



UNITED STATES
NUCLEAR REGULATORY COMMISSION

REGION II
SAM NUNN ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW, SUITE 23T85
ATLANTA, GEORGIA 30303-8931

January 30, 2007

Carolina Power and Light Company
ATTN: Mr. Tom Walt
Vice President - Robinson Plant
H. B. Robinson Steam Electric Plant
Unit 2
3851 West Entrance Road
Hartsville, SC 29550

SUBJECT: H.B. ROBINSON STEAM ELECTRIC PLANT - NRC INTEGRATED
INSPECTION REPORT 05000261/2006005

Dear Mr. Walt:

On December 31, the US Nuclear Regulatory Commission (NRC) completed an inspection at your H.B. Robinson reactor facility. The enclosed integrated inspection report documents the inspection findings, which were discussed on January 10, with Mr. Tom Walt and other members of your staff.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel.

Based on the results of this inspection, the inspectors identified one issue of very low safety significance (Green) and one Severity Level IV non-cited violation. Both of these issues were determined to involve violations of NRC requirements. However, because of their very low safety significance and because they have been entered into your Corrective Action Program (CAP), the NRC is treating these issues as non-cited violations, in accordance with Section VI.A.1 of the NRC's Enforcement Policy. If you deny these non-cited violations, you should provide a response with the basis for your denial, within 30 days of the date of this inspection report to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555-0001, with copies to the Regional Administrator, Region II; the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at the H.B. Robinson facility.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public

CP&L

2

Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Sincerely,

/RA/

Randall A. Musser, Chief
Reactor Projects Branch 4
Division of Reactor Projects

Docket No.: 50-261
License No.: DPR-23

Enclosure: Inspection Report 05000261/2006005
w/Attachment: Supplemental Information

Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Sincerely,

/RA/

Randall A. Musser, Chief
Reactor Projects Branch 4
Division of Reactor Projects

Docket No.: 50-261
License No.: DPR-23

Enclosure: Inspection Report 05000261/2006005
w/Attachment: Supplemental Information

X PUBLICLY AVAILABLE X NON-SENSITIVE

ADAMS: X Yes ACCESSION NUMBER: ML070300522

OFFICE	RII:DRP	RII:DRP	RII:DRS	RII:DRS	RII:DRS	RII:DRP	
SIGNATURE	RCH2	RCH2 for/fax	SDR2	MAS1	JLK1	SON	
NAME	RHagar/fax	DJones	SRose	MScott	JKreh	SNinh	
DATE	01/30/2007	01/30/2007	01/24/2007	01/24/2007	01/19/2007	01/19/2007	1/ /2007
E-MAIL COPY?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO

OFFICIAL RECORD COPY

DOCUMENT NAME: C:\FileNet\ML070300522.wpd

cc w/encls.:

William G. Noll
Director, Site Operations
Carolina Power & Light Company
H. B. Robinson Steam Electric Plant
Electronic Mail Distribution

Ernest J. Kapopoulos, Jr.
Plant General Manager
Carolina Power & Light Company
H. B. Robinson Steam Electric Plant
Electronic Mail Distribution

Chris L. Burton, Manager
Performance Evaluation and
Regulatory Affairs CPB 9
Electronic Mail Distribution

C. T. Baucom, Supervisor
Licensing/Regulatory Programs
Carolina Power & Light Company
H. B. Robinson Steam Electric Plant
Electronic Mail Distribution

J. F. Lucas, Manager
Support Services - Nuclear
Carolina Power & Light Company
H. B. Robinson Steam Electric Plant
Electronic Mail Distribution

Henry J. Porter, Director
Div. of Radioactive Waste Mgmt.
Dept. of Health and Environmental
Control
Electronic Mail Distribution

R. Mike Gandy
Division of Radioactive Waste Mgmt.
S. C. Department of Health and
Environmental Control
Electronic Mail Distribution

Beverly Hall, Chief Radiation
Protection Section
N. C. Department of Environment,
Health and Natural Resources
Electronic Mail Distribution

David T. Conley
Associate General Counsel - Legal Dept.
Progress Energy Service Company, LLC
Electronic Mail Distribution

John H. O'Neill, Jr.
Shaw, Pittman, Potts & Trowbridge
2300 N. Street, NW
Washington, DC 20037-1128

Chairman of the North Carolina
Utilities Commission
c/o Sam Watson, Staff Attorney
Electronic Mail Distribution

Robert P. Gruber
Executive Director
Public Staff - NCUC
4326 Mail Service Center
Raleigh, NC 27699-4326

Public Service Commission
State of South Carolina
P. O. Box 11649
Columbia, SC 29211

Distribution w/encl: (See page 4)

CP&L

4

Report to Tom Walt from Randy Musser dated January 30, 2007.

Distribution w/encl:

C. Patel, NRR

C. Evans (Part 72 Only)

L. Slack, RII EICS

OE Mail (email address if applicable)

RIDSNRRDIRS

PUBLIC

U. S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket No: 50-261

License No: DPR-23

Report No: 005000261/2006005

Facility: H. B. Robinson Steam Electric Plant, Unit 2

Location: 3581 West Entrance Road
Hartsville, SC 29550

Dates: October 1, 2006 through December 31, 2006

Inspectors: R. Hagar, Senior Resident Inspector
D. Jones, Resident Inspector
S. Rose, Senior Reactor Inspector (Section 1R07)
M. Scott, Senior Reactor Inspector (Section 1R07)
J. Kreh, Senior Health Physicist (Section 2OS2)

Approved by: R. Musser, Chief
Reactor Projects Branch 4
Division of Reactor Projects

Enclosure

SUMMARY OF FINDINGS

IR 05000261/2006-005, 10/01 - 12/31/2006, Carolina Power and Light Company; H.B. Robinson Steam Electric Plant, Unit 2; Maintenance Effectiveness and Other.

