1. **RWP / Task / Risk Category / Plan Type / Exposure**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| RWP Number: | BW-01-21-00612 | ALARA Plan Number: | BW-01-21-00612 | W. O. Number: | N/A |
| Task Description: | Task 1 and 2- Core Barrel Moves- Remove and Replace Core Barrel |
| Radiological Risk Category per RP-AA-401-1002 | [x]  **High** [ ]  Medium [ ]  N/A(**IF** classified as Medium or High Radiological Risk attach RP-AA-401-1002, Attachment 1 to this plan) |
| Plan Type: | [ ]  Micro-ALARA (MAP) | [x]  **ALARA** |
| Estimated Exposure: | 0.220 | Person-Rem | Estimated Time: | 235 | Person-hours |
| Exposure Challenge Goal: | 0.198 | Person-Rem  |
|  |

1. **Expected Radiological Conditions**

|  |
| --- |
| **Task 1 and 2 Core Barrel Move Dose Rates (mrem/hr)** |
| Whole Body: | Max Expected Whole Body: | Skin: | Extremity: | Neutron: |
| <1-320 | <1-320 | <1-1000 | < 1 - 1000 | N/A |
|  |
| **Contamination (dpm/100cm2)** | **Airborne (DAC)** |
|  | <1K – 500K |  | <30 | <0.3 Particulate/IO or <1.0ParticulateIO/NG/H3 |
|  |
| **Average Alpha Ratio ** | 30,000-300: 1 | **Alpha Level:** [ ]  Level  [x]  Level  [ ]  Level  |
|  |

1. **High Risk Task Description:**

|  |  |  |
| --- | --- | --- |
| **High Risk Task / Activity** | **Concern** | **Mitigating Actions** |
| Remove and Replace Core Barrel | Potential Airborne | See “Airborne Radioactivity Mitigation Techniques” |
| Remove and Replace Core Barrel | Movement of irradiated components | Review attached IER 11-41 |

1. **Discontinue Work Criteria/ Conditions:**

|  |
| --- |
| **Tasks 1 & 2 Core Barrel Move** |
| Dose Rate: ≥ 400 mRem/hr Inside crane cabContamination Level >500K dpm/100cm2 (β/γ) (GA) >30 dpm/100cm2 (α)(GA) Airborne Concentration ≥0.3 Particulate/IO or ≥1.0ParticulateIO/NG/H3 Set up/General work activities  ≥ 5 DAC (including Part, IO, H3 & NG) Remove/Reinstall Core BarrelNoteIf the Upper Containment Cam alarms or a reading of ≥0.3 DAC is observed on the AMS-4 data screen a Field check of air samples will be performed if < 0.3 DAC, document the results and no additional analysis is required. If the field check indicates. > 0.3 DAC, the sample will be sent to Chemistry for prompt isotopic analysis. Posting protocol – If isotopic analysis indicates ≥ 1.0 DAC, 426’ shall be posted as an ARA. If sample results persist between 0.3 and 1.0 DAC for more than two hours, the area should be posted as ARA. Workers shall don Versaflos to complete the evolution or until subsequent air samples confirm < 0.3 DAC Per RPS.CAMs will be set to ALARM at 1 DAC. If the CAM alarms, air samplers will be promptly evaluated for isotopic per above and the posting and supplemental controls will be based on the results of those samples; not the CAM readings, unless the AMS-4 CAMs exceed 2 DAC.  If the AMS-4’s exceed 2 DAC the area should be posted as an ARA per above and workers shall don Versaflos to complete the evolution or until subsequent air samples confirm < 0.3 DAC Per RPS.Additional Criteria:* Any unplanned ED alarm
* Work cannot be performed as briefed
* Loss of communication
 |

