Central Files

NOV 11 1977

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
Environmental Evaluation Branch
Division of Operating Reactors

Enclosures:
As stated

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| DATE ➤ | | | | 11/11/77 | 11/11/77 | 11/11/77 |

# SHIELDING/RIGGING ARRANGEMENT

Top of active Fuel - 351.5"

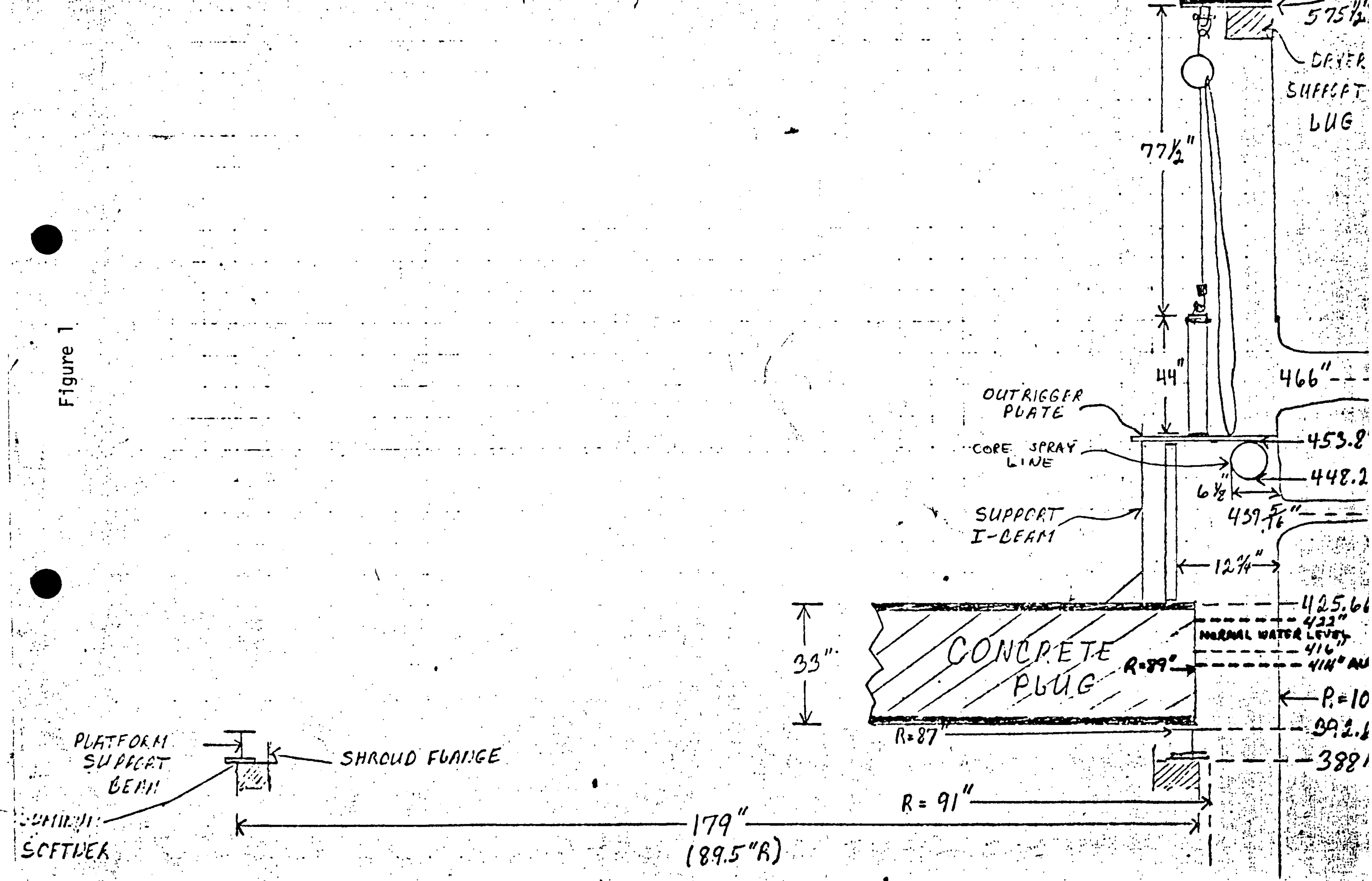


Figure 1

INTERNAL CORRESPONDENCE
FORM 17-3467

Enclosure 1a

DATE July 29, 1977

FROM F. L. Fey, Radiation Protection Supervisor — LOCATION Monticello

TO M. H. Clarity, Supt., Plt. Engr. & Rad. Prot. — LOCATION Monticello

SUBJECT Radiation Exposure Considerations for the Feedwater Sparger Work

In the interest of maintaining radiation exposures ALARA during the feedwater sparger work to be performed during the Fall 1977 Refueling Outage, I am making the following recommendations:

1. The vessel walls should be deconned with a high pressure "hydrolazer". A rig should be fabricated which will allow a person to be lowered into the vessel on the center line with equipment which will allow him to maintain the hydrolazer nozzle within 150 cm of the vessel wall. This will require an extension and outriggers to counteract nozzle thrust.

