NRC FORM 591S PART 1
(10-2013)
10 CFR 2.201

U.S. NUCLEAR REGULATORY COMMISSION

SAFETY INSPECTION REPORT AND COMPLIANCE INSPECTION

1. CERTIFICATE/QUALITY ASSURANCE PROGRAM (QAP) HOLDER:	2. NRC/REGIONAL OFFICE
TN Americas LLC 7135 Minstrel Way, Suite 300 Columbia, Maryland 21045	Headquarters U. S. Nuclear Regulatory Commission Mail Stop TWFN 4B-34 Washington, DC 20555-0001
REPORT NUMBER(S) 072-1004/2017-201	

3. CERTIFICATE/QAP DOCKET NUMBER(S)	4. INSPECTION LOCATION	5. DATE(S) OF INSPECTION
72-1004, 72-1029, 72-1030	117 Windchaser Way Moyock, North Carolina 27958	April 17-21, 2017

CERTIFICATE/QUALITY ASSURANCE PROGRAM HOLDER:

The inspection was an examination of the activities conducted under your QAP as they relate to compliance with the Nuclear Regulatory Commission (NRC) rules and regulations and the conditions of your QAP Approval and/or Certificate(s) of Compliance. The inspection consisted of selective examinations of procedures and representative records, interviews with personnel, and observations by the inspector. The inspection findings are as follows:

☑ 1. Based on the inspection findings, no violations were identified.

☐ 2. Previous violation(s) closed.

☐ 3. The violations(s), specifically described to you by the inspector as non-cited violations, are not being cited because they were self-identified, non-repetitive, and corrective action was or is being taken, and the remaining criteria in the NRC Enforcement Policy, to exercise discretion, were satisfied.

_____ Non-cited violation(s) was/were discussed involving the following requirement(s) and Corrective Actions(s):

☐ 4. During this inspection, certain of your activities, as described below and/or attached, were in violation of NRC requirements and are being cited in accordance with NRC Enforcement Policy. This form is a NOTICE OF VIOLATION, which may be subject to posting in accordance with 10 CFR 19.11.
(Violations and Corrective Actions)

Statement of Corrective Actions

I hereby state that, within 30 days, the actions described by me to the Inspector will be taken to correct the violations identified. This statement of corrective actions is made in accordance with the requirements of 10 CFR 2.201 (corrective steps already taken, corrective steps which will be taken, date when full compliance will be achieved). I understand that no further written response to NRC will be required, unless specifically requested.

TITLE	PRINTED NAME	SIGNATURE	DATE
CERTIFICATE/QAP REPRESENTATIVE	Paul Oleyar, TN Manager of Quality Assurance		4/20/17
NRC INSPECTOR	Jon N. Woodfield	Jon N. Woodfield	5/15/17
BRANCH CHIEF	Patricia Silva		5/31/17

