June 13, 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. 72-1014/2003-201 AND NOTICE OF VIOLATION

Dear Mr. Singh:

This refers to the inspections conducted April 22-24, 2003, at the Holtec International (Holtec) offices in Marlton, NJ, and May 28, 2003, at Southern California Edison ESI (ESI) facility in Westminster, CA. ESI is a subcontractor to Holtec. The purpose of the inspection at the Holtec offices was to examine issues related to the unexpected appearance of hydrogen generation in the Holtec spent fuel storage cask system observed during dry run operations at Columbia Generating Station in Richland, WA in August 2002. Additionally, the inspection examined performance-based samples of the corrective action program and the application of 10 CFR 72.48 design change requirements. The purpose of the inspection at ESI was to examine 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 a Severity Level IV violation of NRC requirements occurred. This violation was evaluated in accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions" (Enforcement Policy), NUREG-1600. The current Enforcement Policy is included on the NRC's website at http://www.nrc.gov/OE The violation is cited in the enclosed Notice of Violation (Notice) and the circumstances surrounding it are described in detail in the subject inspection report. The violation is being cited in the Notice because it was identified by the NRC.

You are required to respond to this letter and should follow the instructions specified in the enclosed Notice when preparing your response. The NRC will use your response, in part, to determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter, its enclosures, and your response 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

Enclosures:
1. NRC Inspection Report No. 72-1014/2003-201
2. Notice of Violation

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

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Distribution:
Docket 72-1014

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BBrown, OCFO	JMonninger,SFPO	SO'Connor,SFPO		

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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:	72-1014/2003-201
Certificate Holder:	Holtec International 555 Lincoln Drive West Marlton, NJ 08053
Inspection Locations:	Holtec International 555 Lincoln Drive West Marlton, NJ 08053 Southern California Edison ESI 7300 Fenwick Lane Westminster, CA 92683
Dates:	April 22-24, 2003 at Holtec International May 19, 2003 at ESI
Inspection Team:	Paul Narbut, Team Leader, SFPO At Holtec: Frank Jacobs, Inspector, SFPO At ESI: Tim McConnell, Inspector, Region IV Brian Gonsoulin, Investigator, 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 72-1014/2003-201

The U.S. Nuclear Regulatory Commission (NRC) performed an inspection at Holtec International (Holtec) in Marlton, NJ, to examine the issues identified in a dry run inspection in August 2002 involving the unexpected generation of hydrogen from the Holtec spent fuel dry storage casks in the spent fuel pool at Columbia Generating Station in Richland, WA. In addition, the inspectors examined Holtec's processes for performing 10 CFR 72.48 analyses for design changes and its corrective action program focusing on root cause identification and corrective actions.

Additionally, the inspectors performed an inspection at Southern California Edison ESI (ESI) in Westminster, CA, to examine helium flow meter calibration issues arising from erroneous helium flow 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 violation of NRC requirements for failure to have adequate design controls to verify the compatibility of materials as required by 10 CFR 72.146. The violation is described in Section 2.2 of this report.

The inspectors found that Holtec's procedures for performing 10 CFR 72.48 evaluations for design changes were adequate and met regulatory requirements as well as industry guidance. The inspectors also found, based on reviewing a sample of completed 10 CFR 72.48 evaluations, that Holtec was implementing its program in accordance with its procedures. Additionally, based on reviewing a sample of root cause analyses and the corresponding corrective actions, the inspectors found that the Holtec root cause analysis and corrective action program was adequately implemented.

The team found that calibration activities at ESI met regulatory requirements. The team concluded further inspection was necessary at other facilities to resolve the helium flow meter calibration problem.

INSPECTION PROCEDURES USED

60851, "Design Control of ISFSI Components"
60852, "ISFSI Component Fabrication by Outside Fabricators"
60857, "Review of 10 CFR 72.48 Evaluations"
NUREG/CR 6314, "Quality Assurance Inspections for Shipping and Storage Containers"

PERSONS CONTACTED

At Holtec, the team held an entrance meeting on April 22, 2003, to present the scope and objectives of the NRC inspection. On April 24, 2003, the team held an exit meeting at the Holtec offices to present the preliminary findings of the inspection. A followup exit meeting was held, by telephone, on April 28, 2003, to clarify some questions asked by Holtec.