1. **Hold Points:**

#### See IER11-41 Specific Hold Point Sign off’s (Attachments 1 & 2)

* RP will ensure that all non-essential personnel are removed from 426’ CNMT, 412’ CNMT and FHB Cross-town prior to Core Barrel lift**.**
* PRIOR to starting the RCFC after Core Barrel lift and move is complete, RP will validate that upper containment air quality is back to pre-lift conditions. Any deviations of this requirement must be approved by the RPM or designee.
* 1AR11/12 area monitors located on either side of the Rx Cavity will be deenergized during core barrel moves per RP-BR-920.
* If Mini-Purge is not available at the time of lift, then the following actions must be met and have RPS approval:
	+ Minimize air flow from Containment to Fuel Handling Building
	+ Limit access to the FH building with positive controls.
	+ Raise the core barrel to the highest point, verify crane operator ED settings are adequate prior to traversing the core barrel to the stand. If the settings are not adequate, the core barrel will be lowered back in place.
1. **Exposure Reduction Measures:**
* FHB Cross-town, 426’, 412 CNMT area is restricted to Lift team and support RP personnel only.
* Cross-town posted and controlled IAW NISP-RP-004 & RP-AA-376-1001. Initial posting should be No Entry / Entry will be thru the 401’ Emergency Hatch Interlock Only.
* RP supervision review radiological condition changes as a result of these movements:
	+ Dose rates increase as Core Barrel is raised.
	+ Dose rates at the handrail will increase as Core Barrel is exposed above the cavity water. The same applies as component is returned from the Lower Cavity to the vessel.
* These movements shall be remote using cameras, headsets and guide ropes. The Work Supervisor shall assign duties to each worker and establish the command and control criteria for directing each lift.
* RP SHALL be present for the removal of items from the cavity IAW NISP-RP-010 & RP-AA-300-1005.
* Verify maintenance crane is in proper position prior to connection Polar Crane to Core Barrel.
* The Core Barrel will be lifted to the highest elevation. If polar crane operator’s ED dose rate alarms, lower the Core Barrel back into the water. RP and Lift Supervisor will evaluate lift evolution and ED settings prior to continuing.
* Maintain maximum water level (as allowed by Operating Procedure and/or current conditional restrictions as declared by operating) in the cavity (shielding value).
* Surveys will be conducted and documented after each movement. RP will rope off and post any areas IAW NISP-RP-004 & RP-AA-376-1001.
* Polar Crane cab must be shielded prior to dry run and actual lift evolution.
* Teledosimetry will be worn by Polar Crane operators and rope tenders in FHB. Monitoring should be performed outside of CNMT.
* RPT’s to utilize RAD UV-1G headset intercom system or another form of communication such as radios for this evolution.
* Access to CNMT 412, 426’ elevation and PZR will be controlled by RP prior to lifts. RP verifies only assigned individuals are in the work area prior to lifts.
* RPT with be posted as guards, positioned at the 2 stairways on 401’ OMB leading to 412’ and at any scaffold erected where personnel can access the SG coffins.
* Other CNMT workers are limited to 401’ elevation and below.
* Control access to the PZR coffin from the ladder on 401’ IMB Pump deck by installing ladder lock.
* Workers will use the specialty ALARA tools provided i.e. cameras, WRM’s/RAD-31’s, RAD UV-1G, to reduce exposure. Cameras are used to align and move components in conjunction with radios.
* RP to evaluate dosimetry placement for each evolution IAW RP-AA-210.
* Polar crane operators (2) shall be the only workers in CNMT above the 401’ elevation.
* RXS Supervisor shall verify the cavity cameras are in place for alignment of components.
	+ Stop all welding and grinding activities in areas to be evacuated at least 45 minutes prior to lift. This is to avoid conflict with the 30-minute post welding and grinding fire watch duties.
	+ Position RDS-31’s, WAM’s and WRM’s for area dose rates during the lift: See attached map
* Outside the shielding on the Polar Crane cab (WRM)
* On sides of Rx Cavity (RDS-31’s)
* On Refuel Bridge (RDS-31’s)
* Equipment Hatch (one inside CNMT & one on FHB side (RDS-31’s)
* 426’ CNMT OMB at Polar Crane access ladder (RDS-31’s)
* 401’ Pump Deck (WAM)

**NOTE**:

The CAM locations have been established to limit the radiation impact from the Core Barrel causing false alarms.

