EDO Principal Correspondence Control

FROM: DUE: 11/21/11 EDO CONTROL: G20110766
DOC DT: 10/21/11
FINAL REPLY:

Senator Richard G. Lugar

TO:

Schmidt, OCA

FOR SIGNATURE OF : ** GRN ** CRC NO: 11-0581

Borchardt, EDO

DESC: ROUTING:

Distribution of Bad Data in the Nuclear Industry
(EDATS: SECY-2011-0569)

Borchardt
Weber
Virgilio
Ash
Mamish
OGC/GC
Leeds, NRR
Burns, OGC
Schmidt, OCA

DATE: 10/26/11

ASSIGNED TO: CONTACT:

EDO Rihm

SPECIAL INSTRUCTIONS OR REMARKS:

Please prepare response in accordance with OEDO Notice 2009-0441-02 (ML093290179). NRR to provide input to Roger Rihm, OEDO, if required. Roger Rihm to coordinate response with OGC and OCA.

Template: SECY-017

E-RIDS: SECY-01

EDATS

Electronic Document and Action Tracking System

EDATS Number: SECY-2011-0569 **Source:** SECY

General Information

Assigned To: OEDO
OEDO Due Date: 11/21/2011 11:00 PM
Other Assignees:
SECY Due Date: 11/23/2011 11:00 PM
Subject: Distribution of Bad Data in the Nuclear Industry
Description:

CC Routing: NRR; OGC; OCA
ADAMS Accession Numbers - Incoming: NONE
Response/Package: NONE

Other Information

Cross Reference Number: G20110766, LTR-11-0581
Staff Initiated: NO
Related Task:
Recurring Item: NO
File Routing: EDATS
Agency Lesson Learned: NO
OEDO Monthly Report Item: NO

Process Information

Action Type: Letter
Priority: Medium
Sensitivity: None
Signature Level: EDO
Urgency: NO
Approval Level: No Approval Required
OEDO Concurrence: NO
OCM Concurrence: NO
OCA Concurrence: NO
Special Instructions: Please prepare response in accordance with OEDO Notice 2009-0441-02 (ML093290179). NRR to provide input to Roger Rihm, OEDO, if required. Roger Rihm will coordinate response with OGC and OCA.

Document Information

Originator Name: Senator Richard G. Lugar
Date of Incoming: 10/21/2011
Originating Organization: Congress
Document Received by SECY Date: 10/26/2011
Addressee: Rebecca Schmidt, OCA
Date Response Requested by Originator: NONE
Incoming Task Received: Letter

OFFICE OF THE SECRETARY
CORRESPONDENCE CONTROL TICKET

Date Printed: Oct 25, 2011 17:33

PAPER NUMBER:	LTR-11-0581	**LOGGING DATE:**	10/25/2011
ACTION OFFICE:	EDO		
AUTHOR:	SEN Richard Lugar		
AFFILIATION:	CONG		
ADDRESSEE:	Rebecca Schmidt		
SUBJECT:	Concerns the distribution of bad data for computer modeling		
ACTION:	Signature of EDO		
DISTRIBUTION:	OCA to Ack		
LETTER DATE:	10/03/2011		
ACKNOWLEDGED	No		
SPECIAL HANDLING:			
NOTES:			
FILE LOCATION:	ADAMS		
DATE DUE:	11/23/2011	**DATE SIGNED:**	

RICHARD G. LUGAR
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COMMITTEES:
FOREIGN RELATIONS, RANKING MEMBER
AGRICULTURE, NUTRITION, AND FORESTRY

United States Senate

WASHINGTON, DC 20510-1401

October 21, 2011

Ms. Rebecca Schmidt
Director
Nuclear Regulatory Commission
Office of Congressional Affairs
Washington, D.C. 20555

Dear Ms. Schmidt:

Because of the desire of this office to be responsive to all inquiries and communications, your consideration of the attached is requested.

