

September 11, 2003

Mr. K. P. Singh  
President and CEO  
Holtec International  
555 Lincoln Drive West  
Marlton, NJ 08053

SUBJECT: NUCLEAR REGULATORY COMMISSION (NRC) INSPECTION REPORT  
NO. 72-1014/2003-202

Dear Mr. Singh:

This refers to the inspection conducted August 25, 26, 28 and September 5, 2003, at the Holtec International (Holtec) offices in Marlton, NJ, and August 27, 2003, at Aalborg Instruments Incorporated facility in Orangeburg, NY. Aalborg is a subcontractor supplier to Holtec. The purpose of the inspection was to examine issues related to the calibration of helium flow gages that were found to read erroneously during spent fuel storage cask dry runs at the Trojan Nuclear Power Plant in the fall of 2002. The enclosed report presents the results of this inspection.

The inspection was an examination of activities as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your certificates of compliance. Within these areas, the inspection consisted of selected examination of procedures and representative records, observations of activities, and interviews with personnel.

Based on the results of this inspection, the NRC has determined that one Severity Level IV violation of NRC requirements occurred. This violation is being treated as a Non-Cited Violation (NCV), consistent with Section VI.A of the Enforcement Policy. The current Enforcement Policy is included on the NRC's website at <http://www.nrc.gov/OE>. The NCV is described in the subject inspection report. If you contest the violation or the significance of the NCV, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001 with a copy to Robert J. Lewis, Chief, Transportation and Storage Safety and Inspection Section, Licensing and Inspection Directorate, Spent Fuel Project Office, Office of Nuclear Material Safety and Safeguards, and the Director, Office of Enforcement, Nuclear Regulatory Commission, Washington, DC 20555-0001.

K. P. Singh

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September 11, 2003

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter, its enclosures, and your response, if you contest the NCV, will be made available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/NRC/ADAMS/index.html> (the Public Electronic Reading Room).

Sincerely,

/RA/  
Robert J. Lewis, Chief  
Transportation and Storage Safety and  
Inspection Section  
Spent Fuel Project Office  
Office of Nuclear Material Safety  
and Safeguards

Docket No. 72-1014

Enclosure: NRC Inspection Report No. 72-1014/2003-202

cc: Mr. Kenneth A. Phy, Entergy Nuclear NE  
Mr. Lansing Dusek, Trojan ISFSI  
Mr. Jack Burdick, Southern California Edison ESI  
Mr. Stefan Radecki, Aalborg Instruments Incorporated

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Transportation and Storage Safety and  
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**U.S. NUCLEAR REGULATORY COMMISSION  
Office of Nuclear Material Safety and Safeguards  
Spent Fuel Project Office**

**Inspection Report**

Docket No: 72-1014

Report: 72-1014/2003-202

Certificate Holder: Holtec International  
555 Lincoln Drive West  
Marlton, NJ 08053

Inspection Locations: Holtec International  
555 Lincoln Drive West  
Marlton, NJ 08053

Aalborg Instruments Incorporated  
20 Corporate Drive  
Orangeburg, New York 10962

Dates: August 25, 26, 28, and September 5, 2003 at Holtec International  
August 27, 2003 at Aalborg Instruments

Inspection Team: Paul Narbut, Team Leader, SFPO  
Tim McConnell, Inspector, Region IV

Approved by: Robert J. Lewis, Chief  
Transportation and Storage Safety  
and Inspection Section  
Spent Fuel Project Office, NMSS

ENCLOSURE 1

## **EXECUTIVE SUMMARY**

### **NRC Inspection Report 72-1014/2003-202**

The U.S. Nuclear Regulatory Commission (NRC) performed an inspection at Holtec International (Holtec) in Marlton, NJ, and Aalborg Instruments (Aalborg) in Orangeburg, NY, to examine helium flow meter and totalizer calibration issues arising from erroneous helium readings discovered during a December 2002 spent fuel dry cask storage dry run inspection at Trojan Nuclear Power Plant in Ranier, OR.

The inspectors identified one non-cited violation (NCV) of NRC requirements for failure to have adequate procurement controls as required by 10 CFR 72.154, which resulted in incorrect data entries for the calibration of the helium totalizers used to inject a prescribed amount of helium into loaded spent fuel storage casks. The NCV is described in Section 2.2 of this report.

