

# The Fukushima Daiichi Accident Study Information Portal

## 2012 ANS Winter Meeting

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November 2012

The INL is a  
U.S. Department of Energy  
National Laboratory  
operated by  
Battelle Energy Alliance



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# THE FUKUSHIMA DAIICHI ACCIDENT STUDY INFORMATION PORTAL

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*This paper presents a description of The Fukushima Daiichi Accident Study Information Portal. The Information Portal was created by the Idaho National Laboratory as part of joint NRC and DOE project to assess the severe accident modeling capability of the MELCOR analysis code. The Fukushima Daiichi Accident Study Information Portal was created to collect, store, retrieve and validate information and data for use in reconstructing the Fukushima Daiichi accident. In addition to supporting the MELCOR simulations, the Portal will be the main DOE repository for all data, studies and reports related to the accident at the Fukushima Daiichi nuclear power station. The data is stored in a secured (password protected and encrypted) repository that is searchable and accessible to researchers at diverse locations.*

## I. INTRODUCTION

The accident at the Fukushima Daiichi nuclear power station is one of the most serious in commercial nuclear power plant operating history. In response to the accident, the NRC and DOE agreed to jointly sponsor an accident reconstruction study. The study was led by Sandia National Laboratory with assistance from Oak Ridge National Laboratory and the Idaho National Laboratory and focused on assessing the severe accident modeling capability of the MELCOR code. MELCOR is a state-of-the-art system level severe accident analysis code developed by Sandia National Laboratory for the NRC. Since this analysis and other like it will be studied for years to come, one of the first objectives of this project was to create an information repository to collect the relevant data and facts related to the accident. The Fukushima Daiichi Accident Study Information Portal was created by the Idaho National Laboratory to collect, store, retrieve and validate information and data for use in reconstructing the Fukushima Daiichi accident. The data is stored in a secured (password protected and encrypted) repository that is searchable and accessible to researchers at diverse locations. The Portal is located at the URL: <https://Fukushima.inl.gov>.

## II. LOGGING IN

When the user visits the Portal, the Portal page is displayed as shown in Figure 1. This page has the “Log In” link in the upper, right-hand corner.



Fig. 1. Welcome screen for the information Portal.

To log in to the Portal, a user must press the “Log In” link located in the upper right-hand corner. Pressing this link takes the user to the Log In screen. If the user has not yet registered for access, he must register by selecting the “Register” link. The Register link will take the user to the registration page and allow him to register for a username and password. Note that all passwords are encrypted. After registering, the request will be considered and then an e-mail will be sent to the user indicating that the appropriate role(s) has been assigned. The Portal utilizes user roles to control access to the data. The roles include Contributor, Reviewer, and User. A Contributor is allowed to create and modify events and artifact data. A Reviewer is allowed to add review information to events and artifacts as a method of quality assurance but is not allowed to add or modify the data. A

User is only allowed to view the data and cannot add or modify data.

Logging in will bring the user to the Home page. The Home page shows the user name in the upper right-hand corner with the Log Out link, the menu options based on the user's assigned roles and the Recent Additions/Changes table. Figure 2 shows the Home page and all of the menu items available to all roles.

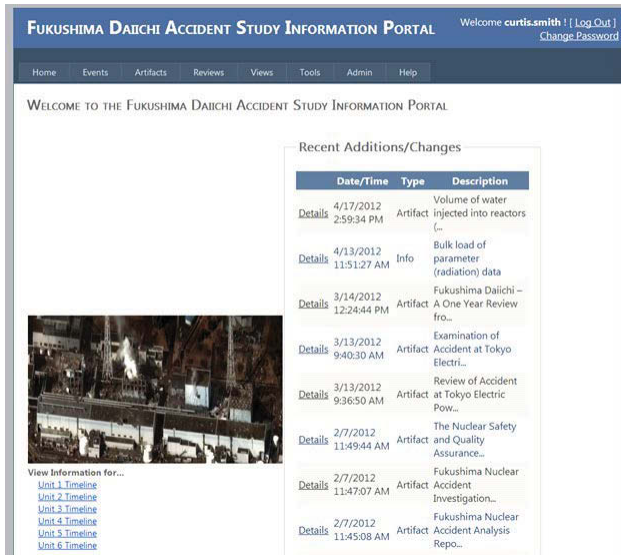


Fig. 2. Home screen for the information portal.

A user's manual is available and a link is located under the help tab. The user's manual contains detailed instructions for adding, modifying and reviewing data as well as creating the various data views that are available to users. Also under the help tab is a tool for sending a message to the Portal Administrators if any problems are encountered.

