Permitted accelerations to handle and transport of nuclear fuel assembly" stipulates that the maximum acceleration applied to the fresh fuel assembly should not exceed six times the gravitational acceleration (6 g) in axial or lateral direction under the normal transportation condition. In order to verify that the KJRR-F transportation cask and its tie-downs structure complies with the above regulation, the normal transportation test from KAERI to Kijang was conducted to evaluate the structural integrity of KJRR-F fresh fuel. From the test result, the maximum acceleration at the fuel assembly was 4.57 g at the test which had the fastest average speed (80 km/h) [2]. Since the maximum acceleration (4.57 g) is lower than 6 g as specified in the KJRR-F PSAR [1], the test presented that there is no problem in transporting the KJRR-F fresh fuel using the transportation cask and its tie-down structure.

2. Normal Transportation Test

2.1 Test model

The KJRR-F transportation cask and its tie-down structure was used to check the vibration characteristics that occurs when the KJRR-F fresh fuel is treated under normal transportation condition. The schematic description of the KJRR-F transportation cask and its tie-down structure is shown in Fig. 1, and the test was carried out using it.

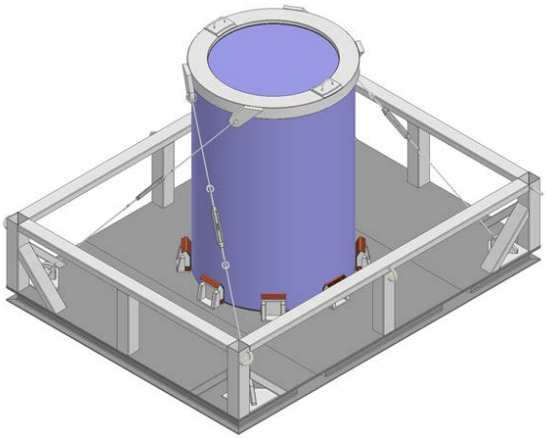

Fig. 1 KJRR-F Fresh fuel transportation cask and its tie-down structure

2.2 Test route

In the normal transportation test, the test model was transported from the KAERI (Manufacturing site) to Kijang (Reactor site). The test was carried out on the route shown in Fig. 2. The normal transportation test took 15 hours, with a total distance of 1,100 km.

Fig. 2 Test route from KAERI to Kijang

2.3 Normal transportation with test model

Using the test model as shown in Fig. 1, the normal transportation test was conducted on the route described in Fig. 2.

The picture taken during the test was shown in Fig. 3.

Fig. 3 Normal transportation with test model

In the normal transportation test, we obtained the velocity of the vehicle using a GPS, and the acceleration of the fuel assembly using an acceleration sensor. The locations of acceleration sensors are described in Fig. 4.

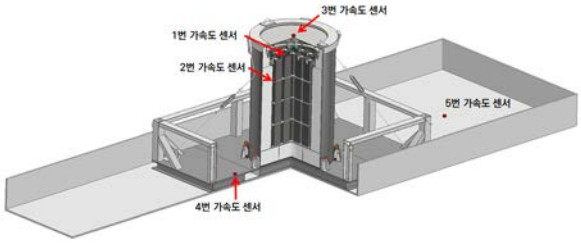

Fig. 4 Location of acceleration sensors

2.4 Test result

Based on the aforementioned test conditions, the test result is shown in Fig. 5 and Fig. 6.

Fig. 5 indicates the velocity data from KAERI to Kijang using the GPS. As shown in Fig. 5, the vehicle drove at an average speed of 80 km/h.

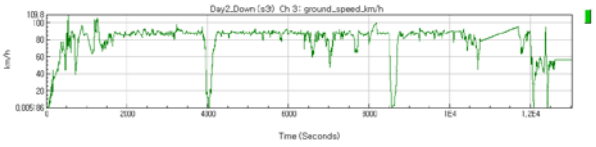

Fig. 5 Test result – Speed from GPS data

Fig. 6 represents the acceleration data at the KJRR-F fuel assembly under the normal transportation test. The red, blue, and green colored lines mean the X, Y, and Z-directional acceleration at the KJRR-F fuel assembly, respectively.

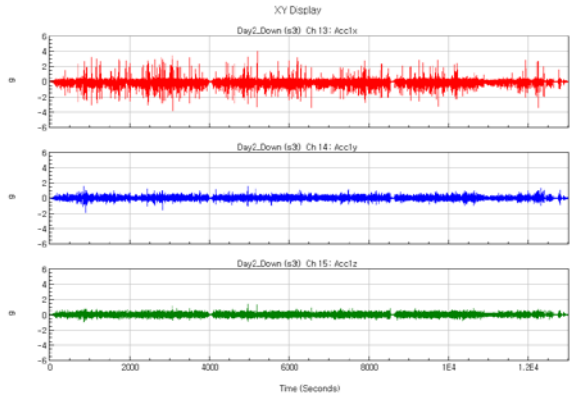

Fig. 6 Test result – X, Y, Z Acceleration data at the fresh fuel assembly

From the acceleration data in Fig. 6, the acceleration of up to 4.57 g in the X-direction was derived. This means that the KJRR-F transportation cask and its tie-down structure is satisfied the regulation (KJRR-F PSAR) [1] because the maximum acceleration is lower than the 6g.

3. Conclusions

In this research, the normal transportation test using KJRR-F transportation cask and its tie-down structure was conducted from KAERI to Kijang at an average speed of 80 km/h. From the acceleration data, the KJRR-F transportation cask and its tie-down structure satisfy the regulation [1] because the maximum acceleration (4.57 g) is lower than the 6g as specified in the KJRR-F PSAR [1]. As a result, it is confirmed that the structural integrity is verified during the normal transportation condition using the KJRR-F transportation cask and its tie-down structure.

REFERENCES

[1] KIJANG RESEARCH REACTOR, Fuel Design Report, KJ-372-KN-422-002.
[2] Gil-Eon Jeong, Yun-Young Yang, Kyoung-Sik Bang, Normal Transportation Test Report for the KJRR-F Fresh Fuel Transportation Cask, KAERI/TR-8080/2020.