Overall, at Holtec and Aalborg, the inspectors found that there was sufficient evidence and records to conclude that the mass of helium injected into the loaded spent fuel storage casks at Trojan was metered with sufficient accuracy by the helium flow meters and totalizers. However, the inspectors identified some specific problems that occurred preceding the fill of the casks. The problems included a lack of detailed troubleshooting records by Holtec field personnel when the measuring inaccuracies were first identified, weak oversight and control of certain contractors and subcontractors involved in the procurement of the instruments and their calibrations, and improper documentation for the calibration of the totalizers resulting in the aforementioned NCV. The inspectors also found that Holtec field personnel demonstrated excellent attentiveness in identifying the calibration problem in the field and then pursuing a complete and satisfactory resolution which resulted in an adequate fill of the casks.

The inspectors were not able to conclusively determine where and how the problem of miscalibration occurred. The inspectors determined that further pursuit of the question of where and how the miscalibration occurred was not warranted given the lack of safety significance (since the casks had been properly filled) and the lack of any indications of, or motivation for, malfeasance or wrongdoing.

## **INSPECTION PROCEDURES USED**

60851, "Design Control of ISFSI Components"

60852, "ISFSI Component Fabrication by Outside Fabricators"

## **PERSONS CONTACTED**

At Holtec, the inspectors held an entrance meeting on August 25, 2003, to present the scope and objectives of the NRC inspection. On August 27, 2003, the inspectors held a pre-inspection briefing at Aalborg Instruments to explain the inspection and NRC's role and responsibilities. On September 5, 2003, the inspectors held an exit meeting at the Holtec offices to present the preliminary findings of the inspection.

The people present at the meetings are listed in Table 1.

Table 1

## Entrance and Exit Meetings Attendance

Name	Title	Affiliation	Entr. 8/25	Exit 9/5	Aalborg brief 8/27
P. Narbut	Team Leader, SFPO	NRC	X	X	X
T. McConnell	Inspector, Region IV	NRC	X	X <sup>1</sup>	X
B. Gutherman	Lic. and Tech. Serv. Mgr.	Holtec	X		
M. Soler	QA Manager	Holtec	X	X	X
J. Griffiths	Project Manager	Holtec	X	X	X
S. Radecki	Sr. Mechanical Engineer and QA Mgr.	Aalborg			X

## LIST OF ACRONYMS USED

AVL	Approved vendors list
CEO	Chief Executive Officer
CFR	Code of Federal Regulations
CoC	Certificate of Compliance
ESI	Southern California Edison ESI
ISFSI	Independent Spent Fuel Storage Installation
ITS	Important-to-safety
LTI	Laboratory Testing Incorporated
NCR	Nonconformance report
NCV	Non-cited violation
NITS	Not-important-to-safety
NMSS	Office of Nuclear Material Safety and Safeguards
NRC	U.S. Nuclear Regulatory Commission
PO	Purchase order
QA	Quality assurance
QC	Quality control
SAR	Safety Analysis Report
SFPO	Spent Fuel Project Office
SNR	Supplier Nonconformance Report

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<sup>1</sup> Attended by telephone

## REPORT DETAILS

### 1. Inspection Scope

The inspectors examined an inspection item which was referred to the SFPO staff from the NRC Region IV office. The item was identified during spent fuel cask dry run operations for cask loading at the Trojan Nuclear Power Plant (Trojan) in Ranier, OR, in December 2002. The item involved disparities encountered with the readings from the helium flow meters and totalizers used to charge spent fuel canisters with helium during dry runs. The helium flow meter issue is described in NRC Inspection Report 50-344/2002-01, dated April 29, 2003.

The inspectors examined the design, quality assurance, and calibration activities associated with spent fuel transportation and dry storage components to determine if they were performed in accordance with the requirements of 10 CFR Parts 21 and 72, the certificate of compliance (CoC), the applicable safety analysis report (SAR), and the NRC-approved quality assurance (QA) program.

The inspectors determined the acceptability of dry storage activities by reviewing procedures and instructions, inspecting selected documents, records, and drawings, verifying personnel training and qualifications, and interviewing personnel responsible for various activities. At Holtec, the inspectors interviewed the involved project manager, and reviewed selected procedures and records. At Aalborg, the inspectors interviewed the involved personnel, reviewed the facility and equipment used, examined calibration procedures, and calibration records. The inspectors also examined QA and quality control (QC) oversight at the facility.