2. The contamination flushed from the walls will accumulate in the reactor water some of which may tend to float. This "crud" should be removed inorder to reduce the exposure from this source. The reactor cleanup is not very effective in cleaning up this activity. A pump should be provided to pump this water to the fuel pool sKimmer surge tanks.

3. The work platform should be constructed as to provide a minimum of 6 feet of water above active fuel and 2" of lead or equivalent to shield workers from the fuel. or equivalent, [initials]

4. The walls of the vessel should be provided with 2.5 cm of lead (or equivalent) over approximately 90% of the circumference from the work platform to a height of at least 6 feet. (1" Steel from Core Spray header up to 6') [initials]

5. The exposed portion of the core spray lines should be provided with 5 cm lead (or equivalent) shielding. (Had to accept 2.5cm.) [initials]

6. The core spray lines must be thoroughly flushed to remove contaminated crud.

Larry Nolan is pursuing items 1 and 2. Items 3, 4, and 5 should be incorporated in the platform design. Number 6 should be handled by procedure.

[signature] Fred L Fey

F. L. Fey
Radiation Protection Supervisor

FLF/kik

ARM Unit in Vessel,
CAM Monitoring in Vessel.

INTERNAL CORRESPONDENCE
FORM 17-3427

Enclosure 1b

DATE September 29, 1977

FROM F. L. Fey, Radiation Protection Supervisor — LOCATION Monticello

TO Radiation Protection Group — LOCATION Monticello

SUBJECT Radiation Protection Memo #77-11
Radiation Protection Requirements for Feedwater Sparger Work

1.0 PURPOSE

This memo establishes radiation protection requirements for feedwater sparger work.

2.0 APPLICABILITY

This memo applies to all personnel working inside the reactor vessel below the head flange.

3.0 DEFINITIONS

3.1 Radiation Protection Group

Radiation Protection and Chemistry Specialists employed by Northern States Power Company or contract Health Physics Personnel assigned to the NSP Radiation Protection Department.

3.2 Health Physics Personnel

Same definition as defined in Step 3.1.

4.0 RESPONSIBILITY

4.1 The Radiation Protection Supervisor has the overall responsibility and authority for insuring that adequate radiation protection precautions and instructions are provided to personnel during feedwater sparger work.

4.2 Health Physics personnel have the responsibility to insure all personnel are provided with the protective equipment/clothing and personnel monitoring devices prescribed on the Radiation Work Permit (RWP) issued for the job.

4.3 The NSP Lead Plant Equipment Operator on the floor has the authority and responsibility to stop the job and require evacuation of the work area if an unsafe condition exists.

4.4 Each individual working on the feedwater sparger job has the responsibility to comply with all verbal and written instructions provided to him by the Health Physics personnel.

5.0 REQUIREMENTS

5.1 All personnel shall be assigned and required to wear high range self-reading pocket dosimeters (0-1R and 0-10R) in the work area.

5.2 All personnel shall be required to wear a finger TLD badge.

5.3 ~~All~~ Personnel ~~shall~~ may be required to wear a personnel TLD badge. as determined by RP Coordinator.

5.4 All personnel shall be timed by individual stop watches by a HP timekeeper. All personnel shall leave the work area when directed by the HP techanician without question.

5.5 No more than six (6) individuals should be in the work area (below the head flange) at any time.

5.6 Each individual shall obtain a "Sparger Exposure Control Log" from RP Cotnrol Office prior to each entry to the Refuel Floor and return it to RP Control Office upon return from Refuel Floor.

5.7 The crane shall be manned any time personnel are below the head flange.

5.8 An alternate escape route/method shall be provided.

5.9 An Area Radiation Montior shall be located within the vessel work area and operating any time personnel are working below the head flange.

5.10 At least two (2) Health Physics Technicians shall be present on the refueling floor when personnel are entering, working in or exiting the work area below the head flange. One will be assigned to keep time and provide warning when an individual should leave the work area.

5.11 All personnel should have completed current Whole Body count before entering the work area.

5.12 All personnel shall have completed respirator training within the past year.

5.13 A Whole Body count should be performed for all personnel involved in feedwater sparger work (below the head flange) prior to leaving the site (upon temination).

5.14 A CAM shall be monitoring airborne radioactivity within the vessel anytime personnel are working below the head flange.

6.0 INSTRUCTIONS

6.1 Health Physics personnel shall complete the "Radiation Protection Sign-off Sheet" prior to each entry into the work area (at least once per shift).

6.2 Health Physics personnel shall periodically monitor the work area and establish the alarm point for area radiation monitor and CAM being used.