INSPECTOR NOTES COVER SHEET

Licensee/Certificate Holder (name and address)	CoC Holder Location: TN Americas LLC 7135 Minstrel Way, Suite 300 Columbia, Maryland 21045	Inspection Location: (On leased property from CRMP Inc.) 117 Windchaser Way Moyock, NC 27958
Licensee/Certificate Holder contacts and phone number	Mr. Paul Oleyar, TN Manager of Quality Assurance Mr. Brian Ocampos, TN Quality Assurance Manager Oleyar 434-832-4876, Ocampos 410-910-6899	
Docket No.	072-1004	
Inspection Report No.	72-1004/2017-201	
Inspection Date(s)	April 17-21, 2017	
Inspection Location(s)	On property leased from Commercial Ready Mix Products, Inc. 117 Windchaser Way, Moyock, North Carolina 27958	
Inspectors	Jon Woodfield, Team Leader, Safety Inspector Carla Roque-Cruz, Safety Inspector Robert Carrion, Senior Reactor Inspector, RII/DRS/Engineering Branch 3	
Summary of Findings and Actions	This inspection was the first routine periodic assessment of TN Americas' (TN) Quality Assurance Program (QAP) implementation at their new NUHOMS Horizontal Storage Module concrete fabrication facility in Moyock, North Carolina. The team assessed TN's onsite management, design, and fabrication controls for compliance to 10 CFR Part 72, 10 CFR Part 21, and TN's NRC approved QAP; as related to TN CoC's 1004 (NUHOMS 24P, 24PHB, 24PTH, 32PT, 32PTH1, 37PTH, 52B, 61BT, 61BTH, 69BTH), 1029 (Standardized Advanced NUHOMS 24PT1, 24PT4, 32PTH2), and 1030 (NUHOMS HD-32PTH). Overall, the team assessed that TN at its new fabrication facility was adequately implementing its QA program with regard to QA, Management Controls, Design Controls, and Fabrication Controls. TN continues to effectively implement their NRC approved Quality Assurance Program for activities subject to 10 CFR Part 72 at its new HSM concrete fabrication facility. The team shared some observations with TN on their programs which are described in the inspector notes. TN acknowledged these observations and captured them in Corrective Action Reports (CAR).	
Lead Inspector Signature/Date	Jon N. Woodfield Jon N. Woodfield 5/15/17	
Inspector Notes Approval Branch Chief Signature/Date	Patricia Silva 5/31/17	

Inspection History

The Moyock facility is a new Horizontal Storage Module (HSM) concrete fabrication facility operated directly by TN personnel and this was the first time it had been inspected by the NRC.

In August 2015, the NRC performed the last inspection of TN's HSM fabrication at concrete fabricator Bayshore Concrete Products Corporation (BCP). Overall, the team assessed that AREVA/TN (at the time) through BCP was adequately implementing their QA program with regard to QA, Management Controls, Design Controls, and Fabrication Controls (ML15278A302). Through BCP, AREVA/TN was effectively implementing their NRC approved Quality Assurance Program for activities subject to 10 CFR Part 72. A Minor Violation for inadequate corrective action to perform an engineering evaluation for a Measuring and Test Equipment deficiency was identified by the NRC and AREVA/TN acknowledged the issue and captured it on a Corrective Action Report (CAR).

Inspection Purpose

The purpose of the current inspection was to assess TN's compliance with 10 CFR Parts 21 & 72, and to verify that the HSM storage systems for which TN is the holder of a NRC Certificate of Compliance (CoC), can be verified to comply with Part 72 in design, procurement, and fabrication requirements, as applicable. The focus of the inspection was to determine whether TN activities associated with the storage of radioactive materials were in accordance with their NRC-approved Quality Assurance Program requirements.

Specifically, the scope of the inspection encompassed a review of TN's fabrication activities related to the concrete Horizontal Storage Modules for conformance to NRC regulations and industry standards. This included, as applicable, material procurement, fabrication and assembly, testing and inspection, and tools and equipment. The inspection also focused on TN's corporate oversight of the Moyock facility's fabrication activities. The team reviewed applicable portions of TN's Quality Assurance Program (QAP) to assess the adequacy of the program and whether it had been effectively implemented.

Primary Inspection Procedures/Guidance Documents

IP-60852, "ISFSI Component Fabrication by Outside Fabricators"
IP-46051, "Structural Concrete Procedure Review" (For Reference only)
IP-46053, "Structural Concrete Work Observation" (For Reference only)
IP-46055, "Structural Concrete Records Review" (For Reference only)
NUREG/CR-6314, "Quality Assurance Inspections for Shipping and Storage Containers"
NUREG/CR-6407, "Classification of Transportation Packaging and Dry Spent Fuel Storage System Components According to Importance to Safety"

INSPECTOR NOTES: APPLICABLE SECTIONS FROM IP 60852 WERE PERFORMED DURING THE INSPECTION WITH RESULTS DOCUMENTED BELOW UNDER THE BASIC HEADINGS OUTLINED IN NUREG-6314

