

## Fuel Cycle Annual Operating Experience Report 2018

### 1.0 Purpose:

The Fuel Cycle Operating Experience Program (FC OpE) supports technical and licensing staff, inspectors, and management by providing insights that can inform inspection planning, licensing reviews, and program changes. The purpose of this annual report is to provide an analysis of reported events at fuel cycle facilities that identifies trends and to make recommendations to improve fuel cycle programs.

### 2.0 Discussion:

Fuel cycle events included in the FC OpE program are reported under Title 10 of the *Code of Federal Regulations (10 CFR)*, Part 40.60 “Reporting Requirements,” 10 CFR Part 70.50 “Reporting Requirements,” 10 CFR Part 70.74 “Additional Reporting Requirements,” and 10 CFR Part 70 Appendix A, “Reportable Safety Requirements.” Table A below shows the total number of events received for operating fuel cycle facilities between 2007 and 2018. Security-related and fitness-for-duty events are not included in this data set.

Total Number of Event Per Facility												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Areva	3	3	5	1	2	2	2	1	2	2	0	0
B&W Technologies	8	4	2	2	1	2	1	0	3	1	1	1
Global Nuclear Fuel	4	5	1	7	13	8	3	2	0	2	1	5
Honeywell MTW	2	1	4	1	16	10	7	12	5	0	0	0
LES/ URENCO	0	0	0	0	3	0	1	0	2	1	2	3
Nuclear Fuel Services	3	5	6	2	0	1	0	6	1	3	0	3
Westinghouse	2	1	2	5	1	2	0	0	1	2	1	3
Total	22	19	20	18	36	25	14	21	14	11	5	15

Table A. Total number of reported events at licensed facilities

### 2.1 Results of 2018 FC OpE Data Analysis

In 2018, the staff received a total of fifteen (15) reported events. Of the fifteen (15) events, licensees retracted four (4) events for not meeting the reporting requirement threshold and reported five (5) under 10 CFR 70 Appendix A (c), “Concurrent Reports,” leaving a total of six

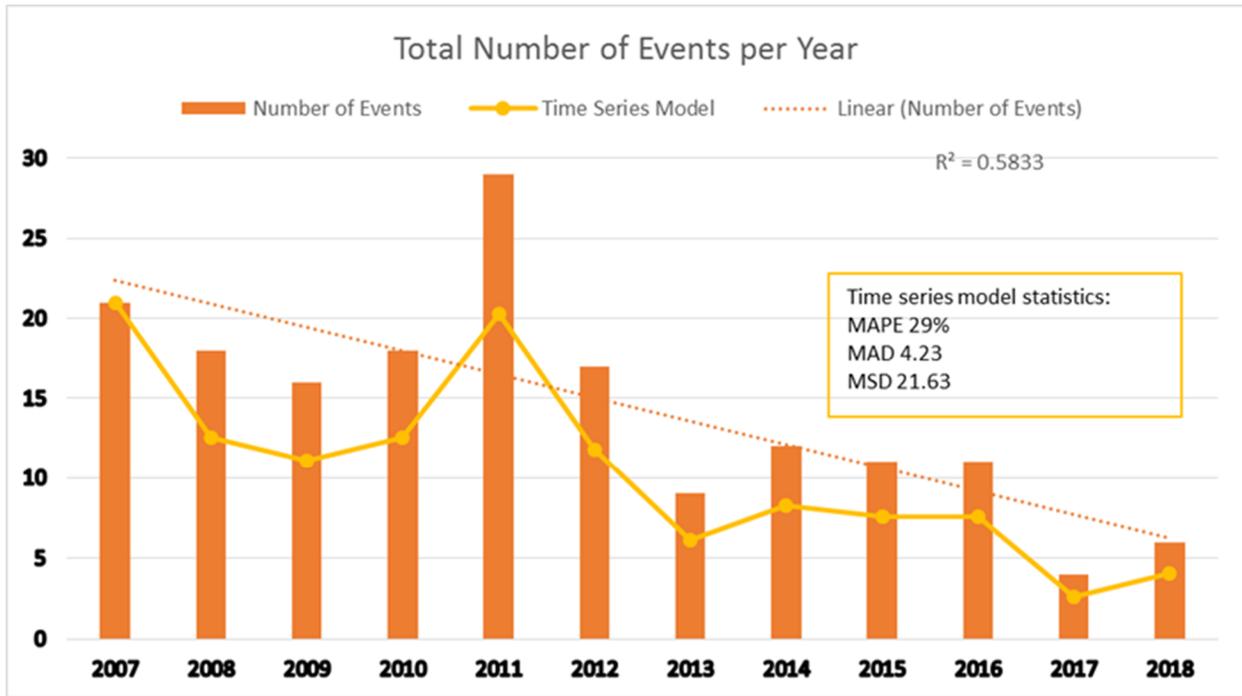
(6) events. Of these six (6) events, three (3) were criticality safety events; two (2) were dermal exposures, and one (1) was an unplanned medical treatment.