### 2. Findings

#### 2.1 Background

The problem with helium flow meters and totalizers at the Trojan Nuclear Power Plant was found, and corrective action was taken by Holtec, before any casks were loaded with spent fuel. The flow meters and totalizers were reading less than the expected values as described in NRC Inspection Report 50-344/2002-05. The flow meters and totalizers are used to inject a prescribed amount of helium into a loaded spent fuel cask. The helium is used to provide a cooling medium for the spent fuel and to provide an inert atmosphere. With a low reading flow meter, too much helium would be injected into a cask, and consequently, cask design pressure limits could be exceeded if an accident condition occurred.

Holtec issued Supplier Nonconformance Report (SNR) number 51 dated December 30, 2002. The SNR noted that the flow meters were reading about 60% of the expected values. Four flow meters, Model GFM 671S, had been manufactured and supplied by Aalborg Instruments and Controls, Orangeburg, NY. Per the SNR, one meter was returned to Aalborg for testing, with helium versus nitrogen, and Aalborg confirmed the large discrepancy in indicated versus actual flow values. Per the SNR, two additional flow meters were then returned to Aalborg for calibration with helium.

Per the SNR, at purchase, Aalborg had originally calibrated the flow meters using nitrogen gas and the Aalborg vendor manual correction factors for helium. However, in accordance with its QA program, Holtec required the meters to be calibrated by a vendor from its approved vendors list (AVL), and Aalborg was not on the Holtec AVL. Consequently, Holtec sent the meters to its approved vendor; Laboratory Testing Incorporated (LTI) in Hatfield, PA. LTI had subcontracted with Southern California Edison ESI in Westminster CA, for the flow meter calibration and Pro Lab, a Division of Process Electronics Corporation in Hatfield, PA, for the totalizer calibration. ESI calibration records dated November 4, 2002, showed that the meters were calibrated with helium and therefore should have given accurate readings when used at Trojan.

Additionally, Holtec issued a 10 CFR Part 21 report dated March 6, 2003, regarding the miscalibration problem.

Previously, in May 2003, the NRC inspected ESI in regards to the helium flow meter calibrations. NRC Inspection Report 72-1014/ 2003-201 dated June 13, 2003, described the inspection and its findings. At ESI, the inspectors did not find a cause for the inaccurate flow meters. The inspectors found no evidence to support, or absolutely reject, the premise that the problem occurred at ESI. The inspectors found no evidence of an error or of willful malfeasance. The inspection report identified the matter of the miscalibrated helium flow meter as an unresolved item (Unresolved Item 72-1014/03-201-02).

## 2.2 Details of the Inspection at Holtec and Aalborg

### Additional Background

As a matter of interest, Trojan was the first site using Holtec casks where the Independent Spent Fuel Storage Installation (ISFSI) operations work was being done by Holtec and Holtec contract personnel under a services contract. Holtec provided fuel handlers, field engineers, and QC personnel to perform the actual dry runs and loading operations. Holtec had provided similar services in the past for spent fuel pool wet storage modification work. Additionally, Trojan was the first site where the calibrated flow meters and totalizers were used to determine the amount of helium injected. Previous sites used a calculation based on supply bottle pressure drop to determine how much helium was injected.

### Aalborg Actions

At Aalborg, the inspectors briefly examined the laboratory, records, instruments, and the QA and QC oversight applied to the calibration work. As was the case in the ESI laboratory the inspectors noted that the metrologist at Aalborg usually worked alone and that the procedure steps and recorded values were not independently verified, except for a records review. As at ESI, the inspectors noted this practice to be standard for metrology laboratories, and acceptable. The controls are similar to those applied to non-destructive examiners. However, during the last calibration of the flow meters at Aalborg, when the instruments were being calibrated under the Holtec QA program by dedication, the Holtec representatives did provide independent verification. The initial Aalborg calibrations of the flow meters had been done using nitrogen and converting the output to helium using a theoretical formula that had proven accurate in the past for many gases and for helium at low flows, and was a standard industry

practice. It was subsequently discovered by Aalborg, through a customer complaint from England in July 2002, that the theoretical conversion factor was significantly in error for light gases such as helium, at high flow rates. Consequently, as a corrective action, Aalborg performed subsequent calibrations using helium while they developed a more accurate conversion factor. Aalborg did not formally notify Holtec of the matter since 10 CFR Part 21 was not invoked in their not-important -to-safety (NITS) purchase order (PO) from Royal, and the Aalborg staff was developing the cause and solution to the problem concurrently with the developing problem at Trojan. Aalborg informally notified Holtec when they were made aware of the problems at Trojan.