4.1 Management Controls

4.1.1 Quality Assurance Policy

The team reviewed Moyock Casting Facility's (MCF) Quality Assurance (QA) Plan for TN Americas LLC (TN) NUHOMS Horizontal Storage Modules (HSM), Revision 1 dated 3/31/2017. The team verified that the QA Plan as written, adequately addresses the applicable QA criteria of 10 CFR Part 72 used for the activities MCF performs to fabricate concrete HSMs. As stated in Section 3, "Responsibilities," of the QA Plan, for MCF operations, Quality Control (QC) is directed by the Deputy Director, MCF (Deputy) with functional responsibility to report all quality matters to the QA Manager through the assigned QA Engineer (QAE) in the TN Columbia, Maryland office. The team noted that QA has no other responsibilities within the project and functions independent of any group or individual directly responsible for the activities monitored.

Since the TN headquarters in Columbia has the ultimate responsibility for quality fabrication of HSMs, the team verified that TN approved the QA Plan, Revision 1 before it was implemented at MCF. In addition, the team noted through discussions with MCF personnel, that the Quality Assurance staff from the TN Columbia office meets with MCF staff at the Moyock facility every month to evaluate the effectiveness of the Quality Assurance Program (QAP). No concerns were identified with MCF's QA Plan.

4.1.2 Nonconformance Controls and Corrective Action Controls

The team reviewed MCF's nonconformance program to assess the effectiveness of controls established for the processing of nonconforming materials, parts, or components. The requirements for MCF's nonconformance program are contained in Transnuclear Implementing Procedure (TIP) 15.2, "Control of Nonconforming Items," Revision 17 dated 4/5/2017. This procedure describes the method for reporting and controlling nonconforming items that are under the control of TN's QAP. This procedure can also be used by MCF staff when a potentially nonconforming condition is discovered during inspection, testing or maintenance activities of TN equipment.

The TIP requires all personnel to report potentially nonconforming items or activities associated with TN hardware in accordance with the requirements of the procedure. If any hardware associated with a TN component is found not to be in conformance with a drawing, specification, or a procurement document requirement, a Nonconformance Report (NCR) is initiated. The NCR database interface program is used to generate, review, approve, and close NCRs. At the completion of each step, a notification email is automatically generated to the next user to inform them that they have an action. The nonconforming condition is then evaluated against applicable requirements and assigned a disposition of "Use-As-Is," "Repair," "Rework" or "Reject." Nonconforming items are also identified with a yellow Hold tag or placed in a clearly identified designated "Hold Area." The QA Manager is responsible for determining if the reported condition is a Condition Adverse to Quality or Significant Condition Adverse to Quality or a condition reportable to a regulatory authority. The QA Manager is also responsible

for initiating a Corrective Action Report (CAR) or Supplier Finding Report (SFR) to investigate the condition further, when needed.

The team interviewed MCF QC and TN QA personnel on the NCR process and found they were all knowledgeable and understood the process as described in the TIP. The team also reviewed a sample of NCRs from the last year that involved Important-to-Safety (ITS) items. The team confirmed that the NCRs received the required review, evaluation, and approvals by MCF and TN headquarters personnel as evidenced by the signatures on the NCR forms. The team assessed that the NCRs reviewed had been appropriately dispositioned and closed in a timely manner. No concerns were identified by the team in the processing of NCRs by MCF and TN.

The team reviewed MCF's corrective action program (CAP) to assess the effectiveness of controls established for the processing of programmatic issues or hardware nonconformances. For example, the team reviewed administrative, procedural, documentation related deviations, measuring & test equipment, concrete formwork, and construction equipment hardware nonconformance CARs. The requirements for MCF's CAP are contained in TIP 16.1, "Corrective Action", Revision 27 dated 3/24/2017. This procedure also provides the process for notifying management of any condition potentially reportable to a regulatory authority and tracking the condition to ensure that reportability determinations, and reports, if necessary, are filed within a timely fashion. Potentially reportable conditions are entered into the CAP as Level 1 CARs. The Corrective Action Program Coordinator (CAPC) is responsible for assigning significance level, reviewing and concurring with corrective action plans and accepting closure of the CAR; providing periodic status reports to management, and maintaining completed CARs and supporting documentation as quality records.