Your findings and views, in duplicate form, along with the return of the enclosure, will be greatly appreciated. Please direct your reply to the attention of Darlee McCollum of my Washington office.

Thank you for your thoughtful attention.

Sincerely,

Richard G. Lugar
United States Senator

RGL/cgd
Enclosure

PRINTED ON RECYCLED PAPER

10955 South Fork Road
Dillsboro Indiana 47018

10 OCT -3 AM 9:53

October 3 2010

Senator Richard Lugar
United States Congress
Dear Senator Lugar:

Please take action to require the Nuclear Regulatory Commission to prohibit distribution of known bad data in the nuclear industry. Bad data is inherently dangerous because it can lead to bad decisions.

Note that the extreme radioactivity and long periods of time of reactor operation and fuel storage and fast reaction times required to make decisions in event of accidents and subsequent failure analysis require use of computer modeling.[1] Note that accurate computer modeling relies upon good data of known quality. Use of bad data when developing or when using computer models of material behavior undermines understanding and leads to poor decisions.

As materials analyst, I have participated in accident investigations where bad information has caused serious accidents and bad information has misdirected subsequent failure analysis investigations.

The NRC stated to me in a letter that the NRC took no action when notified distorted data was provided to the nuclear industry. A copy of the letter is attached as "NRCClosureLetterZrErrors.pdf". This letter describes the NRC response to notification that bad crystallographic texture data on zircaloy nuclear fuel rod cladding materials was provided to industry. Read it carefully: the NRC clearly acknowledged that bad data was provided to the nuclear industry and that the NRC did not know uses of the bad data. Yet "the NRC did not pursue whether distorted results were reported to " the nuclear industry. Note that zircaloy fuel rod cladding contains the radioactive nuclear fuel and by-products and is one key barrier intended to limit spread of radioactive isotopes during operation, storage of spent fuel, and in event of accidents.[1] Note also that research done before and after the above NRC letter has shown that bad crystallographic texture of zircaloy can lead to increased rates deterioration due to stress corrosion cracking, [2,3] increased radiation damage, and influences rates and types of zircaloy reactions with hydrogen[3] (which are concerns due to hydrogen embrittlement of zircaloy cladding and generation of explosive hydrogen gasses at zircaloy cladding, as appears to have occurred at Fukushima).

NRC and industry tolerance of bad data risks creating conditions where bad information leads to bad decisions which either create or exacerbate a nuclear accident and cripple the effectiveness of any subsequent failure analysis investigation. Please contact me at (812) 667-6546 regarding this issue.

Sincerely

Mark J. Kelly

Ph. D.

References:

1. Nuclear Fuel Behaviour in Loss-of-coolant Accident (LOCA) Conditions. State-of-the-art Report". OECD 2009, NEA No. 6846. https://www.oecd-nea.org/nsd/reports/2009/nea6846_LOCA.pdf

2. D. B. Knorr, J. M. Peltier, and R. M. Pelloux, "Influence of Crystallographic Texture and Test Temperature on Initiation and Propagation of Iodine Stress-Corrosion Cracks in Zircaloy", (1972). *Zirconium in the Nuclear Industry: Sixth International Symposium.* Philadelphia, PA: ASTM. pp. 627-651.

3. Y. S. Kim, H. K. Woo, K. S. Im, and S. I. Kwun (2002). "The Cause for Enhanced Corrosion of Zirconium Alloys by Hydrides". *Zirconium in the Nuclear Industry: Thirteenth International Symposium.* (Philadelphia, PA: ASTM): 277. ISBN 978-0803128958.

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 16, 1999

Mr. Mark J. Kelly
10955 South Fork Road
Dillsboro, Indiana 47018

SUBJECT: ALLEGATION NO. NRR-1999-A-0057

Dear Mr. Kelly:

This letter refers to your letter dated September 12, 1999, to Fiona Tobler, Nuclear Regulatory Commission (NRC). In this letter you expressed concerns related to X-ray diffraction texture analyses of zirconium alloy tubing performed at Lambda Research Laboratory. This letter also refers to your letter dated October 19, 1999, to Mary Kay Fahey, NRC, in which you provided examples of erroneous pole figure data used in the texture analysis. In summary, you believe that erroneous or distorted analysis results may have been reported to fuel cladding manufacturers in the nuclear industry.