On May 28, 2003, the team held an entrance meeting at ESI to present the scope and objectives of that portion of the NRC inspection. On May 28, 2003, the team held an exit meeting at the ESI offices to present the preliminary findings of that portion of the inspection.

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

Table 1
Entrance and Exit Meetings Attendance

Holtec International

Name	Title	Affiliation	Entr. 4/22	Exit 4/24	Tel. Exit 4/28
C. Brown	Technical Reviewer	NRC			X
F. Jacobs	Inspector, SFPO	NRC	X	X	X
R. Lewis	Section Chief	NRC			X
J. Monninger	Section Chief	NRC			X
P. Narbut	Team Leader, SFPO	NRC	X	X	X
S. O'Connor	Project Manager	NRC			X
B. Gilligan	Fab. Prog. Mgr.	Holtec	X	X	
B. Gutherman	Lic. and Tech. Serv. Mgr.	Holtec	X	X	X
M. Mc Namara	VP Engineering	Holtec		X	X
K. Singh	President and CEO	Holtec	X		
M. Soler	QA Manager	Holtec	X	X	X
S. Turner	Chief Scientist	Holtec	X		

Edison ESI

Name	Title	Affiliation	Entr. 5/28	Exit 5/28	
P. Narbut	Team Leader, SFPO	NRC	X	X	
B. Gonsoulin	Investigator, Region IV	NRC	X	X	
T. McConnell	Inspector, Region IV	NRC	X	X	
J. Smith	Manager of Metrology	Edison ESI	X	X	
L. Nielson	Metrology Engineer	Edison ESI	X	X	
B. Hoppe	Metrologist	Edison ESI	X		
S. Watson	QA Manager	Edison ESI	X	X	
J. Burdick	Technical Services, Mgr	Edison ESI	X	X	
A. Brunson	Program Manager	Edison ESI	X	X	

LIST OF ACRONYMS USED

CAR	Corrective Action Request
cfm	cubic feet per minute
CFR	Code of Federal Regulations
CGS	Columbia Generating Station
CoC	Certificate of Compliance
ESI	Southern California Edison ESI
FSAR	Final Safety Analysis Report
LTI	Laboratory Testing Incorporated
NIST	National Institute of Standards and Technology
NMSS	Office of Nuclear Material Safety and Safeguards
NRC	U.S. Nuclear Regulatory Commission
QA	Quality Assurance
QC	Quality Control
SAR	Safety Analysis Report
SFPO	Spent Fuel Project Office
SMDR	Supplier Manufacturing Deviation Request
SNR	Site Nonconformance Report
UST&D	U.S. Tool and Die Incorporated

REPORT DETAILS

1. Inspection Scope

The NRC team examined two specific items which were referred to the SFPO staff from the NRC Region IV office. The items were identified during spent fuel cask dry run operations for cask loading. The first item involved unexpected hydrogen generated in the Holtec spent fuel storage cask system observed during dry run operations at Columbia Generating Station (CGS) in Richland, WA in August 2003. The hydrogen issue is described in NRC inspection report 50-397/2002-08, dated November 1, 2002. The second item involved disparities encountered with the readings from the helium flow meters used to charge the loaded canisters with helium during dry runs at the Trojan Nuclear Power Plant (Trojan) in Ranier, OR. The helium flow meter issue is described in NRC inspection report 50-344/2002-01, dated April 29, 2003.

Additionally, the team examined performance-based samples of the corrective action program. The team examined the procedures for identifying nonconformances and for implementing corrective actions.

The NRC team inspected design and quality assurance 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 QA program.

The team 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.

2. Findings - Hydrogen Generation

2.1 Background

Region IV led a dry run team inspection at CGS in July 2002. Hydrogen was observed in the spent fuel pool emanating from the Holtec cannister. At the time, the Holtec Final Safety Analysis Report (FSAR), Revision 0, Section 3.4.1, stated that the generation of hydrogen was not credible. Subsequently, Holtec revised the FSAR to recognize hydrogen generation using a 10 CFR 72.48 evaluation. Region IV's NRC inspection report 50-397/2002-08, dated November 1, 2002, identified the issue as an unresolved item and subsequently remanded it to SFPO for examination. The NRC and Holtec met at the NRC offices on January 9, 2003, to discuss, with other topics, the hydrogen generation problem at CGS.