The report covered a three month period of inspection by resident inspectors and an announced inspection by several reactor inspectors. One Green non-cited violation and one Severity Level IV non-cited violation were identified. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using IMC 0609, "Significance Determination Process" (SDP). Findings for which the SDP does not apply may be Green or be assigned a severity level after NRC management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

A. NRC-Identified and Self-Revealing Findings

Cornerstone: Mitigating Systems

Green. The inspectors identified a non-cited violation of 10 CFR 50, Appendix B, Criterion XVI, Corrective Actions, for failure to identify the cause and take corrective action to prevent recurrence for a significant condition adverse to quality, in that the licensee failed to prevent a repetitive failure of a safety-related pump's motor controller when the effects of temperature which reduced the life expectancy of wiring and insulation were not identified.

This finding is greater than minor because it is associated with the Mitigating Systems Cornerstone attribute of equipment performance and affected the cornerstone objective of ensuring the availability and reliability of systems that respond to events to prevent undesirable consequences. The failure to identify in 2004 that the effects of temperature had reduced the life expectancy of the coil insulation in the motor controller for a service water booster pump resulted in a repetitive failure in 2006. The inspectors determined that the finding was of very low safety significance (Green) because it was not an actual loss of safety function because the redundant system was available. The finding has a cross-cutting aspect in the area of problem identification and resolution. (Section 1R12)

Cornerstone: Emergency Preparedness

No Color. A Severity Level IV non-cited violation was identified for implementing a change to the emergency plan without appropriate justification, contrary to the requirements of 10 CFR 50.54(q). The finding was evaluated under the NRC's Enforcement Policy using the traditional enforcement process because licensee reductions in the effectiveness of its emergency plan impact the regulatory process. The finding was determined to be a non-cited Severity Level IV violation because it involved licensee failure to meet an emergency planning requirement not directly related to assessment or notification (Section 4OA5).

B. Licensee-Identified Violations

None.

Enclosure

REPORT DETAILS

Summary of Plant Status The unit began the inspection period at full rated thermal power. On October 25, the reactor was manually tripped due to a failure of the main turbine's electro-hydraulic control system that resulted in the closure of the main turbine governor valves. The unit was restarted on October 27, and operated at full power for the remainder of the inspection period.

1. REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, Barrier Integrity

1R01 Adverse Weather Protection

a. Inspection Scope

After the licensee completed preparations for seasonal low temperature, the inspectors walked down the auxiliary feedwater system, main steam pressure transmitters, and instrument air compressors. These systems/components were selected because their risk significant functions could be affected by adverse weather. The inspectors reviewed documents listed in the Attachment, observed plant conditions, and evaluated those conditions using criteria documented in Procedure AP-008, Cold Weather Preparations.

The inspectors reviewed the following action requests (ARs) associated with this area to verify that the licensee identified and implemented appropriate corrective actions:

- AR 114858, Drain on D [Instrument Air Compressor] Found Plugged with Ice
- AR 25913, Near Miss - [Steam Generator] A [Power Operated Relief Valve] Lift Due to Freezing

b. Findings

No findings of significance were identified.

1R04 Equipment Alignment

a. Inspection Scope

Partial System Walkdowns:

The inspectors performed the following three partial system walkdowns, while the indicated structures, systems, and/or components (SSCs) were out-of-service for maintenance and testing; or was realigned following maintenance:

Enclosure

<u>System Walked Down</u>	<u>SSC Out of Service</u>	<u>Date Inspected</u>
Motor driven auxiliary feedwater train B	Motor driven auxiliary feedwater train A	November 1
Motor driven auxiliary feedwater train A	Motor driven auxiliary feedwater train B	December 4
Service water train A and B	Service water train B	December 20

To evaluate the operability of the selected trains or systems under these conditions, the inspectors compared observed positions of valves, switches, and electrical power breakers to the procedures and drawings listed in the Attachment.

Complete System Walkdown:

The inspectors conducted a detailed review of the alignment and condition of train A and B of the containment spray system to verify that the existing alignment of the system was consistent with the correct alignment. To determine the correct system alignment, the inspectors reviewed the procedures, drawings, and the Updated Final Safety Analysis Report (UFSAR) section listed in the Attachment. The inspectors also walked down the system. During the walkdown, the inspectors reviewed the following:

- Valves were correctly positioned and did not exhibit leakage that would impact the functions of any given valve.
- Electrical power was available as required.
- Major system components were correctly labeled, lubricated, cooled, ventilated, etc.
- Hangers and supports were correctly installed and functional.
- Essential support systems were operational.
- Ancillary equipment or debris did not interfere with system performance.
- Tagging clearances were appropriate.
- Valves were locked as required by the locked valve program.

The inspectors reviewed the documents listed in the Attachment to verify that the ability of the system to perform its functions could not be affected by outstanding design issues, temporary modifications, operator workarounds, adverse conditions, and other system-related issues tracked by the engineering department.

The inspectors reviewed the following ARs associated with this area to verify that the licensee identified and implemented appropriate corrective actions:

- 172983, SI-844B Failed to Stroke During the Performance of OST-352-4
- 207209, SI-892F and SI-892H Not Listed in OST-355
- 169721, B CV Spray Pump Breaker [Foreign Material Exclusion] Concern
- 167852, Boric Acid Buildup on SI-844B

b. Findings

No findings of significance were identified.

1R05 Fire Protectiona. Inspection Scope

For the six areas identified below, the inspectors reviewed the control of transient combustible material and ignition sources, fire detection and suppression capabilities, fire barriers, and any related compensatory measures to verify that those items were consistent with UFSAR Section 9.5.1, Fire Protection System, and UFSAR Appendix 9.5.A, Fire Hazards Analysis. The inspectors walked down accessible portions of each area and reviewed results from related surveillance tests to verify that conditions in these areas were consistent with descriptions of the areas in the UFSAR. Documents reviewed are listed in the Attachment.

The following areas were inspected:

<u>Fire Zone</u>	<u>Description</u>
26	Switchyard and Transformers
20	Emergency Switchgear Room and Electrical Equipment Area
19	Unit 2 Cable Spreading Room
7	Auxiliary Building Hallway (Ground Floor)
29	Service Water Pump Area
22	Control Room

b. Findings

No findings of significance were identified.