* Continuous Air Monitors (CAM’s) are required to be running during this evolution. CAM’s shall be set up:
	+ By equipment hatch behind Concrete Wing Wall and
	+ By the reactor head stand behind concrete Wing Wall or location approved by RP.
1. **Contamination Control Measures:**
	* General area deconning frequencies will be established as a result of contamination surveys.
	* Smears will be taken on 426’ after the core barrel lift is complete, and prior to work commencing.
	* Deconner’s are available and staged in 426’ FHB.
* Utilize RP-AA-300-1002 for guidance on the detection, evaluation, control, and release

of items or areas, which contain Electron Capture (EC) Isotopes.

* Utilize Alpha monitoring guidelines IAW NISP-RP-002 & RP-AA-302 to provide instructions for the collection, handling and analyzing of smears.
* Survey all equipment leaving the cavity water. All equipment must be rinsed, bagged and labeled IAW NISP-RP-004 & RP-AA-376-1001 by an RPT.
1. **Airborne Radioactivity Mitigation:**
* A contamination barrier shall be installed in the 426’ containment hatch, the 401’ brown security door or CAF butcher doors shall be closed to prevent a wind tunnel affect from blowing up on 426’ elevation.
* 1 hour prior to start of Core Barrel lift, RP FLS will verify that no RCFC is in operation. RP FLS covering the work activity will validate this with the RP OCC representative
* 1 hour prior to start of Core Barrel lift, RP FLS will verify that CNMT Mini-Purge exhaust is in operation. RP FLS covering the work activity will validate this with the RP OCC representative.
* Airborne concerns increase when exposing the large portions of the Core Barrel break the water surface. RPT’s will monitor airborne levels and may direct workers to place the Core Barrel in a safe condition and evacuate the area if concerns arise.
* Engineering controls will be used to prevent the spread of airborne contamination from inside CNMT to the FHB. The engineering controls will include a tarp over the equipment hatch. The engineering controls shall not hamper mechanical manipulation of the lift equipment.
* Delaying movement of Core Barrel after breaking water surface increases risk of components drying and causing airborne contamination. (WM or Demin) water hoses shall be staged to keep exposed internals surfaces wet if a delay and a major drying of the exposed components should occur.
* PRIOR to starting the RCFC after Core Barrel is complete, RP FLS will validate that upper containment air quality is back to pre-lift conditions. Any deviations of this requirement must be approved by the RPM or designee.
* Air sample results must be less than or equal to pre-lift levels (< 0.3 DAC) prior to release of the 426’ elevation for general work.
1. **Operating** **Experience and Lessons Learned:**
	* See Attached
2. **Exposure Analysis: (e.g., site historical best, challenge exposure goal, etc.)**

|  |  |  |  |
| --- | --- | --- | --- |
| Last Performed | Job Description | Actual Exposure | \*Actual Hours |
| B1R23 | Core Barrel / Lower Internal Inspection | 0.217 P-Rem | 278 |
| B1R17 | Core Barrel / Lower Internal Inspection | 0.244 P-Rem | 201 |

1. **ALARA Task Plan:**
	* See Attached Exposure Estimate Spreadsheet
2. **Evaluation Discussions as applicable:**
	* TEDE ALARA Evaluation
* This ALARA plan covers multiple tasks. See attached TEDEs.
1. **Plan for Transport of High Dose Rate Components:**
* **Transport of High Dose Rate Components** will be performed in accordance with A1R22 trash plan and/ or all applicable procedures.
1. **Plan for Disposal of Highly Radioactive Material, including fluids:**
* Follow guidelines established in NISP-RP-007.
* Disposal of highly radioactive material will be performed in accordance with A1R22 trash plan and/ or all applicable procedures.
* A High Rad Transfer Plan will be established for any material >80 mrem/hr. @ 30cm.
1. **Special Dosimetry Requirements / Remote Monitoring / Multiple Dosimetry / EDEx:**
	* Teledosimetry for polar crane operators
	* See A1R22 Remote Monitoring Plan
2. **Contingency Plans:**

**Dose rates > Section 4 Discontinue Work Criteria**

* Exit area immediately
* Notify RP Supervisor
* ALARA to evaluate additional dose reduction techniques and revised dose estimates ad necessary
* RP Supervisor/ALARA approval required prior to recommencing work

**Contamination Levels**: **> Section 4 Discontinue Work Criteria / Conditions**

* ALARA to perform TEDE ALARA evaluation and provide results to the RP Supervisor.
* Revise dose estimate and Planned Recognized Risk Personnel Contamination if applicable.
* RP Supervisor approval required prior to recommencing work.