6.3 Health Physics personnel shall provide timekeeping for all personnel in the work area. Timekeeping shall be based on using a factor of 1.5 times the dose rate as read from the self-reading pocket dosimeter.

6.4 Health Physics personnel shall collect and count air samples at least twice per shift, in the reactor vessel and the refueling floor.

6.5 Health Physics Personnel shall survey the work area for exposure rate and smearable contamination at least once per 12 hour shift and should perform surveys following any change in shielding or contamination until they are familiar with effects of changes.

Fred L Fey

F. L. Fey
Radiation Protection Supervisor

FLF/sdd

# SPARGER EXPOSURE CONTROL LOG

DATE ________

NAME ______________________ TLD# ______

AUTHORIZED EXPOSURE ________

CHECKLIST

TLD'S

☐ WHOLE BODY

☐ FINGER RING

ESTIMATED EXPOSURE RATE ________

MAXIMUM STAY TIME ________

DOSIMETERS

☐ 10 R

☐ 1 R

☐ RESPIRATORY PROTECTION INSTRUCTION COMPLETED

READING

| 10 R DOSIMETER | | | 1 R DOSIMETER | | |
|---|---|---|---|---|---|
| IN | OUT | SUBTOTAL | IN | OUT | SUBTOTAL |
| ___ | ___ | ___ | ___ | ___ | ___ |
| ___ | ___ | ___ | ___ | ___ | ___ |
| ___ | ___ | ___ | ___ | ___ | ___ |
| | TOTAL | ___ x 1.5 = | | | ___ x 1.5 = |

CORRECTED TOTAL 10R ______ 1 R ______.

TOTAL TIME IN VESSEL ______ MINUTES.

CLOCK NUMBER

HP ON DUTY

____________

RADIATION PROTECTION SIGNOFF SHEET FOR FEEDWATER SPARGER WORK

DATE ____________________ TIME __________

**************************************************************************************

Initial

1. An alternate escape route is available.

______________ HP Technician

2. An Area Radiation Monitor is operable and operating with the instrument detector in the work area.

______________ HP Technician

3. At least two (2) Health Physics Technicians are present on the refueling floor..

______________ HP Technician

4. Air Sample has been collected and counted as indicated by 6.4 of procedures.

______________ HP Technician

5. A Continuous Air Monitor is operating and sampling the air in the work area.

______________ HP Technician

6. Smear and Exposure Survey is taken once per shift in work area.

______________ HP Technician

# MONTICELLO FALL '77 REFUEL OUTAGE

REVISION 2
AUGUST 23, 1977

Enclosure 2

9-10 SAT | 9-17 SAT | 9-24 SAT | 10-22 SAT | 10-29 SAT | 11-5 SAT

OUTAGE DAY → 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

| | DURATION (DAYS) |
|---|---|
| Reactor Disassembly | (3.3) |
| Partial Fuel Shuffle & CRD Changeout | (8.0) |
| Replace 12 LPRM's, Remove 4 Sources | |
| Vessel Internals Inspection | (1.5) |
| Cmplt CRD Work, Core Reload & Verif, SDM Test | (0.9) |
| *FW Sparger & Nozzle Work | (25.7) |
| Flood Cavity & Clean Up Reactor Water | (3.0) |
| Reactor Reassembly & Hydro | (3.8) |
| ILRT | (2.7) |
| Core Physics & ECCS Testing | (1.7) |
| Startup | (1.3) |
| | |
| Torus Drain & Decon | (4.5) |
| Torus Work (ATF) | (37.5) |
| Torus Painting & Drying | (5.0) |
| Torus Fill | (0.3) |
| Torus Inspection & Closure | (0.1) |
| | |
| DW Equipment Hatch Removal | (0.2) |
| DW Work (ATF) | (47.2) |
| DW Equip Hatch Re-Installation | (0.2) |
| | |
| Turbine/Generator Work (ATF) | (51.8) |

* SEE PAGE 2

REVISION 2
AUGUST 23, 1977

10-1 SAT 10-8 SAT 10-15 SAT 10-22 SAT

OUTAGE DAY → 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43

| FW Sparger and Nozzle Work | DURATION HRS | DURATION DAYS |
|---|---|---|
| Drain Cavity to Vessel Flange | 16 | (0.6) |
| Decon Cavity & Poly Walls | 20 | (0.8) |
| Drain Reac Below Sparger | 6 | (0.3) |
| Decon Cavity | 30 | (1.3) |
| Install Work Platform & Shielding | 34 | (1.4) |
| Remove FW Spargers | 12 | (0.5) |
| Clean FW Nozzle & Blend Radii | 30 | (1.3) |
| Dye Penetrant Test FW Nozzle | 12 | (0.5) |
| Remove Cladding | 336 | (14 ) |
| Dye Penetrant Test FW Nozzle | 12 | (0.5) |
| Install Spargers | 96 | (4.0) |
| Remove Work Platform & Shielding | 12 | (0.5) |
| TOTAL | 616 | (25.7) |