2.2 Review of the Holtec 10 CFR 72.48 on Hydrogen

The team examined the 10 CFR 72.48 evaluation performed by Holtec subsequent to the discovery of hydrogen at Columbia Generating station. The evaluation was Number 621, Revision 0, dated August 20, 2002, and Revision 1, dated August 30, 2002. The proposed

change was to revise the FSAR to add a requirement to monitor for combustible gases prior to and during cask closure lid welding. The evaluation determined that prior NRC approval for the change was not required. The NRC team concluded that making the FSAR change, without prior NRC approval, was appropriate and in accordance with the requirements of 10 CFR 72.48. Additionally, the team reviewed the Holtec procedure HQP-19.2, "Screening and Evaluation of Changes, Tests, and Experiments Under 10 CFR 72.48," Revision 5, and concluded it met regulatory requirements and industry guidance. Industry guidance is provided by Appendix B, "Guidelines for 10 CFR 72.48 Implementation," to NEI 96-07. Appendix B to NEI 96-07 was endorsed by NRC Regulatory Guide 3.72 dated March 2001, as a method acceptable to NRC staff for complying with 10 CFR 72.48.

The team noted however, that Holtec had based their original FSAR statements regarding the credibility of hydrogen on a process it called pre-passivation. The process, which the inspectors had previously verified as being performed during fabrication, involved soaking the neutron absorbing material, Boral, for a predetermined amount of time, in a water pan, to allow any free aluminum to react with water, go to chemical completion, and produce any potential hydrogen before eventually being immersed in a spent fuel pool in preparation for spent fuel cask loading. Boral is made of a mixture of materials including aluminum powder. The team noted, through review of Holtec's evaluation 621 and discussion with Holtec staff, that the original premise of Boral pre-passivation was technically faulted. The Boral neutron absorber material is somewhat porous and placing the material deep in a spent fuel pool forces water deeper into the material than the shallow water pan method. Consequently, the amount of hydrogen generated when the Boral was submerged deep in the CGS's spent fuel pool was significant, as described in NRC inspection report 50-397/2002-08, as opposed to not credible, as described in the Holtec FSAR.

Hydrogen buildup can be a safety hazard for welders during the cask lid closure welding procedure. This was first identified at another reactor site using a different cask design in 1996, when a hydrogen burn occurred. Subsequently, the NRC issued NRC bulletin 96-04, "Chemical, Galvanic, or Other Reactions in Spent Fuel Storage and Transportation Casks," dated July 5, 1996.

The team noted that 10 CFR 72.146, "Design control," requires that the certificate holder establish measures for the selection and review of the suitability of materials. It further requires that where a test program is used to verify the adequacy of a specific design feature, the certificate holder include suitable qualification testing under the most adverse design conditions. It specifies that the measures be applied to items such as the compatibility of materials. The team also noted that the design bases for the HI-STORM spent fuel cask storage system, the HI-STORM FSAR, Revision 0, Holtec Report HI-200244, Section 3.4.1, "Chemical and Galvanic Reactions," stated that there was no credible mechanism for chemical or galvanic reactions. The FSAR stated that in order to eliminate the aluminum water reaction during fuel loading, all aluminum surfaces would be pre-passivated.

The failure to provide adequate design measures to ensure compatibility of materials and provide means to recognize and mitigate the potential effects of hydrogen generated from the cask materials was considered a violation of 10 CFR 72.146. The team noted that the pre-

passivation of the Boral plates had been done at nominal water depth, whereas the casks were generating hydrogen while at substantial fuel pool depths. Additionally, the team noted that the pre-passivation process had not been qualified under the most adverse conditions, i.e., significant water depth.
(Violation 72-1014/03-201-01)

The team noted that Holtec had sent a bulletin, Holtec Information Bulletin 8, Revision 0, dated August 16, 2002, and Revision 1, dated August 20, 2002, to the Holtec user's group informing them of the hydrogen problem and recommending actions to deal with the hydrogen.

