

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS  
WASHINGTON, DC 20555-001

September 2, 2015

NRC INFORMATION NOTICE 2015-08: CRITICALITY AND CHEMICAL SAFETY EVENTS INVOLVING UNANALYZED CONDITIONS AND UNANTICIPATED UNAVAILABILITY OF IROFS AT FUEL CYCLE FACILITIES

## ADDRESSEES

Those holders of a materials license, certificate, approval, or registration, including those holders of and applicants for a source material license, under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 40, "Domestic Licensing of Source Material," or fuel cycle facility license under 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material," and that are subject to regulations in 10 CFR Part 70, Subpart H, "Additional Requirements for Certain Licensees Authorized To Process a Critical Mass of Special Nuclear Material."

## PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to inform addressees of recent operating experience involving deficiencies with evaluations of credible high and intermediate consequence accident sequences in facility integrated safety analyses (ISAs), delineation of items relied on for safety (IROFS) boundaries, and implementation of effective management measures to ensure the availability and reliability of IROFS. These deficiencies resulted in unanalyzed conditions or unavailability of IROFS established to minimize the likelihood of high or intermediate consequence events.

The NRC expects recipients to review the information for applicability to their facilities and to consider actions, as appropriate, to avoid difficulties in compliance with regulations. Suggestions contained in this IN are not NRC requirements; therefore, no specific action or written response is required.

## DESCRIPTION OF CIRCUMSTANCES

This IN describes four separate examples involving improper or incomplete analysis of credible plant conditions and identification and implementation of reliable safety controls. The events do not constitute a trend. However, there is general applicability with respect to the conduct of accident evaluations that could benefit safety when considered at other facilities. Although NRC staff acknowledges it is not possible to anticipate all potential process upsets, licensees should consider what happens in the industry to prepare for these upsets in their facilities and processes. This IN notes several events that have occurred recently in industry.

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## BACKGROUND

The regulations in 10 CFR 70.61, "Performance Requirements," establish performance requirements that licensees shall evaluate in their respective ISAs. Licensees must demonstrate that the risk of credible high- and intermediate-consequence events, which can significantly affect occupational or public health and safety or the environment and nuclear criticalities, are limited such that the likelihood of a high-consequence event is highly unlikely and the likelihood of an intermediate-consequence event is unlikely. This regulation also requires that controls designated as IROFS shall be ensured to be available and reliable to perform their intended function when needed through the implementation of a system of management measures.

## DISCUSSION

*Event 1:* During periodically scheduled checks of equipment at a fuel fabrication facility, a licensee discovered a small amount of moisture inside an unfavorable geometry feed container that had been used to feed material to a dry conversion system. The system used two IROFS to prevent the accumulation of significant quantities of moisture (a moderator) in the moderator-controlled feed container. The licensee's investigation into the event identified a failed dew-point sensing system that was part of a designated IROFS. This IROFS system was interlocked with valves that closed to stop flow if moisture content in the process exceeded the expected setpoint. The dew-point sensing system failure occurred because of design and installation errors that prevented proper operation.

A second IROFS, also credited in the ISA to limit the risk of significant moderator accumulation, was found to be compromised as well. This administrative IROFS consisted of a computer alarm that indicated a drop in monitored holdup pressure between two isolation valves. A reduction in pressure in the system indicated degraded valve performance. Operators would be expected to act promptly because of a possible loss of integrity of the valve system. This IROFS was found to be unavailable because the alarm had been suppressed during previous system maintenance. An authorized individual suppressed the alarm in accordance with an approved procedure. However, the procedure did not require that suppressed alarms be reset or functionally tested after maintenance. This combination of failures represented an apparent loss of all IROFS for the accident sequence, as documented in the licensee's ISA.

Two aspects of this event are of particular interest for consideration by other licensees. The first relates to the dew-point sensor that was found to be inoperable because of moisture in the sampling train flow meter. While management measures are required to ensure IROFS are available and reliable, the surveillance established for the dew point sensor functionally tested the sensor output but did not verify the operation of the sampling line and the process inputs to the sensor. This is an example of inadequate management measures being applied to maintain the control's availability and reliability.

The second aspect similarly relates to the suppressed alarm. The alarm and resulting operator action were designated as an enhanced administrative IROFS. Management measures were applied to the IROFS; however, surveillance and testing only verified that an alarm logic signal was generated at the proper set point and did not verify that the operators received the alarm. This allowed a situation to occur in which, during maintenance, the alarm indication (a visual indicator on the control screen) was suppressed. This condition was then overlooked upon completion of the maintenance and verification that the logic signal was generated. Because

the control system's alarm was suppressed, the alarm indication was not communicated to the operators as intended. This is also an example of inadequate management measures (functional testing) being applied to ensure a control's availability and reliability, which is especially important following maintenance activities.

