

March 26, 2015

Mr. Michael V. McMahon  
Senior Vice President  
AREVA TN/Americas, Areva Inc. (TN)  
7135 Minstrel Way  
Columbia, MD 21045

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION INSPECTION REPORT NO. 72-1004/2015-201

Dear Mr. McMahon:

This refers to the inspection conducted February 3-11, 2015, at Larsen & Toubro Limited (L&T), India. L&T is under contract with TN to fabricate Dry Cask Storage Systems (DCSS) for storing spent nuclear fuel for use at independent spent fuel storage installations as well as a steel encased lead shielded cask (TN-RAM) and transportation package (TN-LC). The inspection was conducted to determine if L&T fabrication activities at Powai Works, located in Mumbai and Ranoli Works, located in Vadodara were conducted in accordance with U.S. Nuclear Regulatory Commission (NRC)-approved Quality Assurance Program requirements and whether the DCSS and transport casks are fabricated, assembled and tested in accordance with applicable Safety Analysis Reports and Certificates of Compliance. In addition, the inspection assessed compliance with 10 CFR Part 21, "Reporting of Defects and Noncompliance," 10 CFR Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor Related Greater than Class C Waste" and 10 CFR Part 71, "Packaging and Transportation of Radioactive Material." The enclosed report presents the results of this inspection.

Based on the results of this inspection, the NRC has determined that no violations of significance occurred.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC web site at <http://www.nrc.gov/reading-rm/adams.html>.

Sincerely,

**/RA/**

Patricia Silva, Chief  
Inspections and Operations Branch  
Division of Spent Fuel Management  
Office of Nuclear Material Safety  
and Safeguards

Docket No. 72-1004  
Enclosure:  
NRC Inspection Report No. 72-1004/2015-201

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Docket No. 72-1004

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Distribution:

Docket 72-1004 M Lombard, DSFM A Hsia, DSFM

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**U.S. NUCLEAR REGULATORY COMMISSION  
Office of Nuclear Material Safety and Safeguards  
Division of Spent Fuel Management**

**Inspection Report**

Docket: 72-1004

Report: 72-1004/2015-201

Certificate Holder: AREVA TN/Americas, Areva Inc. (TN)  
7135 Minstrel Way, Suite 300  
Columbia, MD 21045

Travel Location(s): Destination City: Mumbai, India  
Transit City(s): Mumbai and Vadodara

Fabricator Facility: Larsen & Toubro Limited (L&T)  
Heavy Engineering Division  
Saki Vihar Road  
Powai Works  
Mumbai, 400072

Inspection Dates: Vadodara (Ranoli Works): February 4-6, 2015  
Mumbai (Powai Works): February 3, 9-11, 2015

Inspection Team: Earl Love, Safety Inspection Engineer, NMSS/DSFM/IOB  
Jeremy Tapp, Safety Inspector, NMSS/DSFM/IOB  
Robert Carrion, Senior Reactor Inspector, RII/DRS/Engineering Branch 3

Approved by: Patricia Silva, Chief  
Inspections and Operations Branch  
Division of Spent Fuel Management  
Office of Nuclear Material Safety  
and Safeguards

## EXECUTIVE SUMMARY

U.S. Nuclear Regulatory Commission (NRC) Inspection Report 72-1004/2015-201

From February 3, 2015, to February 11, 2015, an inspection team led by the Office of Nuclear Material Safety and Safeguards (NMSS) Division of Spent Fuel Management (DSFM) performed an inspection of selected fabrication activities for spent fuel dry storage and transportation casks being manufactured in India for use in the United States. The team examined the activities at two L&T fabrication sites, Ranoli Works (RW) and Powai Works (PW), located in Vadodara and Mumbai, respectively. The work at both facilities was being performed for TN. TN holds Certificates of Compliance (CoC) issued by the NRC for specific spent fuel cask and transportation package designs. The following is a list of active contracts at both L&T facilities:

