UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
WASHINGTON, D.C. 20555

August 13, 2010

NRC INFORMATION NOTICE 2010-16: FAILURE TO DISABLE UNSAFE GEOMETRY BANDSAW RESERVIOR RESULTS IN CRITCALITY SAFETY-RELATED ALERT

ADDRESSEES

All licensees authorized to possess critical mass of special nuclear material.

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to alert addressees to a concern arising from inadequate verification of new items relied on for safety (IROFS) during an engineered change to equipment. NRC expects that recipients will review the information for applicability to their facilities and consider actions to avoid similar problems. Suggestions contained in this IN are not new NRC requirements; therefore, no specific action or written response is needed.

BACKGROUND

B&W Nuclear Operations Group, Inc. (licensee) manufactures high-enriched uranium fuel, reactor core components and reactor cores for public and private sector customers at its Lynchburg, Virginia, facility. The licensee uses a large horizontal band saw, shown in **Figure 1**,

Figure 1
Band saw

ML100540070

to cut fissile components during preparation of samples which may be requested by customers for destructive analysis. The licensee had performed cutting operations with the band saw for many years in its original configuration shown in **Figure 2**. In this original configuration, the band saw re-circulated cutting fluid through a 60 liter (15 gallon unsafe geometry) reservoir to lubricate and cool the saw blade and component during cutting operations.