The team also noted that, after hydrogen first was noted at Columbia, Holtec performed a calculation, Holtec International Position Paper DS-248, "Chemical Stability of the Holtec MPC Internals During Fuel Loading and Dry Storage," Revision 2, dated August 23, 2002, which predicted very little hydrogen generation. Holtec had written Quality Program Violation Form (QPVF) Number 249 dated February 11, 2003, regarding the calculations and provided additional considerations regarding the possible variables that might affect the disparity between the calculated results and the observed hydrogen generation rates. During the inspection, Holtec informed the team that they will no longer attempt to predict the amount of hydrogen, but as an alternative, will require strategies to deal with the hydrogen safely. The team noted that Holtec stated that they intended to make monitoring and purging for hydrogen a requirement rather than a recommendation. Holtec noted, however, that there was some licensee resistance to that approach and no final decision had been made.

Additionally the team explored whether there was evidence that aluminum was the only material generating hydrogen. The team noted that Holtec had suggested, in the January 19, 2003, meeting with NRC that impurities in the Boral may be a source of hydrogen. The team found that Holtec had specified limits for certain impurities in the Holtec purchase specification for Boral. The responsible Holtec materials person stated that certain of the specified impurities accelerated the generation of hydrogen while others tended to retard the reaction. The team examined the chemical analyses for the CGS cask and verified the impurity levels were within specified limits. Previous NRC inspections at the fabricator had also sampled and verified that Boral met the purchase specifications.

Additionally, since a foreign designed and fabricated cask had experienced recent problems with Boral swelling from hydrogen generation, the team inquired as to whether Boral swelling in a Holtec cask was a possible problem. The responsible Holtec materials person explained that Holtec had performed some preliminary studies and laboratory tests to determine if Boral made to Holtec specifications would have swelling problems similar to the Boral made to the foreign specifications. The materials person noted that there were physical and composition differences between the two Boral specifications, and that preliminary Holtec laboratory testing had not identified any swelling even under severe laboratory test conditions. The Holtec materials person explained some of the specification differences and their possible effects on potential swelling. He noted that there had been no examples of swelling in Holtec casks in service. The team concluded that Holtec was adequately addressing the matter.

Additionally, the team reviewed a sample of six other 10 CFR 72.48 screenings and evaluations to assess their compliance with 10 CFR 72.48 requirements and industry guidance. The sampled screenings and evaluations were found to be adequate.

3. Findings - Nonconformances and Corrective Actions

The team examined Supplier Manufacturing Deviation Request (SMDR) number 929, Revision 1, dated October 9, 2002, dealing with a problem of large numbers of liquid penetrant indications in the cask lid forging base metal next to the closure weld to the cask shell. This problem was identified by Holtec in a 10 CFR 72.242(d) report to the NRC dated November 13, 2002. The problem occurred at Plant Hatch in September 2002. NRC inspection report 72-36/2002-02 dated October 15, 2002, deals with some of the surrounding issues. Additionally, Holtec issued a Corrective Action Request (CAR) number 88 dated September 25, 2002, which invoked root cause analysis. Holtec also issued Holtec Information Bulletin number 9, Revision 0, dated September 23, 2002, and Revision 1, dated October 8, 2002, to inform the Holtec owner's group of the problem. The team assessed the adequacy of Holtec's root cause analysis, extent of condition analysis, corrective actions, and corrective actions to prevent recurrence. In short, the root cause was attributed to large metal grain size in the forging due to poor heat treating practices during manufacture of the forging. The corrective action was to replace the defective lid and assess all other welded and loaded casks, plus the other lids on hand. The corrective action to prevent recurrence was to include weldability controls in future procurements of the lid forging. The team considered Holtec's actions for this problem to be adequate.

The team also examined precursor events in April and July 2001, described in CAR 88, which involved liquid penetrant indications in the lid forging base metal adjacent to attachment welds at Holtec's fabricator, U.S. Tool and Die (UST&D). These conditions were documented in SMDR 622 dated September 14, 2001. The problem occurred during lid fabrication at US T&D, so a loaded cask was not involved. The lid indications persisted through several attempts at repair, and the lid was scrapped and replaced. SMDRs do not require a root cause analysis. Holtec representatives stated that they saw the problem as an in-process problem, self revealing, and isolated to two lids. They stated that any additional lid problems would be identified by the liquid penetrant examination already required, although this did not turn out to be true for the Plant Hatch lid. Holtec concluded, in CAR 88 after the Plant Hatch problem, that if root causes had been pursued earlier the problem at Plant Hatch would likely have been prevented. The team agreed with Holtec's conclusion. Holtec provided training to its staff regarding this matter.