The team interviewed MCF QC and TN QA personnel on the corrective action process and the corrective action software used by both and found they were very knowledgeable and understood the process as described in the TIP. The team reviewed a sample of CARs written for issues identified at MFC since the initial startup of operations. The corresponding response and evaluation documented by MCF for each CAR was also reviewed. For the majority of the CARs and corresponding response, the team found that the corrective actions proposed and taken by MCF were adequate and closed out in a timeframe commensurate with the safety significance of the issue. The team found a few instances where extensions to the CAR due date were not formally requested and another instance where all the subjective evidence to support the conclusion and closure of the CAR was not attached to the CAR, as stated in the procedure. The team determined there was no safety significance to these items since the extensions were granted and the subjective evidence not attached should have been a copy of yet to be made editorial changes to procedures. The TN QA staff initiated a new CAR (CAR 2017-124 Revision 1) to address these issues. Overall, no concerns were identified by the team in the corrective action process or with the actions taken by MCF in response to the CARs.

The team also assessed how the requirements of 10 CFR Part 21 were being implemented for the fabrication activities being performed at MCF. TN has responsibility for performing Part 21 assessments for work performed at MCF. As stated above, the QA Manager is responsible for determining if a reported condition in an NCR is a Condition Adverse to Quality or Significant Condition Adverse to Quality or a condition reportable to a regulatory authority. Additionally, TIP 16.1 provides the process for notifying management of any condition potentially reportable to a regulatory authority and for tracking the condition to ensure that reportability

determinations, and reports, if necessary, are filed within a timely fashion. The team verified that for each NCR and CAR reviewed, the assessment for reportability was performed. The team verified that the required Part 21 postings were posted and accessible in the MCF office building and fabrication crew meeting building. No concerns were identified by the team regarding Part 21 assessment, reporting, or posting requirements.

4.1.3 Documentation Controls

The team reviewed the HSM documentation requirements in TN specification NUH-03-0314, "Concrete Construction of NUHOMS HSM," Revision 6. The specification discusses documentation that must be provided to TN's corporate headquarters by MCF prior to actual HSM fabrication for which a purchase order has been issued. Table 9-1, "Document Submittals," of the specification provides a list of documents and schedule for when the documents should be submitted to the TN headquarters engineer prior to HSM construction. The specification lists in Table 9-2, "Documentation Package Contents," the documents that shall be in a generic document package and the documents that shall be in a component documentation package for each HSM purchase order and TN CoC.

It is the responsibility of the QC Manager or his/her designee to review all required records for completeness and accuracy and after such review, to generate a TN CoC. The following documents are listed as to be included in a Component Specific Document Package:

1. Completed Fabrication Plan
2. Concrete Test Results
3. Batch Plant Ticket for all batches used

For the contents of the Generic Document Package, there are 13 items listed in TN specification NUH-03-0314 Table 9-2.

The team reviewed a sampling of final document packages (FDP) for the completed Monticello Project and observed that the Component Specific and Generic Document Packages were not exactly put together as required in the specification Table 9-2. MCF and TN personnel stated that they wanted to make the component and generic document packages a little different from the specification. When asked if the Monticello client had accepted the difference in the organization of the two document packages, TN produced a letter from the utility documenting the utilities review of the Monticello document packages and accepting the organization. The team verified that all the documents required by Table 9-2 were provided, but with just a different organization. TN wrote CAR 2017-126 to document that there was not alignment with the Monticello Project final document packages and the specification requirements. There was no safety issue as all the required documents were provided.

Besides sending copies of the FDP's to their clients, the official final control and retention of the final document packages by TN is controlled by TN's headquarters document control organization under TIP 6.1, "Document Control."

The team interviewed the MCF QC Department's responsible lead individual. The QC lead is the MCF Manager's designee to review all required HSM records for completeness and accuracy and after such review, to generate the documentation packages and complete a TN CoC. The MCF QC lead receives support from a TN QAE in assembling the FDPs.