On September 30, 1999, we had a conference call with you to gather information relating specifically to a potential discrimination issue you identified to us on September 29, 1999. On October 9, 1999, we a had follow up conference call with you to identify the agent assigned to the investigation and to schedule an interview. During our conversation you requested NRC to put the discrimination investigation on hold, but pursue the technical allegations. Based upon your request the Office of Investigations will not pursue your allegation of discrimination.

In pursuing the technical issues we informed you on October 27, 1999, of our intentions to contact experts in the field of texture analyses to help us understand the safety significance of your allegation. Based upon our review and the information obtained from the experts, we believe that the problems with Lambda Research's texture analysis may be attributed to poor control of specimen preparation and texture analysis procedures. Further, we believe that texture analyses, in general, cannot be used to inadvertently qualify unacceptable material. The intrinsic mechanical properties of zirconium-based tubing material cannot be determined from texture analysis. Therefore, we have concluded that errors resulting from the texture analysis at Lambda Research in the development of engineered components is not a safety concern. NRC did not pursue the issue further since we determined it is not a safety concern.

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The enclosure to this letter provides a more detailed summary of the resolution of your concerns. Thank you for informing us of your concerns. We feel that our actions in this matter have been responsive to those concerns. We take our safety responsibilities to the public very seriously and will continue to do so within the bounds of our lawful authority. Unless the NRC receives additional information that suggests that our conclusions should be altered, we plan no further action on this matter. Should you have any additional questions, or if we can be of further assistance in this matter, please call Fiona Tobler or Greg Cwalina, Senior Allegation Coordinators, on the NRC Safety Hotline at 1-800-368-5642 or Fax Number 1-301-415-3741.

Sincerely,

Theodore R. Quay

Theodore R. Quay, Chief
Quality Assurance, Vendor Inspection,
Maintenance and Allegations Branch
Division of Inspection Program Management
Office of Nuclear Reactor Regulation

Enclosure: Statement of Concerns and
NRC Response Allegation No. NRR-1999-A-0057

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ALLEGATION NRR-1999-A-0057
CONCERNS 1 THRU 3
TEXTURE ANALYSES OF ZIRCONIUM ALLOY

CONCERN 1

X-ray diffraction texture analyses of zirconium alloy tubing performed at Lambda Research Laboratory are in question. The alleger believes that analyses performed at Lambda are in error and distorted results may have been reported to clients like GE Nuclear. He also suspects other clients like Westinghouse Bettis and Western Zirconium may be involved. Written procedures at the laboratory were not followed, and some simply cannot be followed, because of the problems with the procedure, training, and software.

NRC RESPONSE:

The area of texture analysis is very specialized and requires that proper sample preparation, procedures, personnel training and equipment are utilized to produce accurate results. As noted in a 1982 paper, "Texture Measurement Techniques for Zircaloy Cladding: A Round-Robin Study," which was published by J.E., Lewis, et al. in the Fifth Conference on Zirconium in the Nuclear Industry, there are many areas that require careful consideration when performing texture analyses. These areas include proper specimen preparation with particular attention to the flatness of the specimen, proper specimen alignment on the goniometer axis, diffraction focusing circle, and selection of the correct 2θ-peak, among other things.

As noted in your September 12, 1999, letter to NRC and other supporting documents, Lambda Research seems to have had some problems controlling the flatness of the specimen and identifying the correct 2θ-peak position prior to conducting texture analyses. These deficiencies were reported by the alleger to have resulted in "distorted" intensity distributions and this has been substantiated. Lambda Research also produced pole figures on several occasions which were indicative of a 90-degree specimen rotation problem. However, it seems that Lambda's clients were cognizant of this type of error and requested that Lambda repeat the analysis. Overall, these problems are indicative of the need for better training of Lambda Research's personnel who prepare the specimens, run the equipment and acquire the data.