### III. INFORMATION STORED IN THE PORTAL

Four types of data are stored in the database; Events (key events identified in the accident sequence timeline), Plant parameter values, Media files (reports, photos, videos, etc.) and Component states (e.g., component X started at time Y and failed at time Z.). Individual plant parameter values, component states and media files are referred to as "artifacts" in the database. Events and artifacts are linked in the database to provide supporting information and support in the traceability of data. Events can be linked to Artifacts and Artifact can be linked together. Figure 3 shows the concept of linking events to artifacts.

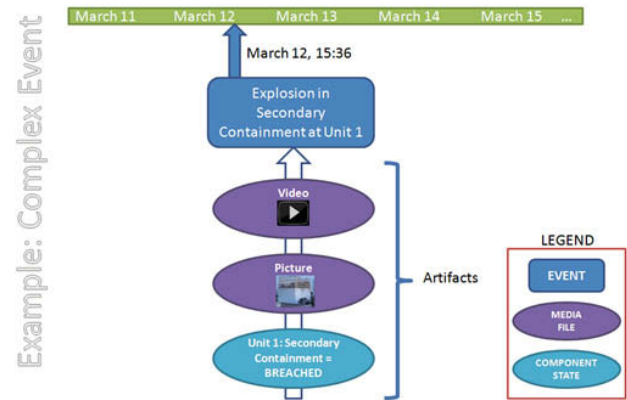


Fig. 3. Example of Artifacts associated with an Event

An Event can have zero to many Artifacts that support the Event. The Event page shows all the Events in the database and all associated Artifacts supporting each. Links are provided to review the associated Artifacts from the Event. The database uses a sophisticated relational SQL-based database that encrypts all information in the database. A Review feature is available in the database to allow knowledgeable persons to comment on the certainty of the attributes of the events. Events and Artifacts may have multiple Review comments associated with each. The reviewer attaches a confidence rating to the data and enters a comment justifying the rating. Fig. 4 shows an example of an Event Review. Each data element is assigned to a plant location, date and cause.

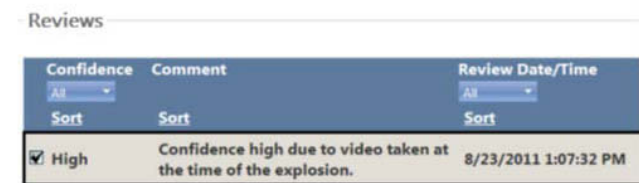


Fig. 4. Example of Review status.

### IV. SOURCES OF DATA USED IN THE PORTAL

Each timeline Event is referenced to a source document contained in the Portal as a media file Artifact. Various reports and TEPCO press releases were referenced in creating the timeline. Where differences in data existed, priority was given to data released directly by TEPCO over other sources and more recently released data was given priority over data which was released earlier. The primary source of timeline information was extracted from a TEPCO press release dated 8/10/11 titled "State of Immediate Response after Disaster Struck at Fukushima Daiichi Power Station".<sup>1</sup> This document is broken down by unit with sections related to general

timeline information, alternate injection and containment venting. A recently released INPO report titled “Special Report on the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station” was also used as a reference to verify timeline data that was created from earlier reports.<sup>2</sup> An early report to the IAEA titled “Report of Japanese Government to the IAEA Ministerial Conference on Nuclear Safety – The Accident at TEPCO’s Fukushima Nuclear Power Station” was heavily referenced early on.<sup>3</sup> Several other reports are presented in the Portal for reference and comparison, but may not have been referenced in the timeline creation. New reports and study results will be added to the Portal as they are released. Users are encouraged to submit useful reports or data to the Portal for use by other researchers.

## V. EXAMPLES OF DATA VIEWS AVAILABLE IN THE PORTAL

### V.A. Event Timeline View

One of the primary activities of this effort was to characterize the events of the accident. To do this, we established the accident timeline of events, including equipment actuation and system failures. The accident timeframe for this study begins with the off-shore Tōhoku earthquake on March 11, 2011, at 14:46 (Japan Standard Time), and ends when conditions at the reactors and spent fuel pools became static. The study end date for Reactors 1, 2, and 3 are (based mostly on when stable sea water injection was attained):

- Unit 1 reactor – conduct analysis through March 13, approximately noon.
- Unit 2 reactor – conduct analysis through March 15, approximately 24:00 hrs.
- Unit 3 reactor – conduct analysis through March 14, approximately 24:00 hrs.