*Event 2:* Operators involved in uranium recovery at a facility initiated a cleanout of dissolver residue from a catch tray. The catch tray is a single continuous shallow tray beneath several dissolvers and filters that are used to process recoverable (although relatively small) quantities of highly enriched uranium. The procedure for the cleanout instructed operators to scrape or sponge the accumulated material in the catch tray into less than or equal to 2.5 liter (L) containers and handle the containers in accordance with waste handling procedures because the uranium content was unknown. In this instance, the operators deviated from established guidelines and scraped accumulated material into four to five large piles, some exceeding 2.5 L in volume, as an interim step before loading the material into containers. The piles were left in place at shift turnover and discovered by supervision during the following shift, at which point the abnormal condition was identified. The licensee had the material placed into 2.5 L containers and had them weighed and assayed before continuing operations. The licensee evaluated the condition and identified an accident sequence in the ISA that was believed to be bounding (using greater than 2.5 L containers to collect the waste). However, during subsequent assessment of the condition, NRC inspectors determined that none of the licensee's existing evaluations adequately addressed the situation encountered.

Of particular note in this event is that, while controls were established for dissolution and processing of materials, as well as for handling of waste in less than or equal to 2.5 L containers, the licensee failed to adequately consider credible upsets for the transitional phase of gathering spilled solid materials (as opposed to solutions) from the catch tray into the less than or equal to 2.5 L containers. The procedure being followed was inadequate to ensure that operators did not scrape the materials together into an unsafe geometry. Diligence must be exercised in assessing evolutions involving maintenance to ensure consideration is given to potential upsets, deviations, or unsafe conditions that can occur when transitioning from one subcritical state to another. The failure to analyze and establish controls for the situation did not ensure the process remained subcritical. The licensee's immediate corrective action was to eliminate cleanout activities of the low level dissolvers until such time as the procedure could be revised to provide clarification and establish suitable controls to ensure subcriticality.

*Event 3:* During troubleshooting of instrumentation problems associated with a resistance temperature detector connected to an evaporator system, the licensee identified approximately 3 ounces of special nuclear material mixture pooled in a thermowell and junction box. The junction box was connected by sealed conduit to an unfavorable geometry electrical panel. The thermowell had developed a pinhole leak that allowed the material to enter the junction box through the electrical conduit. The consequences associated with possible accumulation of fissile solutions associated with failure of the thermowell and the electrical conduit seals had not been considered by the licensee, resulting in an unanalyzed condition.

As an immediate corrective action, the licensee installed drains in all unfavorable geometry electrical boxes connected to process equipment by conduit. As a longer term corrective action for geometry control, the licensee plans to install similar drains in all existing unfavorable geometry electrical boxes, regardless of whether or not a box is connected to process equipment by conduit. The licensee is also revising procedures to ensure that drains are present in all unfavorable geometry boxes before installation. Once this geometry control is established, the relevant accident sequence involving a leak through conduit (or other such

connections and penetrations in liquid bearing systems) is bounded by a previously evaluated sequence in the ISA. It is important that consideration be given to all potential pathways for fissile solution to reach unfavorable geometry, including equipment connections and electrical conduits.

*Event 4:* During the review of operational data at a facility, the licensee staff determined that the original assumptions used in evaluating the potential likelihood of a credible accident sequence in the dry conversion process might have been nonconservative. Specifically, the licensee noted during review of plant records that the initiating event frequency assigned for a specific chemical accident sequence had occurred twice in a 17-year period. Because the licensee's ISA had used an initiating event frequency of 0.1 events/year, it determined that the failure frequency assumed in its ISA was nonconservative. NRC staff considered this event to be inconsequential because the change identified in the initiating event frequency was not statistically significant and, as such, did not result in a failure to comply with performance requirements of 10 CFR 70.61.

Nonetheless, NRC staff considers this event to be of general interest because it is appropriate for licensees to review operational data to validate its analysis of event sequences in their ISA and to look for trends that may indicate degrading performance that may need to be addressed. The regulation in 10 CFR 70.62(a)(3) requires licensees to maintain records of failures or degradation of IROFS and management measures that lead to the performance requirements not being satisfied. While caution must be exercised in drawing conclusions about the reliability and availability of IROFS from a small number of such failures, it is appropriate for licensees to periodically examine operational data (including failures and degradation of IROFS as well as occurrences of other initiating and enabling events) and reevaluate the continued validity of the analysis, including failure frequencies, in their ISAs, as part of maintaining safety analyses up to date with observed system performance.

## **CONCLUSION**

As stated in the Description of Circumstances section, these events do not constitute a trend; however, because there is general applicability with respect to the conduct of accident evaluations that could be of benefit to safety when considered at other facilities, the NRC believes that licensees might benefit from evaluation of conditions at their facilities considering the circumstances of these events.

## CONTACTS

This IN requires no specific action or written response. Please direct any questions to the technical contact listed below.

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Note: NRC generic communications may be found on the NRC public Web site,  
<http://www.nrc.gov>, under NRC Library/Document Collections.

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