The QC lead creates individual binders for each HSM purchase order to collect and store the quality records as they are developed during HSM production. All quality records associated with HSM fabrication are to be sent to the QC lead for retention and control. The QC lead eventually receives all the documentation needed to complete the generic documentation package and each component document package to fulfill the purchase order and issue the TN CoC. The QC lead uses the 9-1 and 9-2 Tables from the TN specification as a checklist to ensure all the required documents are in the generic and component specific documentation packages.

The team sampled the documentation records and found the reviewed records to be complete, well organized, and in compliance with the TN specification for overall content. The QC lead receives and processes a large quantity of quality records for each purchase order and based on his experience and "check lists," knows when he has not received a required quality record and how to track down any missing records at MCF. The team found the control of production quality records to be centralized with basically one individual, the QC lead. However, due to the vast amount of records generated for each HSM purchase order, the team finds this to be a strength in that the individual is experienced in developing the final HSM documentation packages and solely dedicated to HSM production.

The team determined that adequate document control and records management exist at MCF. No concerns were identified by the team in the MCF documentation control area.

4.1.4 Audit Program

The team reviewed TIP 18.1, "Internal Audits," Revision 15 dated 3/24/2017. TIP 18.1 describes the methods for planning, scheduling, conducting, documenting, and following up internal audits. In addition, the team reviewed the results of the one TN internal audit performed to date at MCF, in December, 2016. The audit purpose was to verify the effectiveness and implementation of the TN Quality Assurance Program Description manual Revision 14, dated 12/09/2015, including compliance with the Moyock Quality Assurance Plan Revision 0, dated 1/20/2016, and applicable implementing procedures. The audit scope included activities related to the manufacturing of concrete components for TN Americas' NUHOMS Horizontal Storage Modules. The team noted that the audit report contained findings and observations with adequate supporting details. The audit was also conducted and documented using a checklist tailored specifically to MCF's quality plan/program. The team determined that the audit was adequate in its scope. The team noted that six CARs were initiated for the six findings documented in the audit report. The team reviewed these CARs and determined that for the findings reviewed, all were adequately evaluated and the corrective actions implemented in a timely manner. No concerns were identified by the team regarding the TN audit of MCF and internal audit process.

The external audits of suppliers of services and materials to MCF are performed by the TN headquarters office in Columbia, Maryland and were not reviewed during this inspection. The TN headquarters office is responsible for the TN Approved Suppliers List and performs the external audits of the vendors on the list. Therefore, the NRC review of TN external audits will be part of a TN Americas corporate headquarters inspection.

4.2 Design Controls

4.2.1 Design Development

The team reviewed the HSM design requirements in TN specification NUH-03-0314, Revision 6. The specification lists all the TN design drawings for HSM Models 80, 102 and H. TN is totally responsible for the three HSM Model designs, with MCF not having any design change authority. The specification only allows MCF to write NCRs for HSM fabrication. All NCRs written by MCF must be sent to TN headquarters for review and written approval of the final disposition.

The team then reviewed the MCF process for controlling TN's HSM design and fabrication drawings. The following TN TIPs are the only written procedures that address design control of the TN HSM design and fabrication drawings.

- TIP 3.1, 'Design Control," Revision 17
- TIP 5.1, "Drawing Control," Revision 11
- TIP 5.8, "Fabrication Drawing Control," Revision 0
- TIP 6.1, "Document Control," Revision 16

MCF has been in operation for less than two years and has a small staff. One person is responsible for the manufacturing administration at MCF and is responsible for design control by receiving the transmittals of new or revised HSM design and fabrication drawings, specifications, and Services Program Manual (SPM) updates.

The team interviewed the manufacturing administrator who was responsible for: 1) controlling all the TN HSM design and fabrication new drawings and revisions, 2) controlling transmittal records/approvals for drawings transmitted from TN to MCF, 3) maintaining a master copy of the current HSM design and fabrication drawings in a binder, 4) maintaining the HSM component fabrication drawings current in the field, and 5) maintaining a drawer of superseded drawing revisions. The manufacturing administrator provided the team with a matrix listing all the individuals at MCF with access to controlled documents and drawings for which she was responsible to update, as necessary. The matrix contained many notes on how she was to perform her updates.