**Airborne Concentration**

Any indication of stop work airborne conditions during the lift/moves RPS will initiate steps for essential workers to don FFNP or PAPH and finish the evolution. RP will appropriately post and control the area. Air samples on 412’, 401’, and 377’ will be evaluated with field check first then by the chemistry counting room to ensure those elevations are < 0.3 DAC.

 **Any unplanned ED alarm**

* Exit the area immediately
* RP Supervisor to evaluate performing additional surveys.
* Complete applicable sections of RP-AA-203-1001 and forward to RP Supervision for final
* approval. An RP level 4 manager or above is required to approve removal of the access system.

**If work occurs outside the briefed scope**

* Exit the area immediately
* Contact work supervisor and RP Supervisor discuss with all parties a resolution to get the work back on track.
1. **Briefing Requirements:**
	1. **RP Briefings**
* An RP or ALARA brief does not fulfill the requirements of an independent High Radiation Area (HRA) or Locked High Radiation Area (LHRA) briefing. DO NOT enter and HRA(s) or LHRA(s) without the appropriate area specific briefing IAW NISP-RP-005 attachment.
* Approval for Working in an Area > 1500 mrem/hr Radiation Field and/or ED Accumulated Dose Alarm Greater than 500 mrem requires Radiation Protection Manager or Designee Approval and completion of RP-AA-460-002 attachment.
* For situations identified where workers will encounter an anticipated dose rate alarm while transitioning through an area or working near elevated dose rates then:
* Complete RP-AA-403 attachment and brief Individual giving clear guidance (i.e. adjust position, leave area, etc.)
	1. **ALARA Briefings**
* **Per RP-AA-401 an ALARA briefing would be required if**:
* Work area dose rates greater than 200 mrem/hr AND individual exposure is anticipated to be ≥100 mrem per entry; OR
* Contamination levels are > 500,000 dpm/100 cm2 (average) general area; OR
* Entry to an area designated as an ALPHA III; OR
* Airborne radioactivity is ≥ 0.3 DAC (identified).

**NOTE**

Briefings conducted more than 48 hours in advance of the work, in order to manage resources, will have a follow up review to re-cap previous discussions, prior to beginning work.

**NOTE**

The RP Programs Manager or Designee may waive ALARA Briefing requirements. All waivers shall be documented on RP-AA-401 attachment, ALARA Waiver / Change Form, or equivalent.

**Approvals:**

|  |  |  |  |
| --- | --- | --- | --- |
| Originator: | J. Sailer / | Date: |  |
|  | Print/Sign |  |  |
| Work Group Rep.: |  | Date: |  |
|  | Print/Sign |  |  |
| RP Supervisor: |  | Date: |  |
|  | Print/Sign |  |  |
| RP Programs Manager#: | M. Holba / | Date: |  |
|  | Print/Sign |  |  |
| RP Manager&: |  | Date: |  |
|  | Print/Sign |  |  |
| SASC / SAC, if applicable: |  | Date: |  |
|  | Print/Sign or Enter SASC / SAC Meeting Number  |  |  |

**#** Medium Radiological Risk Requires RP Programs Manager’s Approval (or designee)

**&** High Radiological Risk Requires RP Manager’s Approval (or designee)

**OPEX / Lessons Learned:**

***OE22752 - Worker Received Accumulated Dose 174mRem above the Electronic Dosimeter Setpoint during Lower Internals Move***

ABSTRACT:

During the unit's seventeenth refueling outage, performance of a 10-year in-service inspection of the reactor vessel internal welds was required. Performance of this inspection required the removal of the lower internals of the reactor. Upon completion of the inspection, the lower internals needed to be replaced into the reactor vessel. The lower internals were removed from the lower internals stand for placement in the reactor vessel. An individual that was located on top of the polar crane, who was being used as a spotter for the person-in-charge, received accumulated dose 174mRem above his electronic dosimeter setpoint.