1R07 Biennial Heat Sink Performance - Follow upa. Inspection Scope

During a previous inspection (05000261/2006004), the inspectors found an issue during a review of the licensee's ultimate heat sink configuration and operational controls. This issue is identified as follows:

Lake Robinson is the source of the ultimate heat sink for the Robinson nuclear plant (Unit 2). The lake is impounded by the Lake Robinson dam that serves both the nuclear plant and a fossil plant (Unit 1). The fossil Unit 1 staff controls the operation and maintenance of the Tainter gates (electrically moveable spillway gates) in the Lake Robinson dam. The gates are periodically cycled (opened and then closed) to ensure

freedom of movement. During the cycling, the gates are at risk of continuing to open or failing to close, which could result in a dramatic lowering of lake level, the ultimate heat sink for the nuclear plant. The gates are subject to external events and other types of failures. A failed Tainter gate could lower lake level resulting in loss of supply to the nuclear Unit 2 Service Water (SW) pumps' suction and therefore a loss of SW.

The inspectors noted two procedures that address various degrees of loss of SW for the Unit 2 nuclear plant. With the loss of the Tainter gate(s), it was unclear to the inspectors how the heat sink function was to be met in light of procedure wording (mitigation strategy) and stated level of testing of newly installed SW support equipment. The procedure and equipment qualification uncertainties could be a potential technical specification required procedure problem or an inability to meet heat sink functional needs, a design issue (10 CFR 50, Appendix B), in certain accident scenarios. This issue will require NRC review to determine if the installed equipment and procedures can provide for long term safe shutdown of Unit 2 upon loss of the ultimate heat sink. Accordingly, this issue was left as an Unresolved Item (URI) 05000261/2006004-001, Verify Mitigation Capabilities for Loss of Heat Sink.

For administrative purposes the above URI is closed.

During a December, 2006, follow-up inspection of the procedure issues, the inspectors reviewed the procedures involved; walked down the mitigating equipment, emergency lighting, and tools involved with operator actions; held discussions with system and design engineers; conducted a table-top run-through of the procedures involved; and observed simulator response to the event and the recovery actions. The inspectors observed equipment located on the Unit 1 fossil plant that could support recovery.

b. Findings

Although the inspectors found no problems with the procedures, the required equipment capabilities and qualification remain uncertain. This issue will be open as a separate URI 05000261/2006005-001, Equipment Performance for Functional Recovery After Certain UHS Scenarios. This issue will require further NRC review to determine whether the installed equipment can support recovery of service water in certain accident scenarios.

1R11 Licensed Operator Requalification

a. Inspection Scope

The inspectors observed licensed-operator performance during a continuing-training simulator examination for crew three to verify that actual operator performance was consistent with expected operator performance, as described in Operations Training LOCT-08-6, Rev. 1. This training tested the operators' ability to respond to a series of events that included a faulty reactor coolant system pressure controller, a failed heater drain pump, and a faulted steam generator. The inspectors focused on clarity and formality of communication, the use of procedures, alarm response, control board

manipulations, group dynamics, and supervisory oversight. Documents reviewed are listed in the Attachment.

The inspectors observed the post-exercise critique to verify that the licensee identified deficiencies and discrepancies that occurred during the simulator training.

b. Findings

No findings of significance were identified.

1R12 Maintenance Effectiveness

a. Inspection Scope

The inspectors reviewed the two degraded SSC/function performance problems or conditions listed below to verify the appropriate handling of these performance problems or conditions in accordance with 10 CFR 50, Appendix B, Criterion XVI, Corrective Action, and 10 CFR 50.65, Maintenance Rule. Documents reviewed are listed in the Attachment.

The problems/conditions and their corresponding ARs were:

<u>Performance Problem/Condition</u>	<u>AR</u>
Unanticipated [Limited Condition for Operations] Entry Due to Trip of [Service Water Booster Pump] B	201606
Failure of V6-12C to Stroke Following Maintenance Activities	193247

During the reviews, the inspectors focused on the following:

- Appropriate work practices,
- Identifying and addressing common cause failures,
- Scoping in accordance with 10 CFR 50,65(b),
- Characterizing reliability issues (performance),
- Charging unavailability (performance),
- Trending key parameters (condition monitoring),
- 10 CFR 50,65(a)(1) or (a)(2) classification and reclassification, and
- Appropriateness of performance criteria for SSCs/functions classified (a)(2) and/or appropriateness and adequacy of goals and corrective actions for SSCs/functions classified (a)(1).

b. Findings

Introduction The inspectors identified a Green non-cited violation (NCV) of 10 CFR 50, Appendix B, Criterion XVI, Corrective Actions, for failure to identify the cause of and

take corrective action to prevent recurrence for a significant condition adverse to quality, in that the licensee failed to prevent a repetitive failure of a safety-related pump's motor controller when the effects of temperature which reduced the life expectancy of wiring and insulation was not identified.

Description On July 19, 2004 the A service water booster pump (SWBP) failed due to a defective coil in the control circuit for the motor. The licensee's significant adverse condition investigation report (AR 132454) stated that the cause of the coil failure was long term degradation of wiring and insulation caused by heat. The licensee determined that the root cause of the failure was an inadequate frequency of the preventive maintenance activity to periodically replace the coils. The licensee's corrective action to preclude repetition was to revise the preventive maintenance frequency from nine years to six years, however with a grace period of 25 percent the frequency could be up to seven and a half years. The selection of a six-year replacement frequency was based on the history of previous coil failures. Through interviews the inspectors determined that the licensee's investigation did not measure ambient temperatures in the breaker cubicle, perform thermography, or further investigate the cause and effects of heat on the coil prior to establishing the coil's replacement frequency.

On July 29, 2006 the B SWBP also failed due to a defective coil in the control circuit for the motor. The defective coil had been in service for six years and four months. The licensee's significant adverse condition investigation report (AR 201606) determined that the root cause was the same as the 2004 failure described above. The licensee's investigation, which included measuring breaker cubicle temperature and thermography, determined that the temperatures in the breaker cubicle had reduced the life expectancy of the coil insulation from ten to five years. The corrective action to preclude repetition was to revise the preventive maintenance frequency from six years to three years for replacement of the coils.