The team considered the sampled procedures, nonconformances, and corrective actions to be adequate. Corrective actions were appropriate in scope and timeliness and commensurate with the problems identified.

4. Findings - Helium Flow Meter

Background

The team examined a problem with helium flow meters and totalizers that occurred at the Trojan Nuclear Power Plant during preparation for spent fuel storage loading dry runs in December 2002. The problem was found and Holtec, as the spent fuel cask operations contractor for the Trojan plant, took corrective action before any casks were loaded. The flow meters and totalizers were reading less than the expected values as described in NRC inspection report 50-344/2002-05 dated April 29, 2003. The flow meters were Holtec provided equipment calibrated by a Holtec sub-sub-contractor, ESI. 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 in an accident condition.

Holtec issued Site 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. Also the SNR stated that a subsequent test run was done with nitrogen versus helium at Trojan to examine the problem. Reportedly, Trojan found that using the nitrogen to helium correction factors taken from Aalborg's flow meter manual, the meter gave the expected values for helium.

Then, per the SNR, one meter was returned to Aalborg for testing, with helium versus nitrogen, and Aalborg confirmed the large discrepancy as indicated versus actual flow values. Per the SNR, two additional flow meters were then returned to Aalborg for calibration with helium.

Per the SNR, the flow meters had originally been calibrated by Aalborg using nitrogen gas and the manual correction factors for helium. However, Holtec needed to have the meters calibrated by a vendor from its approved vendors list. Holtec sent the meters to its approved vendor Laboratory Testing, Incorporated (LTI) in Hatfield, PA. LTI had subcontracted with Edison ESI for the flow meter calibration. Edison 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 problem.

Inspection at ESI

The team interviewed the involved personnel, reviewed the facility and equipment used, examined the calibration procedure, and the calibration records. The team also explored the quality assurance (QA) and quality control (QC) oversight at the facility.

ESI is a subsidiary of Southern California Edison, the utility that, among other enterprises, owns and operates the San Onofre Nuclear Generating Station in San Clemente, CA. ESI is located on a 22 acre tract in Westminster, CA and does major work such as turbine rotor refurbishment and generator rewinding for operating power plants. The metrology lab is a small part of the facility, but is extensive, occupying several floors of a large industrial laboratory and office complex. The metrology lab has state-of-the-art equipment and its standards are traceable to National Institute of Standards and Technology (NIST) standards. The lab is accredited by NIST in several measurement disciplines including flow rates. NIST accreditation is voluntary, but is an uncommon credential for calibration facilities. The metrology lab does about 500 flow meter calibrations a year. The metrology lab does work for the affiliated Edison enterprises and for outside enterprises as well.

Details

The team examined the purchase order records issued by LTI to ESI. The records listed the Aalborg flow meter Model Number, GFM 671S, range 0-20 cubic feet per minute (cfm), and unique identifier numbers for each flow meter. The flow meters were calibrated without the totalizers used at Trojan. Per Holtec, the totalizers were calibrated separately by Prolab, in Hatfield, PA, a subcontractor to LTI. The team noted that a miscalibration of either instrument, the flow meter or the totalizer, could affect the flow results. Reportedly, per Holtec, actions were taken at Trojan which isolated the problem to the flow meters.

The team reviewed the calibration records at ESI. The team noted that four flow meters were sent to ESI. The instruments, sequence of events and actions taken are shown in Table 2. Three instruments were received by ESI with the Aalborg calibration seals in place. The three flow meters had reportedly been initially calibrated at Aalborg using nitrogen and theoretical correction factors were applied by Aalborg to make the flow meters read accurately for helium. It is common industry practice to calibrate with air or nitrogen and apply correction factors for other gasses, particularly noxious or flammable gasses. ESI records show that the three flow meters were checked at ESI using helium as the flow gas and were in calibration as found. The instruments were then forwarded to Holtec at Trojan. Holtec was the services contractor at Trojan and provided personnel and equipment to perform the dry runs and actual cask loadings. The fourth flow meter was sent to ESI from Holtec at Trojan after the problems at Trojan were uncovered. ESI found the instrument to be very much out of calibration. ESI did several tests with both helium and nitrogen, with and without back pressure. ESI noted that the calibration seal had been broken on the instrument indicating it had been adjusted prior to receipt. ESI had been told the instrument had been originally calibrated in liters per minute instead of cfm and possibly adjusted in the field. The instrument was not calibrated at ESI and was returned to Holtec in the as received condition.