DESCRIPTION:
Before the actual lift began, on May 4, 2006, health physics (HP) personnel verified that the floor was clear of non-essential personnel. The 13 individuals associated with this job were given a pre-job brief. The prerequisites were noted as being acceptable and the person-in-charge received permission to begin the lift. On the telecommunication headsets with the person-in-charge is a "spotter" located on top of the polar crane as well as the crane operator who was located on the refueling floor. The HP technicians are also on headsets in containment and they have the capability to communicate with the remote monitoring system (RMS) technicians who are monitoring the teledosimetry and remote monitoring. The person-in-charge began to lift the lower internals. When he believed he was at the correct height, he moved slightly from his location and used a method he had used in past occurrences to verify the proper height of the lower internals. This method is different than that specified in the procedure.
As the lower internals were being lifted, one of the two individuals on top of the polar crane began to notice that his telemetry unit was beeping more quickly (1mRem accumulated dose chirps) on this lift then on the previous core barrel lift. These individuals did not notify anyone and shortly thereafter they received a dose rate alarm. The two individuals quickly moved from their current location approximately 43' directly above the core barrel to the far end of the polar crane.
Since the workers were on remote telemetry, immediately upon receipt of the dose rate alarm the RP technicians in the Remote Monitoring Station contacted the RP technicians providing coverage for the core barrel move and told them of the elevated readings one of the workers was in (greater than 10 R/hr) and requested that the workers be relocated. HP then told the person-in-charge that the individual on top of the polar crane was approaching his electronic dosimeter accumulated dose alarm set point, and that he would have to leave the area.
The person-in-charge noted that he needed the person on the crane for this job, and that the person's function on top of the crane was essential to successfully insert the core barrel into the reactor vessel because of the tight core barrel insertion tolerance. The individuals on top of the crane were aware that, depending where they were on top of the crane, that they may receive a dose rate alarm, but the one individual that had communication capabilities did not communicate this to the person-in-charge. As the trolley was progressing, RMS communicated to the HP personnel that one individual (on top of the polar crane) was now at 80 percent of his allocated dose, and he now needed to exit containment. The HP supervisor took this information and told the person-in-charge to stop and the person-in-charge did stop the evolution. Together, the HP supervisor, refueling senior reactor operator and person-in-charge met and the HP supervisor suggested to the person-in-charge that the core barrel be lowered. The person-in-charge noted that he could not safely lower the load (may hit and damage the cavity bottom or lower internals) and that he could not go back to the cavity stand because he could not safely land the internals. The person-in-charge's position was that the only option he had was to continue and lower the internals into the reactor vessel. This was discussed at a previous briefing on April 22, 2006, but the refueling senior reactor operator and RP personnel were not at that briefing. The RP supervisor considered his options and believed it was safest to allow the lift to continue. All parties agreed that with respect to radiological and industrial safety it was appropriate to continue with the replacement of the core barrel into the reactor vessel.
Once the lower internals were centered over the reactor vessel, the person-in-charge instructed the crane operator to lower the load. When the load was lowered to a sufficient level to lower doses, the RP supervisor again instructed the person-in-charge to stop, which he did. The RP supervisor then instructed the individuals on top of the crane to safely descend. The individual that had exceeded his dose alarm setpoint was escorted out of containment by the HP supervisor and asked to complete a written statement on what occurred. The HP supervisor then returned to containment and had the remaining individuals lower the load into the reactor vessel. Once landed, he had all individuals leave containment and complete event recollection forms.
The radiological summary for the activity resulted in one person exceeding his dose rate alarm value (received 474 versus a limit of 300 mRem) and six individuals received dose rate alarms. These include the crane operator, the two individuals on top of the polar crane, a tag line person, the load cell verifier, and the RP supervisor.

CAUSES:
The root cause of this event is the reduced management oversight resulted in a failure to incorporate the proper controls into the work task. Given its radiological significance, this task was not given the attention that it required. It was viewed as another lift and was appended to the refueling process, having not fit cleanly into the in-service inspection process. The project lead did not ensure that all supporting organizations were ready for this task to occur. Inadequate verification of prerequisites, since the individuals that were working on this task did not have a common understanding of what radiological controls were needed to ensure that the dose associated with the task would be ALARA.