### Troubleshooting

At Holtec, the inspectors found that the troubleshooting of the instruments performed by the Holtec field personnel was not carefully documented. Consequently the records were not sufficient to provide an exact understanding of what actions were performed nor which instruments were used. Interviews with the Holtec field engineer provided additional information, but not a complete record. The inspectors noted that the troubleshooting data turned out not to be crucial since Holtec subsequently made the decision to recalibrate the instruments at Aalborg before using the instruments to inject helium into the loaded casks. However, the lack of a detailed record of the troubleshooting activities was considered to be a weakness. Likewise, the lack of a procedure for troubleshooting activities was considered a weakness. Holtec management concurred and stated that they would consider appropriate actions.

### Catching the Flow Meter Miscalibration

The inspectors also reviewed SNR 051 issued December 30, 2002, and discussed it with cognizant Holtec personnel. The SNR was written to document the apparent miscalibration discovered during dry run preparations at Trojan. The field engineer had directed a functional check of the flow meters and totalizers after they were recombined after their separate calibrations at Edison ESI and Pro Lab, respectively. The functional check was successful per the operating personnel, but the field engineer alertly recognized that much more helium was used than anticipated. The field engineer directed further informal checks and determined that the flow meters and totalizers were reading a lower amount of helium usage (about 60%) than was actually being used. The inspectors noted that the resolution of the SNR included proper and independently verified recalibration of the flow meters and a recheck of the instruments onsite when they were again received. The SNR stated the totalizers were not affected and assumed the totalizers were properly calibrated by Pro Lab. As it turned out, the totalizers were accurate, but their calibration data sheets had erroneous data entries, and their calibration procedures were inadequate. This was discovered later after cask loading and during the post-use calibration checks as described in SNR-89 dated June 19, 2003, and described later in this report.

### Procurement Actions

At Holtec, the inspectors noted that the Holtec procurement actions for the purchase and calibration of the instruments had several problems and weaknesses.

- The helium flow meters and totalizers were purchased NITS, as a part of the helium blowdown and backfill skid. The inspectors reviewed PO 1135JE dated February 5, 2002, issued to Royal Instruments, and noted confusing discrepancies in the PO. For instance, the PO required the flow meters to be calibrated while it did not require the totalizers to be calibrated. This was later made moot when Holtec issued a separate important-to-safety (ITS) PO to LTI for calibration of the instruments. The inspectors considered that only requiring the calibration to be ITS, and purchasing the instruments as NITS, met the Trojan Independent Spent Fuel Storage Installation Safety Analysis Report, Revision 2 requirements and was satisfactory, notwithstanding the aforementioned confusing discrepancies. Royal purchased the instruments from Aalborg under their own PO which led to another confusing factor; the first instrument delivered by Aalborg to Royal Instruments was calibrated in liters per minute instead of cubic feet per minute. This was later rectified by recalibration at Aalborg. The flow meter was not used in any loading operation as verified by the inspector's review of the site records for flow meter use. The inspectors noted that both the Holtec POs and the Royal POs lacked some specific technical requirement information and included some technical requirements by reference. The instruments supplied eventually met sufficient requirements, but some of the procurement information was passed on informally. The noted information discrepancies and the lack of some formal information exchanges was considered to indicate a weakness in the procurement process. Holtec representatives agreed and stated that they would consider corrective action.
- The controls placed on the calibration contractor, LTI, did not preclude the contractor from separating the flow meters from the totalizers and sending them to different subcontractors for calibration. While this separation, by itself was later evaluated to be technically satisfactory, it was not the action Holtec intended. Subsequent POs required the flow meter and totalizer to be handled as a set. Additionally, the controls and QA review placed on the totalizer subcontractor (Pro Lab) by LTI and Holtec were not sufficient to prevent the use of an inadequate procedure and inadequate records of the calibration. The inspectors reviewed Holtec nonconformance report (NCR) number 89 initiated June 19, 2003, describing the lack of adequate procedures used by Pro Lab to calibrate the totalizers. Additionally, the inspectors also reviewed the Holtec surveillance report of Pro Lab also dated June 19, 2003. The inspectors noted that the NCR did not address the erroneous input values on the totalizer calibration sheets, which could not have resulted in the listed output values. Holtec stated the erroneous input values were clearly data from a different calibration which had been used for a cut-and-paste template but had been improperly updated. Holtec wrote Revision 1 to NCR 89 to document the inspector identified discrepancy for resolution. The inspectors considered the failure to identify the discrepant condition of the original Pro Lab calibration data sheets to be an example of inattention to detail. The inspectors noted that Holtec had identified the overall problem in NCR 89, Revision 0, and established a mechanism that resulted in proper resolution of the issue.

