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MEMORANDUM FOR: B. Grimes, Chief, Environmental Evaluation Branch

FROM: G. Cwalina, Environmental Evaluation Branch

THRU: L. Barrett, Section Leader, Environmental Evaluation Branch

SUBJECT: MONTICELLO TRIP REPORT

On October 7, 1977 I visited the Monticello Nuclear Plant to observe the licensee's effort to maintain occupational radiation exposures to "as low as reasonably achievable" (ALARA) during repair of the feedwater nozzles. The licensee was engaged in repair of the nozzles utilizing a milling machine designed by GE. Because of the generic nature of the problem (see NUREG-0312, "Interim Technical Report on BWR Feedwater and Control Rod Drive Return Line Nozzle Cracking") and high occupational exposures associated with past repair efforts, the staff is concerned with licensees' efforts to reduce these exposures to ALARA values. There are several methods used to keep occupational exposures ALARA, such as training, decontamination, shielding and development of special tools which reduce exposure time. These techniques, as utilized by Monticello, are discussed in the following paragraphs.

The majority of work performed was done by contract (GE) personnel. These workers were trained on a full scale mockup using the actual tool which was used to remove the cladding from the nozzle. In addition, any local workers must view a videotape of the training session before they are allowed to enter the work area. Daily meetings are held to plan all activities in order to keep occupancy times in high radiation areas as short as possible.

The work area was decontaminated using a "hydrolasing" (high pressure water spray) technique. The decontaminated areas include the reactor vessel walls, reactor cavity and the operating floor in the vicinity of the reactor cavity. Radiation surveys indicated dose rate reduction factors of 2-5 were achieved by hydrolasing.

Extensive shielding was used to reduce dose rates in the work area. (The work was performed with the core in place.) GE designed the shield plug to be used over the core region. This plug consisted of 33 inches of concrete with a 1 1/4 inch steel plate on each side. The plug is a single unit and weighs about 50,000 pounds. The licensee stated that an analysis was done to determine the consequences of dropping the shield plug on the core. The result was the consequences would not exceed those of dropping the steam separators and dryers. The analysis was reviewed by the plant safety committee which concluded that dropping the plug would not constitute an

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unreviewed safety question. We understand PSB personnel informally reviewed the plug design, handling and support systems. The shield was supported by a series of small beams which rest on the core shroud. The top of the plug was about 74 inches above the top of the active fuel. Shielding of the core spray line was accomplished by setting lead shields vertically in front of the line, placing a board resting on the vertical shield and the spray line and covering the board with lead blankets. This shielding arrangement was about 12 inches below the centerline of the feedwater nozzles. The nozzle area, including the feedwater spargers, was shielded by hanging lead shields by pulleys attached to the steam dryer support lugs. These shields are suspended around the entire circumference of the vessel. In order to work on a nozzle, the shields in that nozzle area only are raised so that the remaining nozzles and vessel walls are still shielded. The shielding techniques lowered the dose rates in the area by a factor of 8-10. The dose rate at waist level on the shield plug was 500 mr/hr after shielding and before sparger removal whereas before shielding and after hydrolasing the level was in excess of 4 R/hr. After sparger removal, the level dropped to 300 mr/hr. A sketch of the shielding arrangement is included as Figure 1.

The milling tool in use was developed by GE specifically for the BWR feedwater nozzle cracking problem. Past repairs were made by flapper wheel grinding the nozzles to remove all the cladding. This method required long exposure times. Flapper wheel grinding also causes high airborne particulate activity due to the small sized particles. The new machining technique requires a minimum of flapper wheel grinding to only smooth the nozzle surfaces and then the use of the milling machine to actually remove the cladding. The machine operates at 5-10 RPM using either a rough or fine cutting head. The resultant chips are about 10 mils thick and are collected in a basket located under the nozzle. Occupancy in the grinding zone is necessary only to set the machine and change the cutting heads. All grinding is done automatically, thus greatly reducing occupancy times in the zone. In addition, a continuous water spray impinges on the nozzle which will wash out any small grinding residue. The area was ventilated by a portable air hose which drew 4000 cfm of air from the work area and exhausted it to the containment after passing it through a HEPA and charcoal filter. Workers in the radiation area were carefully monitored for radiation exposure and occupancy time. Full protective clothing including respirators equipped with particulate filters, was required at all times in the work zone.

The work areas on the refueling floor and inside the vessel were continuously monitored. The refueling floor area was monitored using the instrumentation as designed for the plant during normal operations. The vessel work area was monitored by an area radiation monitor located inside the vessel with a readout on the refueling floor and by a continuous air monitor which drew air from the work area near the nozzle at approximately head level. During milling

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operations, the area radiation monitor was reading from 150-200 mr/hr in the vessel. During the flapper wheel grinding the airborne activity in the vessel work area increased to about 90 MPC and the refueling floor airborne activity.was about 1 1/2 MPC.

Radiation protection procedures were formulated in advance of all work and distributed to the plant radiation protection group. A copy of the memos sent to personnel are included as Enclosure 1a and 1b.

A copy of the outage timetable, including the nozzle repair work, is included as Enclosure 2.

The overall plant ALARA programs seems to be well planned and executed. Similar type work was performed at Monticello in 1975 consisting of replacement of the feedwater spargers and examining the nozzle areas for cracks. The early work was done without a core shield and required considerably less work than the recent maintenance. Plant personnel estimate exposure of the present work will be about 1/3 of that previously experienced. It is hoped that experience gained from the Monticello repair can be utilized at other facilities to aid in reducing their occupational exposures during this and other repair jobs.

G. Cwalina
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Division of Operating Reactors

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