CORRECTIVE ACTIONS:
Review and modify as needed the site "Infrequently Performed Tests and Evolutions" procedure, to ensure that it captures events that involves "significant radiological evolutions."
Provide briefings to department managers and individuals that function as project managers on the basis and method of obtaining approval for an IPTE.
Conduct qualification training for individuals that will function as project managers to review roles and responsibilities in performing those functions.
Reinforce the lessons learned from this event in operations, maintenance, radiological protection, and engineering continuing training.
Assign a dedicated RP individual to the refuel team.
Modify the refueling procedures for both units to require dual verification for water level and lift height prior to moving the lower and upper internals.
Modify the refueling procedures for both units to require that contingency plans be developed and discussed for the evolution.
Refueling procedure to be reviewed for industry enhancements that are available that will make moving the upper and lower internals safer. This review will include the potential use of laser levels to verify height, the use of cameras on top of the crane to obtain match marks as well as performing this task remotely.

SAFETY SIGNIFICANCE:
The event is not an industrial, nuclear and radiological significant event.
INFORMATION CONTACT: Dennis Loope, Radiological Protection, 914-736-8401, dloope@entergy.com or Andrew Remskar, See-In Contact, 914-271-7494, aremska@entergy.com

***OE19789 - Unit 1 Experienced Damage to The Reactor Vessel Internals Lift Rig During the Ten Year In Service Inspection***

EVENT DATE: 11/10/2004
UNIT NAME: Surry Unit 1
NSSS/A-E: Westinghouse / Stone & Webster
DOCKET NO.: 050-00280
TURBINE MANUFACTURER: Westinghouse
MAINTENANCE RULE APPLICABILITY: Yes

DESCRIPTION:
During the Surry Unit 1 refueling outage and its 10 year ISI, a guide bushing on the reactor internals lift rig came in contact with the guide stud for the lower internals stand causing tack welds on the guide bushing support block to break. This damage was not immediately apparent. The guide bushing appeared intact and the internals were placed on the stand. The refueling maintenance crew experienced difficulty during disengagement and re-engagement of the reactor lower internals. The lifting rig was inspected and determined to have a misaligned bushing due to the broken tack welds.

CAUSES:
The root cause was failure to ensure that the lower internals load was stable and to verify alignment of the guide bushings were centered over the guide studs prior to lowering the load over the guide studs. During placement of the lower internals on the stand there was some movement of the load. Due to radiological hazards of increased dose while the lower internals is moved, the lift sequence is performed using video coverage of the load movement. As the load was brought into position the camera angle used to verify correct engagement between the guide studs and the guide bushings was from the top of the lift rig. From this viewpoint it appeared that the guide studs were aligned within the center of the bushings, although there was some movement or sway in the load. This movement was not believed to be a concern because of the taper at the top of the guide stud and the load movement was thought to be minor. As the load was being lowered, the guide bushing became mispositioned and contacted the guide stud as the lower internals were placed in the storage stand.

**CORRECTIVE ACTIONS:**
Station personnel repaired the lifting rig guide bushing, verified the alignment of the guide bushings, attached the reactor internals lifting rig to the lower internals, and placed the lower internals in the reactor vessel.

**Long term actions:**
Revise the maintenance procedure "Removal and Installation of Reactor Vessel Lower Internals," to include the following:
1. Require the review of the RCE for this event prior to any lower internals lift.
2. Prior to lowering the lift rig onto the guide studs require that the load is stable and that the guide studs are verified to be positioned in the center of the guide bushings.
3. Require the use of continuous communication (Telex type) radios for the lower internals lift and list the personnel to be in constant communications with the crane operator.
4. Require all camera monitors used during the lower internals lift be set-up in the same location so they can all be viewed simultaneously.
5. Revise the use of the load cell to include one of the following:
" Provide a load cell read out in the crane cab.
" Modify the crane for remote use and station the crane operator at the load cell.
" Require the person monitoring the load cell to have continuous communication with the crane operator.
SAFETY SIGNIFICANCE: The reactor vessel was de-fueled therefore there was no safety significance.