<b>System Name</b>	<b>License</b>	<b>End-user</b>	<b>Location</b>
NUHOMS 61BTH Type 1	CoC 721004	Exelon Nine Mile Point	Ranoli
NUHOMS 61BTH Type 2	CoC 721004	Duke Brunswick	Ranoli
NUHOMS 32P	Material License No. SNM-2505 (Docket No. 72-8)	Calvert Cliffs	Powai
NUHOMS 32PHB	Not Yet Licensed	Calvert Cliffs	Powai
NUHOMS 32PTH1- L	CoC 721004	Duke Crystal River 3	Ranoli
NUHOMS 32PTH1	CoC 721030	NEXTera St. Lucie NEXTera Seabrook	Ranoli
NUHOMS 24PTH-S-LC	CoC 721004	Duke Oconee	Ranoli
24PTH	CoC 721004	Duke Robinson	Ranoli
TN68	CoC 721027	Exelon Peach Bottom	Powai
TN-LC	CoC 719358	TN	Ranoli
TN-RAM	CoC 719233	TN	Ranoli

Planning and material procurement was underway for the TN-RAM and NUHOMS DSC 32PHB for Calvert Cliffs, 32PTH1-L for Crystal River 3, 32PTH1 for St. Lucie and Seabrook, 24PTH-S-LC for Oconee and 24PTH for Robinson. Recently completed work included NUHOMS DSC 32P for Calvert Cliffs, 61BTH for Brunswick, Oyster Creek, Limerick, and Nine Mile Point.

The team examined welding, nondestructive examination activities, leak testing, design control, documentation control, material controls and quality assurance (QA) controls. In addition, the team reviewed numerous quality documents such as inspection reports, corrective action and nonconformance reports, procurement documents associated with commercial grade dedication (CGD) of important to safety (ITS) related components, audits, and design documents. Additionally, the team examined the adequacy of fabrication oversight activities by the reactor licensees and the CoC holders.

## INSPECTION PROCEDURES USED

IP 60852, "ISFSI Component Fabrication by Outside Fabricators"  
IP 86001, "Design, Fabrication, Testing, and Maintenance of Transportation Packagings"  
NUREG/CR 6314, "Quality Assurance Inspections for Shipping and Storage Containers"

## LIST OF ACRONYMS USED

ASME	American Society of Mechanical Engineers Boiler and Pressure Vessel Code
AVL	Approved Vendor List
CAR	Corrective Action Report
CFR	Code of Federal Regulations
CoC	Certificate of Compliance
CGD	Commercial Grade Dedication
CGI	Commercial Grade Item
CMTR	Certified Material Test Report
DCSS	Dry Cask Storage System
DRS	Division of Reactor Safety
DSC	Dry Shielded Canister
DSFM	Division of Spent Fuel Management
EPRI	Electric Power Research Institute
ITS	Important to Safety
L&T	Larsen & Toubro Limited
NQA	Nuclear Quality Assurance
NCR	Nonconformance Report
NDE	Nondestructive examination
NMSS	Nuclear Material Safety and Safeguards
NRC	U.S. Nuclear Regulatory Commission
NSQAM	Nuclear Safety Quality Assurance Manual
NUHOMS	Nuclear Utilities Horizontal Storage Module System
PW	Powai Works
RW	Ranoli Works
QA	Quality Assurance
QAP	Quality Assurance Program
QOP	Quality Operating Procedure
QSM	Quality System Manual
TN	AREVA TN/Americas, Areva Inc.
WPS	Welding Procedure Specification

## PERSONS CONTACTED

The team held an entrance meeting at PW (Mumbai) in the afternoon of February 3, 2015, and at RW (Vadodara) on February 4, 2015, to present the scope and objectives of the NRC inspection. On February 6, 2015, and February 11, 2015, the team held exit meetings at both facilities, respectively, to present the preliminary results of the inspection at each location. The individuals present at the meetings are listed below in Table 2.