Timelines for units 4, 5, and 6 are also included; however the information is limited as detailed studies were not within the scope of this study. Once the data has been entered into the database, the information portal provides a variety of views of this information. For each view, filters are provided to tailor the output to the needs of the user, for example, in the Event Timeline view (see Figure 5), the user may select from the following options:

Fig. 5. Event Timeline Creation Options

Clicking the “Generate Timeline” button produces a detailed timeline using the options specified above, as shown in Figure 6.

Figure 6. Example of the timeline view.

Options are available to view the timelines on the screen or to format them for printing. A graphical timeline view is also available.

### V.B. Component State Chart View

The Component State Chart view allows the Portal user to select and view the status of specific Fukushima plant components as to their functionality (e.g., working or not) over time. Major accident mitigation systems and components are included; HPCI, RCIC, EDGs, Isolation Condensers, DC power, Firewater Injection, Containment Vents, Service Water and SRVs. To use this option, the user must specify which unit to investigate, which components, and over which time. For example, the available options are shown in Figure 7, where we have selected (for Unit 1) the DC Power, the Isolation Condenser, and the Service Water System to be shown for the first 7 days of the event. Selecting the “Preview Chart” option will show the results as seen in Figure 8.

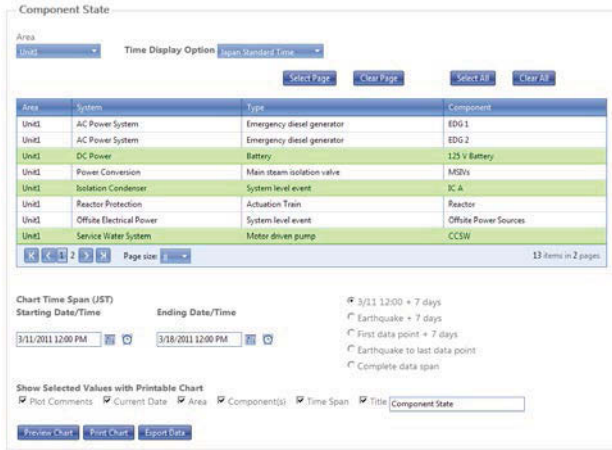


Fig. 7. Options for creating the component state chart.

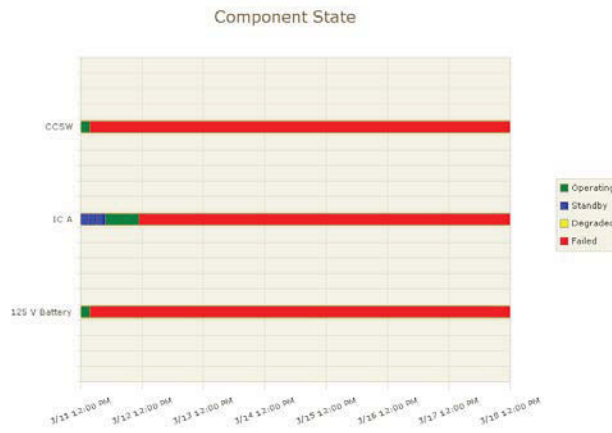


Fig. 8. Output from the component state chart view

In Figure 8, we see that the DC Power system and Service Water System worked for a short period of time following the earthquake (the green region on the status chart) but then was failed (on March 11, 2011) effectively at the time of the tsunami. The Isolation Condenser A (IC A) was initially in standby then worked, but eventually failed later on March 11<sup>th</sup>, 2011. This detail can be seen simply by changing the starting/ending date/time options. For example, looking at only the first day of the event for these three systems would show the results in Figure 9.

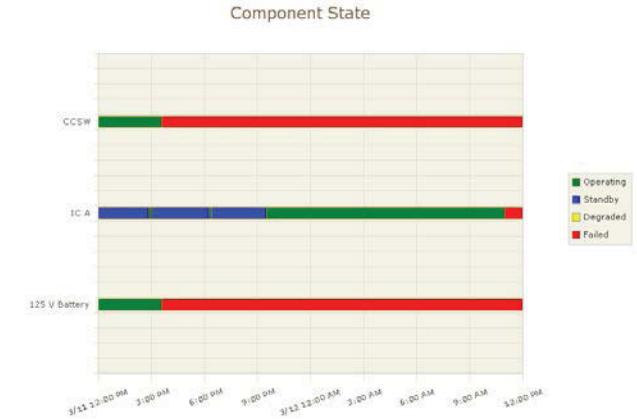


Fig. 9. Output from the component state chart zoomed in.

Options are available to view the component state chart on the screen, format the charts for printing or to export the data to MS Excel.