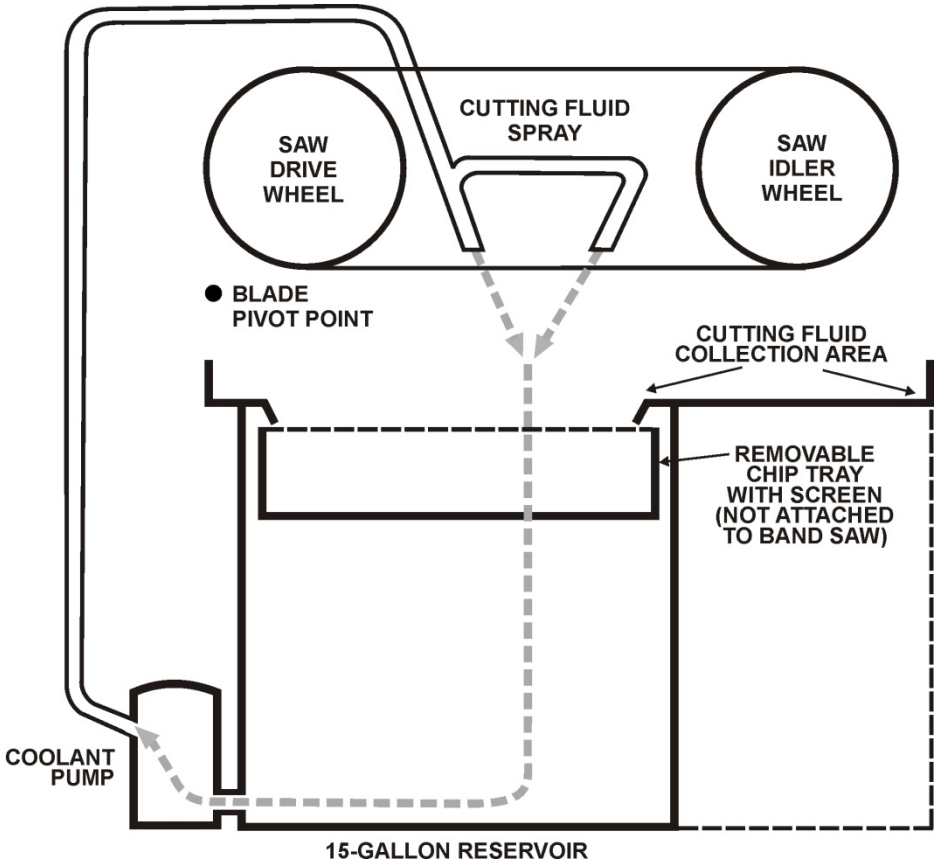

Figure 2
Original Band Saw Configuration

In 2003, based on the need to prepare samples for evaluation, the licensee decided to move the band saw to its current location. Criticality safety analysis of the proposed relocation resulted in the requirement that the band saw cutting fluid system include favorable geometry components. This resulted in the installation of a new external cutting fluid reservoir as shown in **Figure 3**. To facilitate use of the new favorable geometry cutting fluid reservoir, a new chip tray was designed and substituted for the previous chip tray that had a screen on top of the old cutting fluid reservoir as shown in **Figures 4 thru 7** on the next page.

As shown in **Figure 4**, the previous chip tray with screen was replaced with a sloped tray which directed the cutting fluid out of the body of the band saw to the new external cutting fluid reservoir on the floor. The new chip tray did not have a screened bottom and fissile material chips were filtered out of the cutting fluid by a small round screen in front of the tube at the exit of the new chip tray. The modified band saw configuration is shown in **Figure 8**. During cutting

Figure 3
External Safe Geometry Column

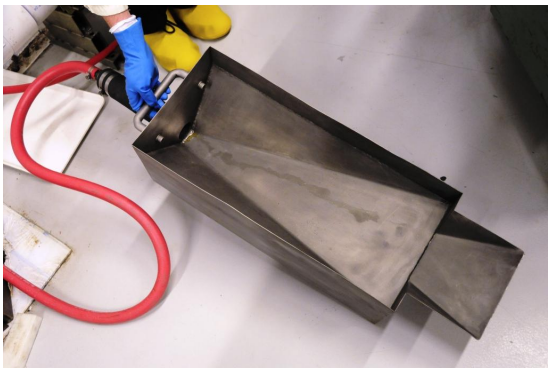

Figure 4
Modified Chip Tray

Figure 5
Chip Tray Location

Figure 6
Chip Tray Pulled Out of Saw

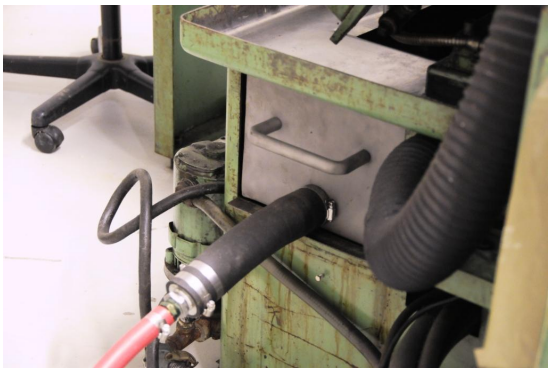

Figure 7
Chip Tray in Position

operations with the modified band saw, the cutting fluid is pumped from the new external cutting fluid reservoir back to the spray nozzles, collected by the removable cutting fluid tray and drained back to the new external cutting fluid reservoir. Only a limited amount of cutting fluid remains in the new chip tray. When this modification was implemented, the licensee safety organization, using a procedure known as a criticality safety release, directed that the old cutting fluid reservoir, formed by the body of the band saw, be disabled. The nuclear safety release for the modified band saw specifically stated "*If each machine has a built in coolant* [cutting fluid] *reservoir it shall be disabled such that it is not usable*." No specific instructions were provided in the release for disabling the old cutting fluid reservoir on the band saw and no actions were taken by the licensee during installation to disable the old cutting fluid reservoir.