Table 2  
Entrance and Exit Meetings Attendance

NRC	Entrance	Exit
E. Love	X	X
J. Tapp	X	X
R. Carrion	X	X
AREVA/TN		
T. Kindelberger	X	X
K. O'Connor	X	X
M. Stoltz	X	X
M. Solano	X	X
Duke Energy		
W. Wilson	X	X
L&T Powai and Ranoli Works		
A. Parab	X	X
A. Paranjpe	X	X
P. Patil	X	X
K. Chaudhari	X	X
S. Sawant	X	X
S. Berry	X	X
L&T Ranoli Works		
J. Arya	X	X
D. Chandarana	X	X
A. Tilewala	X	X
N. Varma	X	X
S. Narang	X	X
M. Bapat	X	X
T. Parikh	X	X
D. Shan	X	X
K. Salot	X	X
P. Gayake	X	X
T. Koradia	X	
L&T Powai Works		
R. Shriwardhankav	X	X
A. Athanikar	X	X
D. Kulkarni	X	X
K. Krishnakumar	X	X
N. Pradhan	X	X
K. Babu	X	X
V. Sehgal	X	X
K. Shenoy	X	X
H. Shan	X	
R. Ramanujan	X	
N. Jeiswal	X	
A. Kode	X	
C. Trivedi		X
R. Padhye		X
D. Nayak		X

## REPORT DETAILS

### 1. Inspection Purpose and Scope

The purpose of the inspection was for the NRC to determine whether L&T Limited fabrication activities at PW, located in Mumbai and RW, located in Vadodara, were conducted in accordance with NRC-approved Quality Assurance Program (QAP) requirements and whether dry cask storage systems (DCSS) and transport casks are fabricated, assembled and tested in accordance with applicable safety analysis reports and CoCs. The team observed selected activities; reviewed procedures and instructions; examined documents, records, and drawings; verified personnel training and qualifications; and interviewed personnel responsible for various activities. This was a first time NRC inspection of L&T for cask fabrication activities.

In addition, the inspection assessed compliance with 10 CFR Part 21, "Reporting of Defects and Noncompliance," 10 CFR Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor Related Greater than Class C Waste" and 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."

### 2. Management Controls

#### 2.1 Scope

The team reviewed L&T's Nuclear Safety Quality Assurance Manual (NSQAM), Issue 5, Revision 4 implemented at PW and Quality System Manual (QSM), Revision 5 implemented at RW.

#### 2.2 Observations and Findings

##### 2.2.1 Quality Assurance Policy

The team noted that L&T PW's NSQAM was based on 10 CFR Part 50 Appendix B, 10 CFR Part 71 Subpart H, 10 CFR Part 72 Subpart G, and ASME NQA-1 requirements. The NSQAM contained a management statement of policy signed by L&T's Executive Vice President responsible for Quality Assurance (QA). In addition, the team determined that the NSQAM considers L&T's RW fabrication location as a nuclear grade supplier and treats them as such. L&T RW's QSM was based mainly on ISO 9000 requirements, but had been updated with certain nuclear QA requirements. This was to ensure fabrication of nuclear grade components at RW was performed in accordance with the applicable 10 CFR Part 71 Subpart H and 10 CFR Part 72 Subpart G requirements. The QSM contained a management statement of policy signed by L&T's President of Heavy Engineering. The team also noted that L&T plans to roll RW under the PW QAP in mid-2015 so they will be using the same processes and procedures moving forward.

##### 2.2.2 Nonconformance/10 CFR Part 21/Corrective Action Program Controls

The team reviewed L&T's non-conformance programs to assess the effectiveness of measures established to control materials, parts, components, and services that have been identified by L&T as not conforming to specified requirements. The team also reviewed L&T's corrective action programs to assess the effectiveness of the measures established to identify and correct issues, and if required, prevent recurrence. In addition, the team reviewed program controls for

10 CFR Part 21, "Reporting of Defects and Noncompliances." Overall, L&T's quality operating procedures (QOPs) provided adequate guidance for the processing of nonconforming items, corrective actions, and 10 CFR Part 21 requirements. However, at RW, the team noted that QOP 85-02 "Corrective and Preventive Action," Revision 4 did not contain definitions or guidance as to what constitutes a "condition adverse to quality" or "significant condition adverse to quality." In addition, for a significant condition adverse to quality, QOP-85-02 did not contain a specific step in the processing Corrective Action Reports (CARs) section to implement a corrective action that prevents recurrence. During interviews with QA personnel, the team determined that those responsible for corrective actions understood: 1) the difference between conditions adverse to quality and significant conditions adverse to quality, and 2) that significant conditions adverse to quality required a corrective action to prevent recurrence. L&T entered these observations into their corrective action program (CAR No. 15/167) to enhance the procedure.