The identification of the problem of inadequate procedures was identified by Holtec. The failure to have adequate calibration procedures for the calibration of the totalizers is considered a violation of 10 CFR 72.154, "Control of purchased material, equipment, and services," which requires, in part, that the certificate holder shall ensure that

purchased services provide objective evidence of quality furnished, sufficient to identify the specific requirements met. This non-repetitive, certificate holder identified and corrected violation is being treated as a Non-cited violation (NCV), consistent with Section VI.A.8 of the NRC Enforcement Policy. The failure to identify the attribute of the inadequate data input values on the Pro Lab calibration records was identified by the NRC and is also considered a violation of 10 CFR 72.154. Although this issue should be corrected, it constitutes a violation of minor significance that is not subject to enforcement action in accordance with Section IV of the Enforcement Policy. Minor violations are not normally documented in accordance with NRC enforcement policy, but the violation is described here to fully explain this complex set of intertwined issues.

### Part 21 Considerations

At Holtec, the inspectors discussed the 10 CFR Part 21 report dated March 6, 2003, issued by Holtec regarding the Aalborg flow meters. The report explains that Trojan was the first site to use the flow meter and totalizer method of controlling the amount of helium injected into the loaded canisters. The previously loaded canisters at other reactor sites did not use the flow meters and used a different methodology to control the amount of helium injected. Therefore, the inspectors had no generic concerns regarding the flow meter use. The inspectors also noted that invoking Part 21 is not required for an instrument that is NITS. However, the problem that Aalborg discovered regarding the erroneous correction factor for helium, could have resulted in improperly filled casks if the miscalibration had not later been discovered by Holtec field personnel. Therefore, the inspectors noted that Holtec could enhance their control of purchased material by adding specific PO language to ensure that significant defects should be reported to Holtec for evaluation, even for NITS hardware. The Holtec representatives stated that they would consider such action.

### Post Calibration Checks

At Holtec, the inspectors reviewed SNR 101 Revision 0, issued June 24, 2003. The SNR noted that a post use calibration check of the helium flow meters and the totalizers showed them to be out of calibration by more than the allowed range. Holtec resolved the nonconformance by performing a calculation, using the worst case post-use calibration data and demonstrated that the canisters were still filled with an allowable mass of helium. The inspectors considered the Holtec actions to be adequate.

### Cause of the Flow Meter Miscalibration

The inspectors were not able to conclusively determine where and how the problem of miscalibration occurred, at ESI or at Trojan. The inspectors determined that further pursuit of the question of where and how the miscalibration occurred was not warranted given the lack of safety significance (since the casks had been properly filled) and the lack of any indications of, or motivation for, malfeasance or wrongdoing. Therefore, Unresolved Item 72-1014/03-201-02 is considered closed.

### 2.3 Conclusions

The inspectors were not able to conclusively determine where and how the problem of miscalibration occurred, at ESI or at Trojan. Overall, at Holtec and Aalborg, the inspectors found that there was sufficient evidence and records to conclude that the mass of helium injected into the loaded spent fuel storage casks at Trojan was measured with sufficient accuracy by the helium flow meters and totalizers. However, the inspectors identified some specific problems that occurred preceding the fill of the casks. The problems included a lack of detailed troubleshooting records by Holtec field personnel when the measuring inaccuracies were first identified, weak oversight and control of certain contractors and subcontractors involved in the procurement of the instruments and their calibrations, and improper documentation for the calibration of the totalizers. The inspectors also found that Holtec field personnel demonstrated excellent attentiveness in identifying the calibration problem in the field and then pursuing a complete and satisfactory resolution which resulted in an adequate fill of the casks.

### 3. **Exit Meeting**

On September 5, 2003, the inspectors had an exit meeting with Holtec International. The results of the inspection were discussed.