The team verified that the manufacturing administrator is maintaining a master copy of the current HSM design and fabrication drawings. The team sample verified that for every design or fabrication drawing associated with a HSM project, there was a transmittal and return-receipt communication between TN and MCF. The team reviewed several controlled hard copies of design and fabrication drawings including the field copies and verified the revisions were current.

The team determined that the current methods for design control at MCF were adequate for the amount of HSM production being performed and since the HSM-H was the only HSM design being fabricated at the time of the inspection. Design control was simplified also since each purchase order was done in series to completion without two or more different HSM designs being fabricated in the field at the same time. The team made the observation that design control was currently adequate at MCF using the manufacturing administrator's matrix but needed to be more structured in a procedure as production increased with the possibility of different design and fabrication drawing revisions being active at the same time on different projects. MCF stated that they were aware of this concern and had been working on SPM-6.1, "MCF Controlled Document Management," to have a procedure to better structure the design controls over multiple projects being worked in parallel. However, MCF stated that finalizing and issuing the SPM procedure was being delayed due to other work priorities. MCF/TN issued

CAR 2017-123 to document that SPM 6.1 needed to be completed in a timely fashion to support the increasing production and possible multiple parallel projects being worked at MCF.

The team assessed that overall, MCF was adequately implementing design control as required in the TIPs listed above as applicable to MCF's scope of work. No immediate concerns were identified by the team in the design control area. MCF is in the process of strengthening this area with a new procedure.

4.2.2 Modifications

TN is responsible for all HSM design modifications and any analysis justifying the changes. MCF only receives design changes to TN design drawings and fabrication drawings. Reference Section 4.2.1 above for how revised fabrication drawings are distributed to production staff and previous fabrication drawing revisions are removed from production. The team identified no concerns with the MCF process for placing TN HSM design/fabrication modifications into HSM production.

4.3 Fabrication Controls

4.3.1 Material Procurement

Various Services Program Manual procedures for the AREVA/TN Americas Projects define how materials used in fabrication are verified, controlled, and traced from the time of purchase through the life of the fabricated HSM components; and how the traceability documentation was controlled, available, and auditable, and that applicable codes, standards, and regulations are referenced.

The team reviewed procedures, selected drawings and records, and interviewed selected personnel, to verify that the procurement specifications for materials, equipment, and services met the design requirements. The team reviewed selected purchase orders (POs) for elements used in the fabrication of the components of the HSM, including, the reinforcing steel, embedded elements, and Portland Cement. In all cases, the team determined that procured materials met the design specifications and were traceable to the serial number of the specific component (base, roof, or door) of the HSM in which it was used.

In addition, the team observed quality activities in the receiving and storage area and noted how reinforcing steel and other embedded items were being stored. The team reviewed associated receipt inspection reports and storage records for those items and verified that the materials were controlled, verifiable, and traceable from the time of purchase through fabrication. No concerns were identified by the team in this area.

4.3.2 Fabrication and Assembly

The team interviewed MCF/TN personnel and reviewed documentation of fabrication activities affecting safety aspects of the HSMs to verify that the activities were performed in accordance with approved methods, procedures, specifications, and PO requirements. The team reviewed documentation packages associated with HSM components (bases, roofs, doors, and overhead vent covers) and noted that an approved fabrication plan (also called a traveler) was initiated for each component to ensure high standards of fabrication and assembly control. Fabrication plans were sufficiently detailed to include fabrication drawings and revisions, specifications and revisions, embeds, hold points and witness points, concrete placement information, batch ticket