The team reviewed a selection of both Nonconformance reports (NCRs) and CARs issued since the beginning of 2014 for fabrication of the TN-LC and TN NUHOMS dry shielded canisters (DSCs) at RW. The team assessed that for the twenty two (22) NCRs reviewed, they had been appropriately dispositioned. Where NCRs had not yet been dispositioned, red hold tags were verified in the shop to be located on the affected components. However, the team noted with regard to NCR 20233-NCR-003 that the NCR had not yet been dispositioned and that an NCR hold tag was not affixed as required. This issue was entered into L&T's corrective action program (CAR No. 15/163). The team noted that the component in question was still in the receiving process and not yet released for production and would not have been inadvertently used. As such, the team determined this to be an isolated incident and constituted this as a violation of minor safety significance not subject to enforcement action in accordance with Section IV of the Enforcement Policy.

The team assessed that for the seven (7) CARs reviewed at RW that they had been adequately documented, actions were timely, and the corrective actions taken were adequate except for one example. The team noted an issue with regard to CAR 14/144. This CAR was written to correct inadequate storage of basket rail assemblies, specifically, entrapment of moisture during storage, that was self-identified by L&T personnel. Since this CAR was dispositioned as a significant condition adverse to quality, corrective actions to prevent recurrence were required by QOP 85-02, Step 2.1. One of L&T's corrective actions to prevent recurrence was to revise procedure 32PTH/24PTH/32PHB/HTS, "Procedure for Handling & Temporary Storage," to include provisions to prevent moisture entrapment during storage. Another procedure, L&T/61BT/61BTH Types-1 & 2/DSC/042/HTS, "Procedure for Handling, Temporary Storage & Shipping," addressed storage of rail assemblies, but L&T failed to revise this procedure to prevent recurrence of moisture entrapment during storage of basket rail assemblies covered under this procedure. The team noted that the potential safety consequences of not updating the second procedure were minimal due to the fact that L&T inspects the basket rails after storage for degradation and would not be installed in that condition. The failure to perform adequate corrective actions to revise the second procedure to prevent recurrence is a second example and constituted a violation of minor safety significance not subject to enforcement action in accordance with Section IV of the Enforcement Policy. This issue was also entered into L&T's corrective action program.

The team reviewed Section 15, "Control of Nonconforming Items," Section 16, "Corrective Action," and Appendix A3, "Reporting of Defects and Noncompliances," of the NSQAM at PW. The team noted adequate guidance for the processing of nonconforming items, corrective actions, and 10 CFR Part 21 requirements. The team reviewed a selection of both NCRs and



CARs issued since the beginning of 2014 for fabrication of the TN-68 cask. The team assessed that for the six (6) NCRs reviewed, they had been appropriately dispositioned. Where NCRs had not yet been dispositioned, red hold tags were verified in the shop to be located on the affected components. In addition, the team assessed that for the fourteen (14) CARs reviewed, they had been adequately documented, actions were timely, and the corrective actions taken were adequate. The team noted that L&T had identified a few areas such as document control and training, where there had been repeat issues. As a result, L&T initiated CARs for these areas to perform root cause evaluations, which were near completion during the time of the inspection. The team assessed that L&T's evaluations were comprehensive in nature and included adequate corrective actions to prevent recurrence. In addition, the team noted that L&T currently uses a manual corrective action system but plans to move to a computer system in mid-2015 to decrease processing time and allow for more robust tracking and trending to be performed.

TN specification documents require L&T to have procedures for the implementation of 10 CFR Part 21 requirements at their facilities. The team reviewed applicable Part 21 procedures and also verified posting of Part 21 documents at various locations in administrative offices as well as in the fabrication areas. No concerns were identified.

### 2.2.3 Documentation Controls

The team reviewed documentation controls to verify that fabrication and procurement documents were approved and reviewed and updated periodically. The team verified that 1) quality records were identified, retrievable, controlled, stored, and periodically reviewed and updated; 2) controlled documents were reviewed and approved, and 3) appropriate procedures (including the correct revision) were available at the job location where the prescribed activity was performed. The team verified that a completed document close-out review program was documented and had been implemented. The team interviewed plant personnel responsible for the program as well as reviewed several project specific documents. Plant personnel demonstrated the process to the team and showed how the documents were processed, distributed, and stored. Overall, activities related to documentation controls were verifiable, controlled, and traceable; were reviewed by authorized personnel for adequacy; and were used at the location where the prescribed activity was performed.