Analysis The inspectors determined that the failure to fully evaluate and identify that the effects of temperature had reduced the life expectancy of the coil from ten to five years in the 2004 root cause investigation is a performance deficiency. The finding is more than minor because it is associated with the Mitigating Systems Cornerstone attribute of equipment performance and affected the cornerstone objective of ensuring the availability and reliability of systems that respond to events to prevent undesirable consequences, in that the failure to identify in 2004 that the effects of temperature had reduced the life expectancy of the coil insulation in the motor controller for a safety-related pump resulted in a repetitive failure in 2006. The inspectors determined that the finding is of very low safety significance (Green) because it was not a design or qualification deficiency, was not an actual loss of safety function for a system, and was not risk significant due to a seismic, fire, flooding, or severe weather initiating event. This finding has a cross-cutting aspect in the area of Problem Identification and Resolution because the licensee did not fully evaluate a safety problem, in that the evidence of elevated temperatures was not adequately evaluated.

Enforcement 10CFR50, Appendix B, Criterion XVI, Corrective Action, requires, in part, that for significant conditions adverse to quality measures shall assure that the cause of

Enclosure

the condition is determined and corrective action taken to preclude repetition. Contrary to the above, the licensee's investigation failed to identify the cause of a safety-related pumps' motor controller failure which resulted in a corrective action that failed to preclude repetition of the failure. Because the failure to determine the cause and take corrective action to preclude recurrence is of very low safety significance, and was entered into the CAP as AR 215929, it is being treated as an NCV, consistent with Section VI.A.1 of the NRC Enforcement Policy, and has been designated as NCV 05000261/2006-05-01, Failure to prevent a Repetitive Failure of a Safety-Related Pump's Motor Controller.

1R13 Maintenance Risk Assessments and Emergent Work Control

a. Inspection Scope

For the four time periods listed below, the inspectors reviewed risk assessments and related activities to verify that the licensee performed adequate risk assessments and implemented appropriate risk-management actions when required by 10 CFR 50.65(a)(4). For emergent work, the inspectors also verified that any increase in risk was promptly assessed, and that appropriate risk-management actions were promptly implemented. Documents reviewed are listed in the Attachment. Those periods included the following:

- The work week of October 30 - November 3, including scheduled maintenance on the A CCW pump and A MDAFW pump; and emergent maintenance on the 6A feedwater heater level control valve
- The work week of November 13 - November 17, including scheduled maintenance on the dedicated shutdown diesel generator; emergent maintenance on a main steam header pressure transmitter; and a tornado watch for the immediate area
- The work week of December 4 - December 8, including scheduled maintenance on the B motor driven auxiliary feedwater pump
- The work week of December 16 - December 22, which included development of leakage from a pressurizer power-operated relief valve

b. Findings

No findings of significance were identified.

1R15 Operability Evaluations

a. Inspection Scope

The inspectors reviewed the operability determination associated with AR 214754, Flowserve 10 CFR 21 Notification. This AR addressed verifying that certain valves were comprised of stainless steel and not carbon steel. The inspectors assessed the

accuracy of the evaluation, the use and control of any necessary compensatory measures, and compliance with the Technical Specification (TS). The inspectors verified that the operability determination was made as specified by procedure OPS-NGGC-1305, Operability Determinations. The inspectors compared the justifications provided in the determination to the requirements from the TS, the UFSAR, and associated design-basis documents to verify that operability was properly justified and the associated valves remained available, such that no unrecognized increase in risk occurred:

Documents reviewed are listed in the Attachment.

b. Findings

No findings of significance were identified.

1R17 Permanent Plant Modifications

a. Inspection Scope

The inspectors reviewed the modification described in Engineering Change 64363, A [Component Cooling Water] Pump Replacement Motor to verify that:

- this modification did not degrade the design bases, licensing bases, and performance capabilities of risk significant SSCs,
- implementing this modification did not place the plant in an unsafe condition, and
- the design, implementation, and testing of this modification satisfied the requirements of Procedure EGR-NGGC-005, Engineering Change, and 10 CFR 50, Appendix B, Criterion III, Design Control.

Documents reviewed are listed in the Attachment.

b. Findings

No findings of significance were identified.

1R19 Post Maintenance Testing

a. Inspection Scope

For the five post-maintenance tests listed below, the inspectors witnessed the test and/or reviewed the test data to verify that test results adequately demonstrated restoration of the affected safety functions described in the UFSAR and TS. Documents reviewed are listed in the Attachment.

The following tests were witnessed/reviewed:

<u>Test Procedure</u>	<u>Title</u>	<u>Related Maintenance Activity</u>	<u>Date Inspected</u>
OST-409-2	[Emergency Diesel Generator] "B" Fast Speed Start	Replacement of solenoid valves in the air-start system	October 11
OST-201-1	[Motor Driven Auxiliary Feedwater Pump] System Component Test - Train A	Cleaning and testing of lube oil cooler	November 2
OST-908	Component Cooling System Component Test	Replacement of motor and cabling for the A component cooling water pump	November 3
OST-646	Fire Suppression Water System Engine Driven Fire Pump Test (Annual)	Replacement of batteries, thermostat and other routine maintenance activities	December 1
OST-302-1	Service Water Pumps A and B Inservice Test	Replacement of motor hold down bolts	December 19

b. Findings

No findings of significance were identified.

1R20 Refueling and Outage Activities

For the forced outage that began on October 25 and ended on October 27, the inspectors reviewed system lineups and control board indications to verify that technical specifications, license conditions, and other requirements, commitments, and administrative procedure prerequisites for mode changes were met prior to changing modes or plant configurations. The inspectors periodically reviewed RCS boundary leakage data, and prior to reactor startup, walked down containment to verify that debris had not been left which could affect performance of the containment sump. Also, the inspectors observed the licensee perform the reactor start-up in accordance with GP-003, Normal Plant Startup from Hot Shutdown to Critical, Rev. 76 and GP-005, Power Operation, Rev. 80. The inspectors also reviewed the items that had been entered into the CAP. Documents reviewed are listed in the attachment.

Enclosure

b. Findings

No findings of significance were identified.

1R22 Surveillance Testing

a. Inspection Scope

For the five surveillance tests listed below, the inspectors witnessed testing and/or reviewed the test data to verify that the systems, structures, and components involved in these tests satisfied the requirements described in the TS, the UFSAR, and applicable licensee procedures, and that the tests demonstrated that the SSCs were capable of performing their intended safety functions. Documents reviewed are listed in the Attachment.