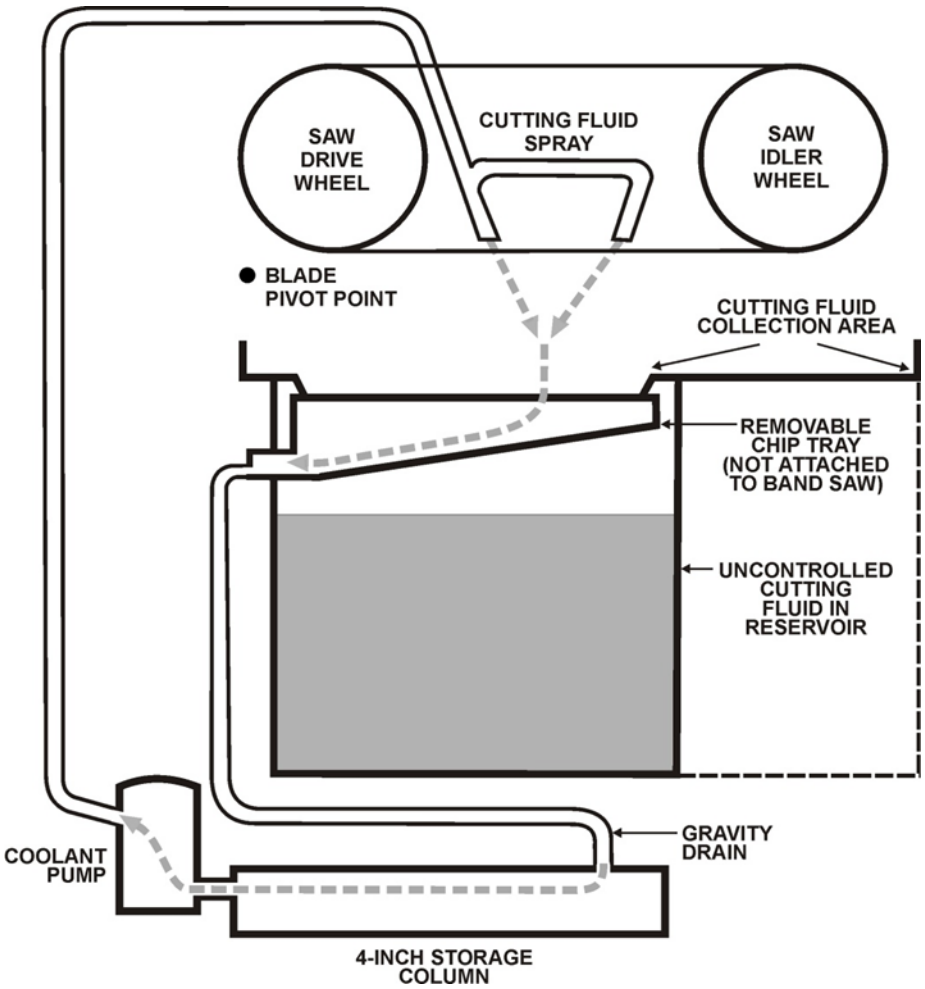

Figure 8
Modified Band Saw Configuration

As shown in **Figures 5 and 6**, the old cutting fluid reservoir could not easily be seen even with the new chip tray removed and the operators had no reason or motive to look during routine operations. The licensee always used the same two operators with the band saw and these operators were trained and experienced enough to know that solution in the old cutting fluid reservoir was an upset condition.

DESCRIPTION OF CIRCUMSTANCES

On July 15, 2009, while the band saw was in operation cutting a fissile component, a band saw operator observed cutting fluid leaking from a screw hole in the band saw body and the licensee shut down the cutting process. Licensee safety personnel subsequently removed the new chip tray from the band saw and found that the old cutting fluid reservoir was nearly filled with cutting fluid. The reservoir had a base of approximately 12 inches by 24 inches and was filled with cutting fluid to a depth of nearly 14 inches. These dimensions are unsafe for highly enriched U-235 solutions and mixtures. The licensee declared an Alert and took actions to restore control of the band saw including evacuating the areas near the saw, preparing a sampling procedure, and performing sampling to assure that criticality would not occur during removal of the cutting fluid from the reservoir. Subsequent to the sampling, the licensee drained the solution from the reservoir and estimated that it contained 51 liters of cutting fluid and 13.76 grams of U-235.