With respect to the deficiencies in specimen preparation and the texture analysis technique (i.e., identification of the correct 2θ-peak position), we believe that the alleger is making every attempt to correct the situation and produce more accurate, consistent data. Adherence to the most recent ASTM Standard E 81-96, "Standard Test Method for Preparing Quantitative Pole Figures," which contains up-to-date procedures for conducting texture analysis with modern x-ray diffraction equipment, may help to prevent these types of problems in the future. Further, the references provided at the end of this document may be useful for making comparisons between Lambda Research's data and other data sets regarding the texture of various zirconium materials.

Since the area of texture analysis is very specialized, we consulted with two experts in this field. One of the interviews was conducted with a materials science and engineering professor who has published many papers on the texture analysis of zirconium-based alloys. The second interview was conducted with a senior engineer of one of the major nuclear fuel fabrication companies who has experience in texture analysis from a fuel cladding design perspective.

These two experts stated that the generation of "bad data" and/or "distorted results" can be attributed to many sources, including poor sample preparation, inexperienced analysts or technicians, and inadequate control of the data acquisition equipment and procedures. However, they believed that the techniques employed for texture analysis cannot inadvertently be used to qualify substandard material. In other words, the data from a properly prepared specimen, using equipment that has been adequately prepared for texture analysis, will produce results that are representative of the specimen's (or material's) texture. For example, one expert concluded that, using the basal direct pole figure, substandard material could be identified if the peak intensities and/or the locations of the peak maxima were outside their acceptable ranges. Thus, if the texture analyses were conducted on "good material" but the specimen was poorly prepared (e.g., the surface is rough or wavy), the texture analysis results would tend to have characteristics that could indicate the material may be "unacceptable." Alternatively, if the texture analysis is performed on poor quality material, the characteristics of the data would show the material is poor. Both experts believed that texture analysis, alone, cannot be used to determine the intrinsic mechanical properties of zirconium-based tubing material. Rather, as one expert suggested, texture analysis can be used to estimate mechanical properties relative to certain directions of the tubing (e.g., the results of a texture analysis may show that the tensile strength of the tube in the axial direction is larger, or smaller, than the tensile strength in the radial direction).

We are unsure how GE Nuclear or Lambda Research's other clients use the texture analysis results. However, one of the experts stated that his company does not conduct texture analyses, i.e., direct pole figures, on a routine basis to evaluate characteristics of the tubing. The texture analyses are conducted typically as part of an evaluation of new product material or a new manufacturing process. Alternatively, his company employs a test that evaluates the contractile strain ratio (CSR) as a check on the control of the tubing manufacturing processes. Then, the mechanical properties of the cladding are correlated to the CSR. When the calculated CSR is found to be within a specified range, the mechanical properties of the material are found to be acceptable. In addition to the CSR, the expert's company also performs a tensile test to evaluate the mechanical properties of the cladding on a per lot basis.

In summary, the problems associated with Lambda Research's texture analysis, we believe, stem from poor control of specimen preparation, training, software and texture analysis procedures. These deficiencies resulted in "distorted" intensity distributions, and this has been substantiated. However, we also believe that texture analyses alone cannot be used to inadvertently qualify unacceptable material. The intrinsic mechanical properties of zirconium-based tubing material cannot be determined from texture analysis. We have concluded that errors resulting from the texture analysis at Lambda Research in the

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development of engineered components is not a safety concern. Therefore, the NRC did not pursue whether distorted results were reported to Lambda's clients.

CONCERN 2:

The owner of the company repeatedly refused to allow the alleger or anyone else to review the past zirconium alloy texture analysis reports and data, which would determine if the problems with the analyses have caused bad data to be reported to the clients.

NRC RESPONSE:

Based upon our response to Concern 1 and our determination that the issues involved were not safety significant the NRC will not pursue this concern.