numbers, concrete mix identification number and mix design report, fresh sample testing information, curing method used, cured sample test results, and post-pour inspection results. Each step of the fabrication plan was signed off by an independent MCF QC technician when the step was satisfactorily completed. The team reviewed selected records of completed HSM components and observed work in progress of HSM components to verify that the process was adequately controlled. For the work in progress, the team observed rebar and embedded items being taken from protected controlled storage areas for use in the fabrication of a HSM component and noted that the items were properly labeled and traceable to procurement documents. Formwork for the HSM components was observed to be clean with a release agent applied to the interior face to minimize the effort of stripping the formwork after the component had cured for the requisite time. Rebar and embed placement was observed to be done as specified on the fabrication drawings, which included: the proper rebar size, rebar spacing and location, and rebar spacing to the forms to achieve the required concrete cover. The team observed the concrete placement for TPP-B-ID-07 (a HSM-H base component for the Turkey Point ISFSI) and noted that the concrete was properly evaluated for acceptability prior to placement and was placed in accordance with the American Concrete Institute (ACI) requirements to preclude voids, segregation of constituents, cold joint formation, etc., to ensure that a high-quality component was produced.

The team also observed formwork being removed from initially cured (not 28 day strength concrete) HSM components and the moving of the components to a staging area away from the fabrication area. Additional QC reviews and "touch up" activities would take place in the staging area prior to shipping the completed HSMs to ISFSI sites. The team did make one observation in the area of materials used to repair voids in the surfaces of the concrete components after removing the forms. Five Star grout and concrete products are used to repair minor surface voids and these products are sold in bags. During the review of an NCR, it was noted by the team that Five Star products had been used to make the component surface repairs. The team asked MCF/TN if there was any shelf-life for the Five Star products in the bags and how was the shelf-life controlled and monitored during storage. It was determined that the Five Star materials in the bags only had a shelf-life of one year. During a walkdown of the storage area for the Five Star bags, loose sheets of paper were found with month and year dates on them which appeared to be the product manufacturing month and year. For one sheet of paper, the month and year was exactly one year prior to the month and year of the inspection. The shelf-life of one of the Five Star bagged products in storage would expired at the end of the month in which the inspection was conducted; so the grout or concrete mix in the bags was still good to the end of the month. MCF would need to determine if the grout bags or concrete bags shelf-life would expire at the end of April, 2017. MCF/TN wrote CAR 2017-122 to address this issue of how to more formally control and prevent the use of materials with an expired shelf-life at MCF.

The team determined MCF's implementation of fabrication practices, assembly processes, and material storage controls at the new fabrication facility to be currently adequate with no concerns identified beyond the observation that materials with a shelf-life need additional controls going forward.

4.3.3 Test and Inspection

The team observed selected fabrication activities and post-pour HSM component visual examinations as well as material storage controls to verify that all phases of the fabrication, inspection, and storage processes were properly controlled and implemented. Observations included a review of laydown areas for the rebar to be used for HSM components and the steel

cargo shipping containers in which HSM embeds were housed and controlled. With respect to the concrete used in the fabrication of HSM components, the team toured and observed the operation of the onsite batch plant and discussed its operation with the Batch Plant Operator and the Concrete Materials Manager, noting that the aggregate and admixtures were properly segregated/labeled. The team observed cement, coarse and fine aggregates, admixtures, and water discharged into the drum mixers of the concrete trucks which mixed the raw materials into fresh concrete. The concrete trucks then transported the fresh concrete to the area where the HSM component forms were filled with the poured concrete. The team also observed the required testing of fresh concrete prior to its placement in the forms of HSM components. The fresh concrete was field tested for its slump, temperature, and unit weight.

The fresh concrete was also tested for air content prior to being placed in plastic cylinder forms for preparation of the concrete break test cylinders. The concrete break test cylinders are utilized to determine when the minimum required concrete strength is achieved (approximately 3500 psi) so form removal and lifting of completed components may safely be done, as well as the standard scheduled 28-day compression strength testing. The testing and sample preparation activities were performed in accordance to the relevant ACI requirements and American Society for Testing and Materials (ASTM) standards.

The team also observed concrete being discharged into the concrete pouring bucket which was lifted by crane and carried to the distribution system on top of the HSM-H formwork for final placement and vibration. Upon completion of the concrete placement, the team observed the finishing activities utilized by the MCF fabrication personnel.