<u>Test Procedure</u>	<u>Title</u>	<u>Date Inspected</u>
OST-051*	Reactor Coolant System Leakage Evaluation (Every 72 Hours During Steady State Operation and Within 12 Hours After Reaching Steady State Operation)	October 17
OST-925	Containment Fan Coolers Valve Position Indicator Verification	November 7
RST-001	Radiation Monitor Source Checks	November 29
OST-108-2**	Boric Acid Pump B Inservice Test	December 7
OST-603	Motor Driven Fire Water Pump and Engine Driven Fire Water Pump Test (Weekly)	December 17

* This procedure was a Reactor Coolant System leakage detection surveillance.

**This procedure included inservice testing requirements.

b. Findings

No findings of significance were identified.

4. OTHER ACTIVITIES

4OA1 Performance Indicator (PI) Verification

a. Inspection Scope

The inspectors verified the Safety System Functional Failures PI for the period from the fourth quarter of 2005 through the third quarter of 2006, by reviewing Licensee Event Reports and Maintenance Rule records to verify that the licensee had accurately accounted for safety system functional failures that safety systems had experienced. The inspectors also compared the licensee's basis in reporting this PI to the definitions and guidance contained in NEI 99-02, "Regulatory Assessment Indicator Guideline," Rev. 4. In addition, the inspectors interviewed licensee personnel associated with collecting, evaluating, and distributing these data. Documents reviewed are listed in the Attachment.

b. Findings

No findings of significance were identified.

4OA2 Identification and Resolution of Problems

.1 Routine Review of ARs

To aid in the identification of repetitive equipment failures or specific human performance issues for followup, the inspectors performed frequent screenings of items entered into the CAP. The review was accomplished by reviewing daily AR reports.

.2 Annual Sample Review

a. Inspection Scope

The inspectors selected AR 193627, Site Wide Human Performance Trend for detailed review. The inspectors selected this AR because it relates specifically to human performance at the site, and therefore generally to the Initiating Events, Mitigating Systems, and Barrier Integrity Cornerstones. The inspectors reviewed this report to verify:

- complete and accurate identification of the problem in a timely manner;
- evaluation and disposition of performance issues;
- evaluation and disposition of operability and reportability issues;
- consideration of extent of condition, generic implications, common cause, and previous occurrences;
- appropriate classification and prioritization of the problem;
- identification of root and contributing causes of the problem;
- identification of corrective actions which were appropriately focused to correct the problem; and

- completion of corrective actions in a timely manner.

The inspectors also reviewed this AR to verify compliance with the requirements of the CAP as delineated in Procedure CAP-NGGC-0200, Corrective Action Program, and 10 CFR 50, Appendix B. Documents reviewed are listed in the Attachment.

b. Observations and Findings

No findings of significance were identified.

.3 Semi-Annual Trend Review

a. Inspection Scope

The inspectors performed a review of the CAP and associated documents to identify trends that could indicate the existence of a more significant safety issue. The inspector's review focused on repetitive equipment issues, but also considered the results of daily inspector CAP item screening discussed in Section 4OA2.1, licensee trending efforts, and licensee human performance results. The inspector's review nominally considered the six month period of July, 2006, through December, 2006, although some examples expanded beyond those dates when the scope of the trend warranted. The review included issues documented outside the normal CAP in major equipment problem lists, repetitive and/or rework maintenance lists, departmental problem/challenges lists, system health reports, quality assurance audit/surveillance reports, self assessment reports, and Maintenance Rule assessments. The inspectors compared and contrasted their results with the results contained in the latest monthly and quarterly trend reports. Corrective actions associated with a sample of the issues identified in the trend reports were reviewed for adequacy. The specific documents reviewed are listed in the Attachment.

The inspectors also evaluated the trend reports against the requirements of the CAP as specified in 10 CFR 50, Appendix B, Criterion XVI, and in Procedures CAP-NGGC-0200, Corrective Action Program and CAP-NGGC-0206, Corrective Action Program Trending and Analysis.

b. Assessment and Observations

No findings of significance were identified. The inspectors evaluated trending methodology and observed that the licensee had performed a detailed review. The licensee routinely reviewed cause codes, involved organizations, key words, and system links to identify potential trends in their CAP data. The inspectors compared the licensee process results with the results of the inspectors' daily screening, and did not identify any discrepancies or potential trends in the CAP data that the licensee had failed to identify.

4OA3 Event Follow-up

.1 Plant Events

a. Inspection Scope

The inspectors reviewed plant parameters, equipment performance, and operator actions as a result of a manual reactor trip from 100 percent power on October 25 to assure proper equipment operation and appropriate operator response. The reactor trip resulted from a failure of the main turbine's electro-hydraulic control system that resulted in the closure of the main turbine governor valves. The inspectors evaluated the troubleshooting and repair of the turbine electro-hydraulic control system to verify that the cause of the event was resolved prior to restart. The inspectors also verified that the licensee made timely notifications as required by 10 CFR 50.72. Documents reviewed are listed in the attachment.

b. Findings

No findings of significance were identified.

4OA5 Other Activities

.1 Operation of an Independent Spent Fuel Storage Installation (ISFSI) (IP 60855.1)

a. Inspection Scope

The inspectors performed a walkdown of the two ISFSIs on site (reference dockets 72-3 and 72-60). The inspectors also reviewed changes made to programs and procedures and their associated 10 CFR 72.48 screens and/or evaluations to verify that changes made were consistent with the license or Certificate of Compliance; reviewed records to verify that the licensee has recorded and maintained the location of each fuel assembly placed in the ISFSIs; and reviewed surveillance records to verify that daily surveillance requirements were performed as required by technical specifications. Documents reviewed are listed in the attachment.

b. Findings

No findings of significance were identified.

.2 (Closed) NRC Temporary Instruction (TI) 2515/169, Mitigating Systems Performance Index (MSPI) Verification

a. Inspection Scope

During this inspection period and in accordance with Temporary Instruction 2515/169, the inspectors completed a review of the implementation of the MSPI guidance for reporting unavailability and unreliability of monitored safety systems.