CONCERN 3:

Fear of Retaliation:

The alleger believes, if the owner of Lambda Research were to find out that he discussed these concerns with NRC, GE Nuclear, or other clients, he would probably make changes.

NRC RESPONSE:

On September 30, 1999, we had a conference call with you to gather information relating specifically to a potential discrimination issue you identified to us on September 29, 1999. On October 9, 1999, we had a follow up conference call to identify the agent assigned to the investigation and to schedule an interview. We explained that an investigation by our Office of Investigations into your allegation of discrimination by Lambda Research could not be pursued without your approval to release your identity. During our conversation you requested NRC to put the discrimination investigation on hold, but pursue the technical allegations. Based upon your request the Office of Investigations will not pursue your allegation of discrimination. Therefore, NRC does not plan on taking any action on this concern.

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REFERENCES:

J.M. Dahl, R.W. McKenzie and J.H. Schemel, "Thermomechanical Control of Texture and Tensile Properties of Zircaloy-4 Plate," in *Zirconium in Nuclear Applications*, ASTM STP 551, American Society for Testing and Materials, 1974, pp. 147-159.

J.E., Lewis, G. Schoenberger, and R.B. Adamson, "Texture Measurement Techniques for Zircaloy Cladding: A Round-Robin Study," in *Zirconium in the Nuclear Industry: Fifth Conference*, ASTM STP 754, D.G. Franklin, Ed., American Society for Testing and Materials, 1982, pp. 39-62.

E. Tenckhoff, "A Review of Texture and Texture Formation in Zircaloy Tubing," in *Zirconium in the Nuclear Industry: Fifth Conference*, ASTM STP 754, D.G. Franklin, Ed., American Society for Testing and Materials, 1982, pp. 5-25.

E. Tenckhoff and P.L. Rittenhouse, "Texture Development and Texture Gradients in Zircaloy Tubing," in *Applications-Related Phenomena for Zirconium and Its Alloys*, ASTM STP 458, 1969, pp. 50-67.

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B 11907

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 10, 2000

Mr. Mark Kelly
10955 South Fork Road
Dillsboro, Indiana 47018

SUBJECT: ALLEGATION NO. NRR-2000-A-0009

Dear Mr. Kelly:

This refers to your letter dated February 18, 2000, in which you expressed concerns related to Lambda Research Inc. You were concerned about retaliation for raising issues regarding inaccurate testing and falsification of information.

Enclosure 1 to this letter documents your concerns as we understand them. We have initiated actions to examine the facts and circumstances on the basis of our understanding of your concerns. If the description of your concerns in the enclosure is not accurate, please contact me so that I can assure that we correctly understand your concerns before we start our review.

Both of your concerns involves employment discrimination for raising safety concerns, please be aware that the NRC does not investigate all allegations of discrimination and will determine whether an investigation is warranted in your case. An evaluation without identifying you would be extremely difficult. Therefore, if the NRC does investigate, please be aware that in evaluating your claim of discrimination, your name will be disclosed. Furthermore, NRC evaluation of your claim of employment discrimination may take up to 18 months to complete.

Your letter to us indicated that you are filing a complaint with the Department of Labor. If you have filed a complaint with DOL, please send a copy to us also.

In my earlier letter to you dated October 20, 1999, pertaining to your allegation regarding Lambda Research Inc., I provided you an NRC brochure entitled, "Reporting Safety Concerns to the NRC." It includes information on the allegation process, identity protection, and the processing of claims for discrimination against workers, handled by the Department of Labor. Should you need another copy, please contact me.

Thank you for notifying us of your concerns. We will advise you when we have completed our review of this matter. However, should you have any questions or comments during the interim regarding this matter, please call either Greg Cwalina or me toll-free at 1-800-368-5642.

Sincerely,

Fiona T. Tobler

Fiona T. Tobler, Senior Allegations Coordinator
Office of Nuclear Reactor Regulation

Enclosures: As stated

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