### 2.2.4 Audit Programs

The team reviewed the audit program as defined in the PW NSQAM, Section 18, Issue 5, Revision 3, "Quality Audits," to verify that the program was comprehensive and that audits were scheduled and conducted periodically in accordance with approved procedures by trained audit personnel who documented the audit results and followed up deficient areas by means of the corrective action program. The team noted that audit personnel did not have direct responsibility in the areas being audited and that the audit records were reviewed and approved by appropriate levels of management. The team also verified that an audit discrepancy resolution program had been developed, documented, and implemented and that resolutions were implemented in a timely manner and that contractors, vendors, and suppliers were approved and placed on an approved vendor list which was maintained to ensure compliance. The team reviewed internal audits to verify that they were conducted in accordance with the program as previously defined. The team noted that all eighteen quality criteria had been evaluated within a twelve month timeframe in the internal audit process.

## 2.3 Conclusions

The team assessed that both L&T's PW NSQAM and RW's QSM conformed to the applicable requirements. Overall implementation of L&T's QAPs was assessed to be adequate. The team concluded adequate guidance for the processing of nonconforming items, corrective actions, and 10 CFR Part 21 requirements and that the audit program was verifiable, controlled, and traceable and that audits were conducted as defined by the program. Two examples of a violation of minor safety significance not subject to enforcement action in accordance with Section IV of the Enforcement Policy were identified for L&T's failure to: 1) affix a hold tag to a piece of nonconforming equipment, and 2) perform adequate corrective actions to prevent recurrence of moisture entrapment during storage of quality materials.

## 3. Design Controls

### 3.1 Scope

Since L&T did not perform design activities for TN, the team limited examination in this area to verification that TN design and procurement requirements were reflected in fabricator specifications, drawings, procedures, and records. The team reviewed a sample of those documents to determine that the quality activities performed by L&T were suitably controlled.

### 3.2 Observations and Findings

The team reviewed various L&T purchase orders, CGD evaluations, plans and reports, specifications, fabrication drawings, procedures, and records to determine if the requirements of TN CoC's were satisfied with respect to fabrication, assembly and testing of the dry storage components. The team noted a discrepancy between a TN specification and L&T's procurement of inner shell plates during CGD. The TN procurement specification for the TN-68 casks, E-18597, revision 9, stated that containment boundary material be fabricated, examined and tested in strict accordance with Subsections NB and WB of the ASME Code and that materials meet all requirements of WB 2000. The team noted the requirement that certain plate material be examined by the angle beam ultrasonic method according to WB-2532.2. Contrary to the requirement, at the time of CGD, the angle beam ultrasonic for the inner shell had not been performed. L&T had self-identified and initiated an NCR (20119-042) as well as a CAR (14/083) to address this deficiency. The team reviewed L&T's rework traveler (TN68/NCR 20199-042/01), ultrasonic examination report (20199-18131), and recertification documents for compliance to WB-2532. As part of L&T's assessment of the extent of condition, a second component was identified to not having met a specific test requirement as defined by TN68 specification E-18597. Specifically, surface components of a lid assembly were not magnetic particle examined as required by ASME NB-2520. To address this issue, and prior to this inspection, L&T initiated an NCR (20199-NCR-142). Similarly, the team reviewed L&T's rework traveler (TN68/NCR 20199-142/2) and observed in-process rework (machining) in preparation for the conduct of the required magnetic particle examination. In both cases, L&T self-identified the deficiencies. The team reviewed the cause, corrective, and preventative actions taken by L&T to prevent recurrences and noted that the inner shell plates and lid assembly used in fabrication did not affect any completed casks and that overall, no other issues were identified.