The inspectors examined surveillance tests that were not included in unavailability calculations because the licensee had determined either that the test would not render the train unavailable for greater than 15 minutes, or that the system could be promptly restored from the test configuration through operator action. As part of this review, the inspectors reviewed the associated recovery actions to verify that they were uncomplicated and contained in written procedures.

On a sample basis, the inspectors reviewed operating logs, work history information, maintenance rule information, CAP documents, and surveillance procedures to determine the actual time periods the MSPI systems were not available due to planned and unplanned activities. The inspectors then compared the results to the baseline planned unavailability and actual planned and unplanned unavailability, to verify the data's accuracy and completeness. Likewise, these documents were reviewed to verify MSPI component unreliability data identified and properly characterized all failures of monitored components. The unavailability and unreliability data were then compared with performance indicator data submitted to the NRC to verify it accurately reflected the performance history of these systems.

b. Findings and Observations

The licensee accurately documented the baseline planned unavailability hours, the actual unavailability hours and the actual unreliability information for MSPI systems. No significant errors in the reported data were identified, which resulted in a change to the indicated index color. No significant discrepancies were identified in the MSPI basis document which resulted in: (1) a change to the system boundary, (2) an addition of a monitored component, or (3) a change in the reported index color.

.3 (Closed) URI 05000261/2006004-001, Verify Mitigation Capabilities for Loss of Heat Sink

As indicated in Section 1R07, the inspectors closed URI 05000261/2006004-001, Verify Mitigation Capabilities for Loss of Heat Sink. The closure was based on satisfactory inspection of emergency procedures.

.4 (Closed) Unresolved Item (URI) 05000261/2006008-01: Blending of EAL Schemes

a. Inspection Scope

An in-office follow-up review was conducted in order to determine whether the above-referenced URI constituted a finding.

b. Findings

Introduction. During an onsite inspection conducted August 14-18, 2006, the inspector determined that there were several inconsistencies between the EALs in PLP-007, Robinson Emergency Plan, Revision 60, and the EAL guidance provided in NUREG-0654, Appendix 1, Revision 1, which nominally comprised the basis for the licensee's

emergency classification scheme. This potential issue was categorized as URI 05000261/2006008-01 pending completion of further NRC staff review.

Further review by staff in Region II and the Office of Nuclear Security and Incident Response (NSIR), together with internal agency discussions, determined that changes in Revision 33 (effective February 23, 1996) were made in a manner that was contrary to the requirements of 10 CFR 50.54(q).

Description. The inspector identified differences between the formally approved and the current versions of the Robinson Emergency Plan NUREG-0654-based emergency classification scheme or EALs. The inspector determined that the subject differences were attributable to changes made without prior NRC approval using the staff guidance contained in EPPOS [Emergency Preparedness Position] No. 1, dated June 1, 1995. EPPOS No. 1 was an internal NRC document intended to provide guidance to the staff regarding the acceptability of incorporating selected NUMARC/NESP-007 EALs (including both deletions and clarifications allowed by the NUMARC/NESP-007 methodology) into a NUREG-0654-based EAL scheme. Licensees wishing to adopt some or all of the modifications delineated in EPPOS No. 1 would either request prior NRC approval for such changes or provide appropriate justification for the changes utilizing the technical bases of NUMARC/NESP-007 in the 10 CFR 50.54(q) evaluation, independent of explicit reference to EPPOS No. 1.

The licensee's 10 CFR 50.54(q) evaluation for Revision 33 of the Emergency Plan primarily utilized references to EPPOS No. 1 and extended quotations from that document as justifications for the deviations from the EAL guidance in Appendix 1 to NUREG-0654. NRC staff review determined that this constituted an inadequate 10 CFR 50.54(q) evaluation and justification for the changes made in Revision 33 to the Emergency Plan.

Analysis. The finding was evaluated under the NRC's Enforcement Policy using the traditional enforcement process instead of the Significance Determination Process (SDP) because licensee reductions in the effectiveness of its emergency plan impact the regulatory process (see Section 2.2.e of Appendix B to NRC Manual Chapter 0609). The finding was determined to be a non-cited Severity Level IV violation because it involved licensee failure to meet an emergency planning requirement not directly related to assessment or notification. The EAL modifications incorporated in Revision 33 of the licensee's Emergency Plan were not submitted to the NRC for approval prior to implementation, nor were they justified on their own merits in the associated 10 CFR 50.54(q) evaluation utilizing the technical bases of NUMARC/NESP-007, independent of reference to EPPOS No. 1 (which is not regulatory guidance). This was a performance deficiency in that it constituted an inadequate 10 CFR 50.54(q) evaluation. The licensee made changes to its Emergency Plan using an alternate method for complying with the regulations without adequate justification and without NRC approval prior to implementation.

Enforcement. 10 CFR 50.54(q) states, in part, that the licensee may make changes to emergency plans without Commission approval only if the changes do not decrease the

Enclosure

effectiveness of the plans, and the plans, as changed, continue to meet the standards of 10 CFR 50.47(b) and the requirements of Appendix E to 10 CFR Part 50. Section IV.B of Appendix E states, in part, that a revision to an EAL must be approved by the NRC before implementation if the licensee is proposing an alternate method for complying with the regulations. Contrary to the above, on February 23, 1996, the licensee made changes to its Emergency Plan using an alternate method for complying with the regulations (i.e., incorporation of EAL modifications based upon NUMARC/NESP-007, Rev. 2) without NRC approval prior to implementation. Because the violation was entered into the licensee's corrective action program as NCR 214737, it is being treated as a non-cited Severity Level IV violation consistent with Section VI.A of the Enforcement Policy. NCV 05000261/2006005-02, Inadequate 10 CFR 50.54(q) Evaluation for Emergency Plan Rev. 33.