The team reviewed the calibration procedure and facility, in particular the instrument called the “Bell Prover,” which measures the volume of gas passed through the flow meter being calibrated. The Bell prover is a counter-weighted metal bell immersed in oil. The bell fills with gas and rises out of the oil bath by the volume of gas collected, giving a volume reading. Volume, temperatures, pressures, time and other parameters are read throughout the test and the results are normalized to gas flow rate at standard temperature and pressure by a

mathematical algorithm. The accuracy of the Bell Prover is checked periodically against a NIST standard.

The team interviewed the metrologist who performed the calibrations. The metrologist was direct and forthcoming in his answers and was positive in his recollections. He was properly qualified and certified. He performed a walk through of the calibration procedure for the team and pointed out that the helium bottle was kept in a consistent location in the gas bottle rack. He asserted that there was little chance of a gas mixup.

The team reviewed the correspondence and documentation files at ESI. The team noted that two editions of the Aalborg operating manual for the flow meters showed different correction factors (K) for rescaling the flow meters from nitrogen to helium. Also, Holtec subsequently informed the team by telephone that Aalborg had devised a new K factor which was different from the two published values based on further research into higher flow rate flow meters. The factors are:

Aalborg Manual TD 9411M Rev F Sept 2001	0.2668
Aalborg Manual TD 9411M Rev G April 2002	1.454
New Aalborg K for high flow per Holtec	2.43
Holtec calculated K	1.4
Edison ESI calculated K	1.405

Holtec stated the 0.2668 value in Revision F of the Aalborg manual was a typographical error. The proper value, 1.454, was transposed one line down in the table of gases. The new K factor of 2.43 is not yet published and the team did not have the opportunity to explore the change with Aalborg or Holtec. The team concluded this matter warranted further inspection.

The inspectors examined the QA and QC oversight applied to the calibration work. The team noted that the metrologist worked alone and that the procedure steps and recorded values were not independently verified. The ESI QA/QC checks were applied to the completed documentation and packaging. The team noted that this provided less independent verification than is customarily applied to many nuclear safety related activities. ESI pointed out that the oversight methods they used were the metrology industry norm. ESI noted that additional independent oversight was provided by periodic audits, NIST certification, and the lack of negative customer feedback. The team noted that single verification was acceptable to the NRC in certain areas such as ultrasonic examination where different verification practices were defined by the industry's standards.

The team considered that the reasons for the erroneous readings from the flow meters and totalizers used to fill the spent fuel casks with helium at Trojan were not understood and further inspection to resolve the matter was required. The matter is considered to be an unresolved item (Unresolved Item 72-1014/03-202-02). NRC policy defines an unresolved item as, a matter about which more information is required to determine whether the issue in question is an acceptable item, a deviation, a nonconformance, or a violation.

Conclusion

The team found the facility and personnel at ESI to be professional, skilled, and credible. The team did not find a cause for the inaccurate flow meters. The team found no evidence to

support, or absolutely reject, the premise that the problem occurred at ESI. The team concluded that further inspection is warranted. The team also concluded that the misadjustment of the flow meters may have occurred at ESI, but the likelihood appeared to be low. The likelihood of a misadjustment at Trojan was considered possible. The item will be followed up as an unresolved item.