L&T procures ITS-A components as commercial grade and performs dedication according to the guidelines of EPRI Report NP-5652, "Guideline for the Utilization of Commercial Grade Items in Nuclear Safety Related Application," TR-102260, "Supplemental Guidance for the Application of

EPRI Report NP-5652,” and EPRI TR-017218-R1, “Guideline for Sampling in the Commercial-Grade Item Acceptance Process.” The team assessed L&T’s dedication program, including technical evaluations and selection of commercial grade item (CGI) critical characteristics for acceptance and determined that L&T’s methods were satisfactory. The team reviewed various CGI evaluations, plans and reports and determined for those components reviewed that dedicated ITS-A components will perform their identified safety function. The team noted that upon acceptance, components are subjected to 10 CFR Part 21 reporting requirements as basic components. In addition the team noted that TN reviews and approves all of L&T’s dedication activities for compliance to their specifications and regulatory requirements. The following ITS-A CGD packages were reviewed:

TN68:

- Inner Shell Alloy Steel Plates
- Helico Flex O-ring Seals
- Lid Bolts
- Threaded Inserts
- Lid Outer Plates
- Low Alloy Steel Solid Electrode and Flux for Submerged Arc Welding
- Stainless Steel Bare Welding Wire for Gas Tungsten Arc Welding

61BTH DSC:

- Stainless Steel Plates
- Stainless Steel Bare Welding Wire for Gas Tungsten Arc Welding

TN-LC

- Stainless Steel Plates of Grade SA 240, Type XM19

3.3 Conclusion

In the area of design controls, no findings of significance were identified.

**4. Fabrication Controls**

4.1 Scope

The team evaluated control of the fabrication process through observations, examinations, and personnel interviews in the areas of material procurement, fabrication and assembly, test and inspection, and tools and equipment.

4.2 Observations and Findings

4.2.1 Material Procurement

The team verified that appropriate procedures were implemented for control of the procurement process. The team selected samples of materials and services in use, as well as from completed work, to assess for compliance with CoCs, TN specifications, and procurement requirements. The team examined the fabricators’ procurement specifications, CGD evaluations, plans and reports, certified material test reports, receipt inspection records,

certificates of conformance, and vendor qualifications. The team reviewed procurement documents of ITS category A component materials such as the inner shell and basket steel plates, lid outer plates, cask flanges, and welding electrodes including flux. The team noted that CGD reports included certified material test reports (CMTRs) and other third party test reports (as applicable). In addition, the team reviewed CGD evaluations and plans of ITS-A components (e.g., helicoflex o-ring seals, steel bolts, and threaded inserts) not yet received by L&T. Overall, the team noted that requirements of storage cask (TN68), transport packaging (TN-LC), and dry shielded canister (61BTH) specifications had been met. The following TN specifications were assessed for compliance to CoC's:

- NUH-32P-0105, Revision 1, dated January 27, 2014, "NUHOMS 32P and 32PHB Dry Shielded Canisters"
- NUH-61BTH-0105, Revision 1, dated March 15, 2010, "NUHOMS 61BTH Type 1 and 2 Dry Shielded Canisters"
- E-18597, Revision 9, dated January 19, 2010, "Procurement Specification for the TN68 Spent Fuel Storage Cask"
- 65200-0102, Revision 1, dated January 28, 2014, "TN-LC Transport Cask and Baskets"
- E10057, Revision 2, dated July 6, 1989, "Design Criteria for the TN-RAM Packaging"

#### 4.2.2 Fabrication/Assembly/Testing

The team examined selected samples of fabrication specifications, quality plans, engineering drawings, work control procedures, and travelers to determine that fabrication met the requirements of the CoCs. The team observed fabrication activities, welding processes and examined applicable qualification and certification records to determine that fabrication satisfied requirements and was accomplished by qualified personnel. The team also reviewed completed 61BTH final documentation packages to assess work which had been completed prior to the inspection. The packages reviewed were:

- Brunswick, DSC Identification Number: BNP-61BTH-2-E-2-LT14
- Nine Mile Point, DSC Identification Number: NMP-61BTH-I-A-2-034

Personnel performing welding and nondestructive examination (e.g., helium leak, ultrasonic, liquid penetrant, and radiography) activities were qualified and were maintaining their qualification in accordance with applicable quality procedures. The team observed welding of DSC and TN68 inner shell seams, basket arc spot, lid outer plate overlay, and component fit-ups, and reviewed corresponding production weld data sheets, weld repair records (as applicable), weld procedure specifications, and welder performance qualification/proficiency records. The team noted welders, travelers, procedures, specifications, and weld consumables used were adequate and compliant with applicable TN specifications, as well as ASME Code and regulatory requirements.