4OA6 Meetings, Including Exit

On November 29, 2006, the inspector presented the finding discussed in Section 4OA5 to Mr. T. Walt and other members of his staff via teleconference. On January 10, 2007, the resident inspectors presented the other inspection results to Mr. Tom Walt and other members of his staff. During the January 10 meeting, the licensee identified as proprietary certain information that had been examined by the inspectors. That information is not included in this report.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee personnel

C. Church, Operations Manager
B. Clark, Nuclear Assurance Manager
J. Huegel, Maintenance Manager
W. Noll, Director of Site Operations
D. Blakeney, Outage and Scheduling Manager
E. Kapopoulos, Plant General Manager
W. Farmer, Engineering Manager
J. Lucas, Manager, Support Services - Nuclear
T. Walt, Vice President, Robinson Nuclear Plant
T. Tovar, Radiation Protection Superintendent
S. Wheeler, Supervisor, Regulatory Support
G. Ludlum, Training Manager

NRC personnel

R. Musser, Chief, Reactor Projects Branch 4

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

05000261/2006005-001	URI	Equipment Performance for Functional Recovery After Certain UHS Scenarios (Section 1R07)
----------------------	-----	--

Closed

05000261/2515/169	TI	Mitigating Systems Performance Index Verification (Section 4OA5.2)
05000261/2006004-001	URI	Verify Mitigation Capabilities for Loss of Heat Sink (Section 1R07)
05000261/2006008-01	URI	Blending of EAL Schemes (Section 4OA5.4)

Opened and Closed

05000261/2006005-01	NCV	Failure to Prevent a Repetitive Failure of a Safety-Related Pump's Motor Controller
05000261/2006005-02	NCV	Inadequate 10 CFR 50.54(q) Evaluation for Emergency Plan Rev. 33 (Section 4OA5.4)

Discussed

None

LIST OF DOCUMENTS REVIEWED

1R01 Adverse Weather Protection

Procedure

OP-925, Cold Weather Operation, Rev. 35
AP-008, Cold Weather Preparations, Rev. 14

Work Orders

777529, AP-008 (BA) Cold Weather Preparations (Section 8.1.3.4)
776383, Insulator - Review Plant Areas Exposed to the Weather
777532, Engineering Reference AP-008 (Cold Weather Preparations) and Review All
Temporary Modifications
777531, Freeze Protection - Plant Equipment

1R04 Equipment Alignment

Partial System Walkdown

Motor Driven Auxiliary Feedwater system:

Drawing G-190197, Feedwater, Condensate and Air Evacuation System Flow Diagram, sheet 1
of 4, Rev. 76

Drawing G-190197, Feedwater, Condensate and Air Evacuation System Flow Diagram, sheet 4
of 4, Rev. 55

Service Water system:

Clearance Order Checklist 131

Drawing G-190199, Service and Cooling Water System Flow Diagram, sheet 2 of 13, Rev. 63

Complete System Walkdown

Drawing 5379-1082, Safety Injection System Flow Diagram, Sheet 2 Of 5, Rev. 45

Drawing 5379-1082, Safety Injection System Flow Diagram, Sheet 3 Of 5, Rev. 26

Safety Injection System Health Report, dated 3/1/06

List of open work orders for containment spray system, dated 11/8/06

1R05 Fire Protection

FSAR

3.1.5.6, Fire Zone 20 - Emergency Switchgear Room and Electrical Equipment Area

3.1.5.5, Fire Zone 19 - Unit 2 Cable Spread Room

3.1.3.2, Fire Zone 7 - Auxiliary Building Hallway (Ground Floor)

3.9.1, Fire Zone 29 - Service Water Pump Area

3.1.5.7, Fire Zone 22 - Control Room

Procedures

OMM-003, Fire Protection Pre-Plans/Unit No. 2, Rev. 47

OST-625, Fire Door Inspection (Semi-Annually), Rev. 26

results from OST-611-13, Low Voltage Fire Detection and Actuation System Zones 24, 25A, 25B, 25C and 26 Cold Shutdown Exceeding 24 Hours if not Performed in the Previous Six Months, Rev. 4, completed 9/22/05.

results from OST-628 Function Test of the Halon 1301 System (Annual), Rev. 21, completed 9/5/06.

results from OST-611-11, Low Voltage Fire Detection and Actuation System Zones 19 and 20 (Semi-Annual), Rev. 4, completed 6/10/06.

results from OST-611-6, Low Voltage Fire Detection and Actuation System Zone 11 and 13 (Semi-Annual), Rev. 3, completed 6/24/06.

results from OST-629, Zone 12 and Zone 14 Pre-Action Sprinkler System Quarterly Flow and Low Air Alarm Test and Zone 12 and Zone 14 Pre-Action Sprinkler System and Zone 23 Dry Standpipe System Annual Functional Test, Rev. 24, completed 11/22/06

Other Documents

Work Order 00759574-01, Flame Detector 25B6 Would Not Actuate During OST-611-13.

1R07 Biennial Heat Sink Performance

Procedures

EPP-28, Loss of Ultimate Heat Sink, Rev. 5

OP-402, Auxiliary Feedwater System, Rev. 65

OP-801, Fire Water System, Rev. 41

1R11 Licensed Operator Requalification

Procedure AOP-019, Malfunction of [Reactor Coolant System] Pressure Control, Rev. 13

1R12 Maintenance Effectiveness

Action Requests

AR 193247, Failure of V6-12C to Stroke Following Maintenance Activities

AR 201606, Unanticipated [Limited Condition for Operations] Entry Due to Trip of [Service Water Booster Pump] B

AR 132454, [Service Water Booster Pump] A Failure and Unanticipated [Limited Conditions for Operations] Entry

Other Documents

Drawing B-190628, Control Wiring Diagram, Sheet 846, Rev. 13

DBD/R87038/SD04, Design Basis Document, Service Water, Rev. 0

1R13 Maintenance Risk Assessments and Emergent Work Evaluation

Procedure OMM-048, Work Coordination and Risk Assessment, Rev. 28

Procedure ADM-NGGC-0006, Online EOOS Models for Risk Assessment, Rev. 5

1R15 Operability Evaluations

Flowserve Letter, USNRC 10 CFR Part 21 Notification, dated 10/31/2006
AR 214754, Flowserve 10 CFR 21 Notification

1R17 Permanent Plant Modifications

Engineering Change 64363, A [Component Cooling Water] Pump Replacement Motor
Calculation RNP-E-8.002, AC Auxiliary Electrical System Voltage/ Load Flow/ Fault Current
Study