Table 1
Helium Flow Meter Chronology

Date/Event	FMeter1	FMeter2	FMeter3	FMeter4	Notes
???	per Holtec, all flow meters were purchased calibrated for Helium using N2 at Aalborg				
11/4/02	Cal Check sat at ESI,(w. He) Test 385225			-	Shipped to Holtec@ Trojan
12/2/02		Cal Check sat at ESI (w. He)	Cal Check sat at ESI (w. He) Test 386518		Shipped to Holtec@ Trojan
???	Per Holtec at Trojan (1) Meters read low using Helium by 60% (based on bottle usage) (2) test run with N2, applying Aalborg correction factors for He [which one?], read ok (based on bottle usage). Holtec concluded the meters were set with N2 at ESI.				
???	Per Holtec, Aalborg tested “the returned unit” with He, found wide disparity				
12/30/02	Per Holtec, two additional units returned to Aalborg, recalibrated using He, surveilled by Holtec for dedication.				
???	Per Holtec, at Trojan, testing with a bottle of He gave expected results.				
12/30	Loading commenced on first cask at Trojan. Used Aalborg calibrated meters for He fill				
1/9/03 per ESI letter, (2/6/03 per data sheets)				Cal chk unsat. at ESI He@ind 20cfm =30cfm actual. N2@ind 20cfm = 12 actual	Unit received by ESI with seals broken, shipped to Marlton (Griffiths)
3/6/03	Holtec issues Part 21 report on Flow Meters. It states the readings on the **totalizers** was low. Holtec determined that the totalizers were ok and that the flow meters were off (How?)				

Flow meter: Aalborg Model GFM 671S

FMeter 1: Asset No. 6001412, HI-FM-001, SN 79743-1(G70743-1?) . . . . . *Totalizer HI-FM- 006
FMeter 2: Asset No. 6001930, HI- FM-002, SN83883-1 . . . . . *Totalizer HI-FM- 004
FMeter 3: Asset No. 6001929, HI -FM-003, SN83883-2 . . . . . *Totalizer HI-FM- 005
FMeter 4: Asset No. 6002687, HI -FM-007/HI- FM-008, SN69420-1 . . . . . *Totalizer HI-FM- 008
* Totalizers are not integral to the flow meter and may have been switched between flow meters. Totalizers are Aalborg Model **TOT1-10.**

5. Exit Meetings

On April 24, 2003, the team had an exit meeting with Holtec International. The results of the inspection were discussed. A followup exit meeting was held, by telephone, on April 28, 2003, to clarify some questions asked by Holtec.

On May 28, 2003, an exit meeting was held at Edison ESI. Again, the results of the inspection were discussed.

NOTICE OF VIOLATION

Holtec International
Marlton, NJ

Docket No. 72-1014

During an NRC inspection conducted at Holtec International, in Marlton, NJ, on April 22-24, 2003, a violation of NRC requirements was identified. In accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions," NUREG-1600, the violation is listed below:

A. 10 CFR 72.146, “Design control,” states in part that the certificate holder shall establish measures for the selection and review of the suitability of materials. Where a test program is used to verify the adequacy of a specific design feature, the certificate holder shall include suitable qualification testing under the most adverse design conditions. The measures shall be applied to items such as the compatibility of materials.

The design bases for the HI-STORM spent fuel cask storage system, The HI-STORM FSAR, Revision 0, Holtec Report HI-200244, Section 3.4.1, “Chemical and Galvanic Reactions,” stated that there was no credible mechanism for chemical or galvanic reactions. The FSAR stated, in part, that in order to eliminate the aluminum-water reaction during fuel loading, all aluminum surfaces will be pre-passivated.

Contrary to the above, design measures were not adequate to ensure compatibility of materials. During dry runs and spent fuel cask loading at Columbia Generating Station, significant amounts of hydrogen were generated indicating significant aluminum-water reaction. The pre-passivation of the Boral plates had been done at nominal water depth, whereas the Boral plates were subjected to substantially greater water depth during cask loading in the spent fuel pool. The pre-passivation process had not been qualified under the most adverse conditions, i.e., the water depth associated with cask loading.

This is a Severity Level IV violation (Supplement VI).

Pursuant to the provisions of 10 CFR 2.201, Holtec International, is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555 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, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation" and should include for each violation: (1) the reason for the violation, or, if contested, the basis for disputing the violation or severity level, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken to avoid further violations, and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence, if the correspondence adequately addresses the required response. Where good cause is shown, consideration will be given to extending the response time.

ENCLOSURE 2

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

Because your response 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), to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html, (the Public Electronic Reading Room). If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.790(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21.

In accordance with 10 CFR 19.11, you may be required to post this Notice within two working days.

Dated this 13th day of June, 2003.