The team identified components, materials and consumables (e.g., penetrant and weld flux materials, used on the shop floor for fabrication and traced them back to their associated purchase orders and applicable design drawings. With the exception of an L&T self-identified discrepancy between a TN specification and procurement of TN68 inner shell plates and lid

assembly during CGD (refer to Section 3.2 for details), receipt inspection was able to show that the material conformed to the requirements of the design drawings. No concerns were identified in the translation of design information into procurement documents, CGD reports, and use of materials in the fabrication process.

The team observed shop material in use at different production stages and noted adequate measures were established and implemented for release and distribution to shop work stations. Items were properly identified as to the inspection and/or production status and components were appropriately stored. Overall, material controls were adequate and no issues were identified.

#### 4.2.3 Test and Inspection

The team performed a review of in-process travelers and witnessed visual/liquid penetrant examinations, dimensional/fit-ups, 61BTH basket free path, bubble leak and pneumatic pressure testing (see below). Afterwards, the team performed a detailed assessment of post-inspection records and process qualification records (e.g., remote visual and shell rolling/forming). The team reviewed certification records for NDE personnel, including associated eye exams, and no concerns were identified. Overall, the quality of construction and capabilities of inspection personnel to perform these test and inspection activities were adequate.

##### Ranoli (DSC 61BTH):

- Pneumatic Pressure Test, Sub Assembly No. 0101/05 (Report No. 0101-Assembly-05/PNT/2.35/01) - Brunswick
- Dimensional Inspection, Assembly No. 10, Gap checks: Shield Plug, Inner and Outer Top Covers (Report No. 0100B-10/DI/GAP/01) - Nine Mile Point
- Basket Free Path Test, Assembly No. NMP-61BTH-1-A-2-039 - Nine Mile Point

##### Powai (TN68):

- Overlay Welding, Lid Outer Plate, Assembly No. 0300/03
- Circumferential Seam Welding, Inner Shell No. 3
- Basket Arc Spot Welding, Basket Assembly No. 01 (including pre-shift coupon bend test)
- Liquid Penetrant Examinations, Shell Longitudinal Seams, Sub Assembly Nos. 0204/7 and 8 (Report Nos. 20199/0204/7 and 8-3.20)

In observing various assembly and testing processes during fabrication, the team noted that multiple hold and witness points existed for verification of quality activities. In some cases these hold and witness points had been completed to provide assurance to oversight personnel that activities were being performed properly. Many of the hold witness points existed at or for test and inspection activities. The team noted that overall L&T and TN had adequate control of processes and ongoing work, including the testing and inspection of individual items and assemblies.

#### 4.2.4 Tools and Equipment

The team reviewed selected measuring and test equipment including records and procedures to assure that equipment used in activities affecting quality were properly controlled and calibrated. The team compared a sampling of measuring and test equipment in current use for fabrication activities at both facilities and determined overall compliance to procedural requirements. The team verified that if the measuring and test equipment had been sent off-site for calibration that 1) the calibration service provider was on the Approved Suppliers List, and 2) had been audited within the last three years. The team noted for the equipment currently out of calibration, it was either clearly segregated from the equipment in calibration or had been sent off-site for calibration. Overall, L&T adequately implemented measuring and test equipment calibration, tracking, and record retention requirements.

#### 4.3 Conclusion

Overall, the quality of fabrication, quality controls, and QA oversight by the CoC holders and the licensees at both facilities were adequate.

#### **5. Exit Meeting**

On February 6, 2015, after the first week of inspection at RW (Vadodara), the team had an exit meeting with TN and representatives of L&T in which the results of the inspection were discussed. The team determined fabrication processes were adequate with regard to the quality of workmanship and facility housekeeping practices. For the second week of inspection, the team moved to the PW facility located in Mumbai. On February 11, 2015, the team had an exit meeting with TN and L&T representatives. The team again found the quality of workmanship and housekeeping to be adequate. No violations of significance were identified.

The team concluded that the quality of fabrication and the quality controls at both facilities and that the oversight by the CoC holders and the licensees was adequate. The NRC team observed TN's effective communications with L&T staff. L&T engineers and quality inspectors were very familiar with applicable U.S. codes and standards. The team found the QA organization's problem identification and resolution practices to be comparable to those in the United States.