The licensee subsequently determined that it was possible for cutting fluid to pass by the new chip tray and enter the old cutting fluid reservoir because the new chip tray was removable and the old cutting fluid reservoir was not sealed. It was possible during operations for cutting fluid to splash upward, pass around the new chip tray and enter the old cutting fluid reservoir. Also, one to two liters of water were used to clean the band saw every day and cleaning water could also enter the old cutting fluid reservoir. The licensee noted that, during operations, an average of a liter of cutting fluid was added to the system each day to make up for losses including losses to the old cutting fluid reservoir. The licensee also determined, based on analysis of the cutting fluid found in the old cutting fluid reservoir and the likely mode of entry for fluid, that the old cutting fluid reservoir was probably filled at least halfway with fresh cutting fluid during relocation as would be normal if the band saw had not been modified. NRC determined that the old cutting fluid reservoir would likely become critical at approximately 9 to 10 inches depth with sufficient mass.

Prior to adding the external safe geometry column, the licensee assured criticality safety for the operation by estimating the maximum mass that could be removed in a single cut on a component and then using a mass log to track the number of cuts performed on that component. When 350 grams was approached or cutting on the component was complete, the licensee removed the cutting fluid, cleaned the old cutting fluid reservoir and replaced the cutting fluid. Based on the operations of the band saw, cutting any single component could not result in more than 780 grams (the licensee's safe mass limit) of fissile material accumulating in the old cutting fluid reservoir before the cutting fluid was replaced. This method had provided criticality safety protection for the band saw for many years[1].

<u>Corrective Actions</u>

The licensee performed extensive corrective actions including:

- Facility extent of condition review walkdowns.
- Facility nuclear safety release requirements review for the last 10 years to identify similar problems.

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[1] Additional discussion and analysis of the band saw event is contained in Inspection Report 70-27/2009-006 (ML092870702).

- Nuclear safety release procedure revisions to include specific instructions for verification.
- Nuclear safety release peer checking system development and implementation.
- DoAll saw modification design and implementation.
- Integrated safety review of the sectioning facility including development of a new DoAll saw criticality safety analysis.
- Favorable geometry coolant system failure mode analysis.

DISCUSSION

NRC considered what safety margin remained in the above upset condition. Based on sampling of the cutting fluid found in the old cutting fluid reservoir, many years would have been required before a number of cuts were performed that would have made 1800 grams of U-235 available to the old cutting fluid reservoir. Also, the intended function of the new chip tray was to remove chips from the cutting fluid through screening or settling and NRC determined that the tray had worked as designed. As a result of these two factors, NRC concluded that criticality in the reservoir remained unlikely during the upset but that double contingency protection had been lost. For normal and upset conditions, NRC expects that criticality will be highly unlikely or that double contingency protection will be provided.

NRC noted that the amount of cuts made during the upset was fortuitous and that the new chip tray design was not implemented as a criticality control. Therefore, changes to the number of requested cuts, the new chip tray design or the band saw operating procedure could have led to a different result. The above event represented an unacceptable loss of control.

The licensee had a system for ensuring implementation of new and changed criticality safety controls called a nuclear safety release. This system required the responsible criticality safety engineer to place pre-operational requirements in the engineering change package which would be verified before the safety signature was received approving use of the new or changed equipment or process. This system had worked well for many years but can be seen to depend on the judgment and thoroughness of criticality safety engineers in establishing and verifying pre-operational requirements.

NRC is concerned about licensee management measures used to assure that IROFS are not compromised during the change process. In the situation described above, either more detailed pre-operational requirements or a more thorough review of the stated requirement may have prevented the event. NRC expects management measures at fuel cycle licensees to maintain the availability and reliability of IROFS.

Failure to adequately verify planned equipment modifications affecting criticality safety can result in failure to establish necessary controls or the compromise of established controls. NRC safety inspections will routinely review licensee facility operations to ensure that plant changes are adequately evaluated, implemented and verified. These inspections will include review of licensee change management procedures to ensure that analytical assumptions are not compromised during or after implementation.

CONTACT

This information notice requires no specific action, nor written response. If you have any questions about the information in this notice, please contact the technical staff listed below.

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