The team toured the MCF outside contractor's testing laboratory and observed the 28-day compression strength testing of concrete cylinder samples prepared during the fabrication of HSM components 28 days prior to the team inspection and noted that the testing was performed using a calibrated Baldwin press by an ACI-certified technician. The test results will be included in the final document package for the respective HSM components as part of the fabrication plan for the component. The team also noted that the temperature and moisture/humidity of the concrete test cylinder curing room was well controlled, monitored, and recorded. The testing results demonstrated that the 28-day concrete compressive strength was well above the minimum design strength of 5000 psi.

The team reviewed the certifications of selected QC personnel and verified that they were qualified and certified. For observed fabrication activities, the team determined that the MCF personnel were trained, certified, or qualified to perform their fabrication activities based upon review of each individual's training records or certifications.

The team determined that MCF's testing and inspections were controlled, verifiable, traceable, and retrievable from the fabrication planning phase through fabrication and final acceptance. No concerns were identified by the team in this area.

The team reviewed the following documentation specifically related to testing and inspections at MCF:

- Personnel Qualifications for four MCF staff
- Personnel Qualifications for two outside contractor test laboratory staff
- Rebar Certified Material Test Reports for Heat numbers: 2052270, 2053845, and 2054958
- Cement Certified Material Test Reports dated: 11/1/2016, 1/5/2017, and 2/1/2017

- SPM-5.21.1, General Construction Requirements and Methods for Fabrication of HSM-H
- SPM-5.21.5, HSM-H Base - Concrete Construction
- SPM-13.2, Material Storage and Housekeeping at Moyock Casting Facility

Supplier Oversight Reports (SORs)

- SOR-MCF IS 2016-013
- SOR-MCF-2017-1-16-JJP
- SOR-MCF-2017-1-18-JJP
- SOR-MCF-2017-1-20-JJP
- SOR-MCF-2017-1-23-JJP
- SOR-MCF-2017-1-24-JJP

4.3.4 Tools and Equipment

The team reviewed the Measuring and Test Equipment (M&TE) requirements in TN specification NUH-03-0314, Revision 6. The specification contained a list of all M&TE requiring routine calibration. MCF uses an outside contractor to perform the following services: field and laboratory testing of concrete and aggregates, concrete and concrete constituent materials laboratory and field testing, and equipment calibration and batch plant inspections. The team verified that the firm was listed on TN's Approved Suppliers List for these services.

The specification also states: calibration dates, calibration source, and due dates shall be marked on the M&TE or recorded in the Calibration Log.

The team traveled to the outside contractor's testing lab which was away from MCF and interviewed the Lab Manager responsible for administrating the M&TE program and the updating of the calibration logs for the M&TE devices listed in the specification. The Lab Manager provided the calibration log records for the M&TE listed in the specification requiring calibration. The records provided the device's manufacturer, its serial number, its model number, the frequency of calibration, last calibration date, and next calibration due date. The team verified that all the generic M&TE listed in the specification were in the contractor's calibration program. For each of the generic M&TE devices in the specification, for example a thermometer, there were several units and models available for use with unique serial numbers, except for the concrete cylinder compressive testing machine.

The team reviewed a sampling of the calibration certificates or reports for a slump cone, air content meter, thermometer, scale, and calipers. All these M&TE had been used at the MCF and the team determined that all the required information was filled out, including the proper signoffs and date the calibration was performed. The team also reviewed the visual inspection examination reports for sieves used in the aggregate verification testing. In addition, the team reviewed the current calibration records for the concrete cylinder break machine manufactured by Baldwin, serial no. 523025. The team found the calibration certificates to be thorough with all the required information and load testing documented.

The team visually inspected one each of the following M&TE to verify that calibration stickers were attached showing component identification information and calibration dates.

- Cylinder Compressive Testing Machine
- Unit Weight Bucket

- Air Content Meter
- Gram Scale
- Sieves
- Thermometer
- Micrometer
- Temperature Recorder for Cylinder Curing Room

For each M&TE inspected the team found them to have stickers with the proper identification and calibration information.

Overall, no M&TE program concerns were identified by the team during the inspection.