To identify trends in events reported since 2007, the staff screened the data and removed retracted events and those considered as occupational hazards or personal health related issues, such as some unplanned medical treatments. In the case of unplanned medical treatments, the staff removed those that were caused by personal health issues (e.g., low blood sugar, heart attacks), non-radiological or non-chemical exposure events (e.g., a pinched finger or a fall). After removing these events, the staff retained a total of 172 events for further analysis.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total Events	21	18	16	18	29	17	9	12	11	11	4	6

**Table B. Total Number of Events for the Trend Analysis**

Table B. shows the total number of events per year as a result of the screening of data. Using the screened data, the staff performed a linear regression analysis to identify potential trends. Figure 1 shows a graph of the screened data compared to the resulting linear regression equation. The results of linear regression suggest that a linear trend may not be a good fit to the data. The value of  $R^2$  is 0.5833, meaning that linear regression explains a little less than 60% of the variance in the model; therefore, linear regression does not provide a statistically reliable model for analyzing the data. Given that the screened data consist of events occurring over a long period of time, the staff chose to apply a time series analysis, specifically double exponential smoothing. A time series analysis can model more complex trends, including the prediction of repeated events. Figure 1 also shows the results of the time series analysis as the yellow dotted line. Visually, the time series model is a better fit, and the statistics associated with the model support the visual representation, indicating a significantly better fit than the linear regression model. The time series model fits more than 70% of the data with a mean average deviation (MAD) of four (4) events, suggesting that the total number of events follows a trend influenced by time. This behavior is similar to what the staff documented in the 2017 FC OpE Report which indicated recurring issues in management measures, problem identification, and corrective action. Therefore, the staff maintains its recommended inspection focus areas of management measures, identifying problems, and corrective action.



*Note: Mean Absolute Percent Error (MAPE); Mean Absolute Deviation (MAD); Mean Standard Deviation (MSD)*

**Figure 1. Time Series Model and Linear Regression**

Event Classification Process:

The staff developed an event classification process to categorize and characterize the screened data. The event classification process consists of three steps: (1) determine the applicable performance areas (e.g., areas relevant to core inspections); (2) determine contributing factors that led to the events; and (3) determine the level of safety significance (See the Office of Nuclear Material Safety and Safeguards Policy and Procedure 6-14, “Fuel Cycle Operating Experience,” for details regarding the screening criteria). The staff performed the screening, during which they considered initial event notification information and applicable inspection reports in order to make a determination on the classification.

Performance Area Evaluation:

From the six events reported in 2018 relevant to fuel facility operation, three were criticality safety events; two were dermal exposures, and one was an unplanned medical treatment. The staff performed a detailed analysis of the number of events per year by performance area. Figure 2 is a scatter plot that illustrates the number of events per year by performance area. The plot shows that, on average, there are more criticality safety events per year, followed by operational safety events. In addition, the graph shows a time series behavior similar to the one observed in Figure 1.

In 2018, the six (6) events are evenly split between criticality and operational safety. Of the three (3) criticality events reported in 2018, two (2) involved unanalyzed conditions in the existing facilities' ISAs, and one (1) involved criticality accident and alarm system (CAAS) unavailability during a corrective maintenance. In the three (3) operational safety events, two (2) were dermal chemical exposure events, and one (1) was an unplanned medical treatment due to an HF release. The predominant contributing factor for these reported events was failure or degradation in management measures (e.g., configuration management, maintenance).