### V.C. Parameter Data Chart View

The Parameter Data Chart view allows the Portal user to select and view the status of specific Fukushima plant physical parameters (e.g., pressures, temperatures, water levels) over time. To use this option, the user must specify which unit to investigate, which plant parameter to investigate (and desired units, SI and English units are available), and over which time period. For example, the available options are shown in Figure 10, where we have selected (for Unit 1) the Reactor Vessel Level for both the A and B sensors to be shown for the first 7 days of the event. Selecting the “Preview Chart” option will show the results as seen in Figure 11.

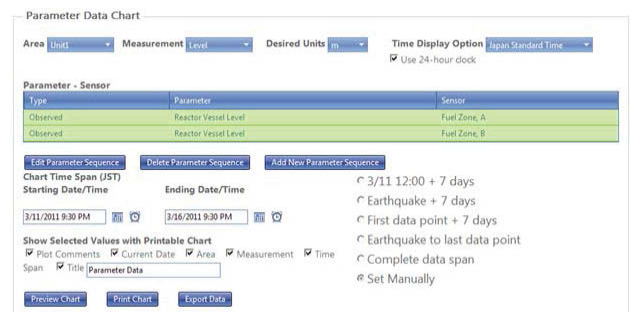


Fig. 10. Options for creating the parameter data chart.

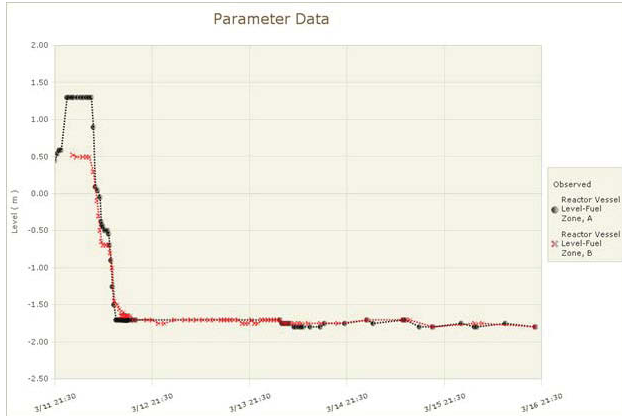


Fig. 11. Output from the parameter data chart view

Options are available to view the parameter data chart on the screen, format the charts for printing or to export the data to MS Excel. A dynamic parameter data chart view is also available which allows users to zoom into specific time periods shown on the charts simply by clicking on the graph.

#### V.D. Radiation Data Plot View

The radiation plot view allows Portal users to select and view the radiation data that was collected around the Fukushima plant site over time. Various plant locations are available and the user has the ability to view the data as a plot or on a map. A location map is provided for the various monitoring points that are available. An example of a radiation plot is shown in Figure 12.

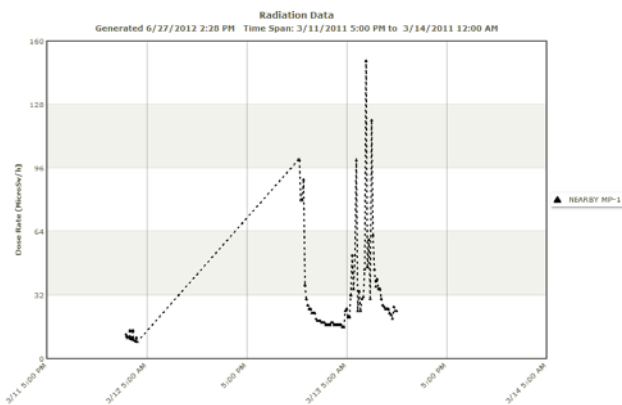


Fig. 12. Output from the radiation plot view.

#### VI. CONCLUSIONS

The Fukushima Daiichi Accident Study Information Portal was created to support a wide variety of studies related to the accident. The Portal includes a relational database controlled by web based user interface which

allows users from all over the world to add, retrieve and review data related to the accident at Fukushima Daiichi. Various user defined views are available for graphically displaying the data stored in the Portal. The primary data views include an event timeline, component state charts and parameter data charts. The Portal was designed to be used by researchers of the Fukushima Daiichi accident now and for years to come.

#### REFERENCES

1. TEPCO, "State of Immediate Response after Disaster Struck at Fukushima Daiichi Power Station," (2011).
2. INPO, "Special Report on the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station," INPO 11-005 (2011).
3. Nuclear Emergency Response Headquarters, Government of Japan, "Report of the Japanese Government to the IAEA Ministerial Conference on Nuclear Safety," (2011).