Procedure MOD-026, Cable Design for the H. B. Robinson Plant, Rev. 4

1R19 Post Maintenance Testing

Procedures

OST-409-2, [Emergency Diesel Generator] "B" Fast Speed Start, Rev. 29

OST-201-1, [Motor Driven Auxiliary Feedwater Pump] System Component Test - Train A, Rev.
25

OST-908, Component Cooling System Component Test, Rev. 62

OST-646, Fire Suppression Water System Engine Driven Fire Pump Test (Annual), Rev. 24

OST-302-1, Service Water Pumps A and B Inservice Test, Rev. 48

Work Orders

798967-01, Clean and Test A [Motor Driven Auxiliary Feedwater Pump] Oil Cooler

743704-01, Diesel Driven Fire Pump Engine Inspection

809652-01, Diesel Driven Fire Pump Engine Inspection - Annual

743705-01, Calibrate the Engine Driven Firewater Instruments

717526-01, Replace Batteries for the Diesel Driven Fire Pump

717524-01, Replace Engine Driven Fire Pump Thermostat and Seal on a Four Year Frequency

971092-01, Motor Hold Down Bolts Need Replacement

Other Documents

Engineering Change 64363, A [Component Cooling Water] Pump Replacement Motor
Calculation RNP-E-8.002, AC Auxiliary Electrical System Voltage/ Load Flow/ Fault Current
Study

1R20 Refueling and Outage Activities

Procedure PLP-006, Containment Vessel Inspection/Closeout, Rev. 69

1R22 Surveillance Testing

Procedures

OST-051, Reactor Coolant System Leakage Evaluation (Every 72 Hours During Steady State
Operation and Within 12 Hours After Reaching Steady State Operation), Rev. 34

OST-108-2, Boric Acid Pump B Inservice Test, Rev. 18

OST-925, Containment Fan Coolers Valve Position Indicator Verification, Rev. 7

PM-207, Testing of Thermal Overload Relays for MCC-6, Rev. 12
PM-447, Molded Case Circuit Breakers Instantaneous Trip Testing, Rev. 15
RST-001, Radiation Monitor Source Checks, Rev. 72
OST-603, Motor Driven Fire Water Pump and Engine Driven Fire Water Pump Test (Weekly),
Rev. 29

Other Documents

Work Order 706251-01, MCC-6(17J) Perform Thermal Overload Test

40A1 Performance Indicator Verification

Procedure ADM-NGGC-0101, Maintenance Rule Program, Rev. 19
Licensee Event Report 2006-001-00, Manual Reactor Trip Due to Failure of a Turbine Governor
Valve Electro-Hydraulic Control Card
Maintenance Rule event reports that cover the previous 18 months, for systems 1000
(Containment Isolation Valve), 1080 (Reactor Protection), 2005 (Reactor Coolant), 2045
(Residual Heat Removal), 2060 (Chemical and Volume Control), 2080 (Safety Injection),
2116 (Post Accident Monitoring), 4080 (Component Cooling Water), 5095 (Emergency
Diesel Generator), 5235 (Electrical - [Direct Current] System), 6135 (Instrument Air), 6140
(Station Air), 7105 (Spent Fuel), and 8220 ([Heating, Ventilation, and Air Conditioning] -
Control Room Area)

40A2 Identification and Resolution of Problems

AR 193627, Site Wide Human Performance Trend
Robinson Human Performance Strategic Plan, 10/16/06
Year-to-date trends in site-level Human Performance Events, the Robinson Human
Performance Index, and Human Performance Indexes for Operations, Maintenance,
Engineering, Radiation Protection, Environmental & Chemistry, and Training
3rd Quarter (2006) Leadership Continuing Training materials

40A3 Event Follow-up

AR 210311, Manual Reactor Trip Due to 100 percent Load Rejection
Post Trip/Safeguards Review Report, dated 10/27/06
Sequence of Events Log, dated 10/25/06
Alarm History Report, dated 10/25/06
Drawing 5379-3695, Logic Diagram, Turbine Trip Signal, Rev. 13
System Description, SD-033 Main Turbine, Rev. 11
System Description, SD-032 Electro-Hydraulic Control System, Rev. 10

40A5 Other Activities

Independent Spent Fuel Storage Installation

Procedure

OST-021, Daily Surveillance, Rev. 20

FMP-004, Special Nuclear Material (SNM) Inventory, Rev. 22

REG-NGGC-0010, 10 CFR 50.59 and Selected Regulatory Reviews, Rev. 8

NGGM-PM-0028, Transnuclear NUHOMS Dry Fuel Storage Program Manual, Rev. 0

10 CFR 72.48 Screen/Evaluation

198678, ISFS-005

183844, PLP-130 Rev 0 (PRR 157922)

166672, ISFS-014 (PRR 166321)

169870, PRR 156900 - MST-924

166705, SP-1521 (PRR 162014)

Other Documents

ISFSI Punch List, dated 9/5/2006

Self-Assessment Report 176330, Cross Functional Review of the ISFSI Program/System
Updated Final Safety Analysis Report for the Standardized NUHOHMS Horizontal Modular
Storage System for Irradiated Nuclear Fuel

Independent Spent Fuel Storage Installation Safety Analysis Report

AR 202680, [Self Assessment] #17630, I-1 ISFSI Project Poor Transition

Temporary Instruction (TI) 2515/169

Action Requests

176133, Conduct a Self-Assessment of NRC Performance Indicators

211342, Error in NRC MSPI Data Forms

68240, Safety Injection Pump C Black Oil

208470, MSPI Basis Document Has Incorrect Assumptions for RHR-759A/B

Other Documents

System Health Reports for Auxiliary Feedwater, Residual Heat Removal, Emergency Diesel
Generators, Service Water, Component Cooling Water and Safety Injection

Maintenance Rule Functional Failure and Unavailability Reports for Auxiliary Feedwater,
Residual Heat Removal, Emergency Diesel Generators, Service Water, Component Cooling
Water and Safety Injection

RNP-F/PSA-0057, NRC Mitigating System Performance Index Basis Document for the
Robinson nuclear Plant

Historical MSPI Unavailability Report

Operator Logs, for the period 1/1/2002 - 12/31/2004

DBD/R87038/SD03, Design Basis Document Residual Heat Removal System