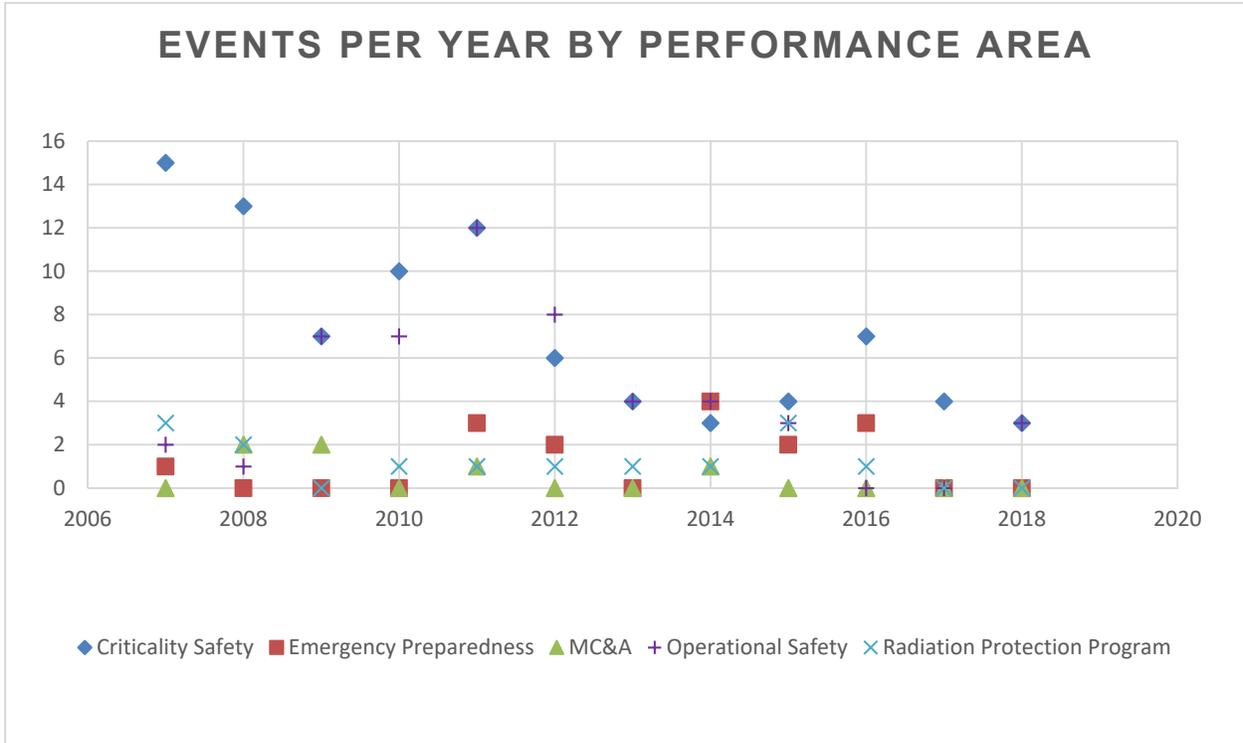


Figure 2. Events per year by performance area

Safety Significance Evaluation:

All events, regardless of significance, are maintained in the FC OpE Database for future reference, tracking, and trending. However, the staff used the screened data to analyze the safety significance of the events in 2018. The staff rates safety significance from high to low using the criteria described in NMSS P&P 6-14 which are consistent with the NRC Enforcement Policy. Based on the rating criteria, all the events reported during 2018 were of low safety significance. Furthermore, on average, the safety significance of the events in 2018 compared to the previous four (4) years is low.

## 2.2 The 2017 FC OpE Report Impact on the Fuel Cycle Facility Oversight Program

The 2017 FC OpE report provided an overall analysis of reported fuel cycle facility events between 2007 and 2017. The analysis included the screened data of 166 events relevant to fuel cycle facility operation. From the analysis of the screened data, the staff identified trends in the performance areas of criticality and operational safety<sup>1</sup>. Based on these trends, the staff made recommendations for the inspection program<sup>2</sup>. Some of these recommendations included changes to CY 2018 inspections and inspection planning in the areas of criticality and operational safety to have an:

- 1) Enhanced programmatic focus on management measures, identifying problems, and corrective actions, and
- 2) Enhanced vertical slice inspections on management measures to verify that applied management measures are in agreement with the requirements specified in the license application; are adequately developed; are adequately implemented, and are adequately documented.

In response to the recommendations in the 2017 FC OpE report, the staff facilitated a knowledge management (KM) session. The session focused on the preparation and execution of inspections while incorporating insights of operating experience and recommended best practices. In addition, the KM session included an overview of the FC OpE Database and applicable guidance as tools to prepare for an inspection. Region II continues implementation of the 2017 FC OpE report recommendations.

### 3.0 Conclusions:

Based on the reported events this year the staff concludes:

- 1) An analysis by performance area highlights that the most common areas for reported events continue to be criticality and operational safety. In addition, the staff observed that the events reported under these areas in 2018 were related to unanalyzed conditions, failures in CAAS, and dermal exposures.
- 2) Given the low safety significance of reported events in 2018 as compared to events reported in the previous four (4) years, at this time, the staff does not have any additional recommendations for the inspection program.

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<sup>1</sup> The complete list of performance areas is documented in NMSS Policy and Procedure (P&P) 6-14.

<sup>2</sup> See 2017 FC OpE Report, Agencywide Documents Access and Management System Accession Number ML17362A161

- 3) Some of the contributing factors associated with the events in 2018 were failures or degradation in management measures (i.e., configuration management, maintenance).

#### **4.0 Recommendations:**

- 1) The staff should consider including an evaluation of its implementation of the 2017 FC OpE report recommendations as a topic for self-assessment per Inspection Manual Chapter 2650 “Fuel Cycle Inspection Assessment Program.”
- 2) Although no additional actions are recommended beyond 2017 FC OpE Report as a result of 2018 update, the staff should continue to study reported events to identify any focus areas, changes, or trends.