



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

50-443

March 18, 1993

The Honorable Joseph Lieberman, Chairman
Subcommittee on Clean Air and Nuclear Regulation
Committee on Environment and Public Works
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

I am responding to your letter of February 16, 1993, in which you referred to a televised report by WSSB-TV (CBS), Hartford, Connecticut, concerning faulty equipment imported from China and used at the Seabrook Station, Seabrook, New Hampshire. You also requested a reply that addressed our analysis of this issue and its effects on all U.S. Nuclear Regulatory Commission (NRC) licensees, our coordination of this issue with other Federal and State agencies, other NRC licensees that reported having flanges that could be substandard, and the steps we are taking to address any safety issues.

On December 7, 1992, Mr. Cole of WSSB-TV contacted the NRC and inquired about the NRC's actions regarding China flanges at the Seabrook Station. Mr. Cole was provided a verbal overview of the NRC's actions regarding the flange issue, as well as specifics on NRC follow-up activities at Seabrook.

On September 10, 1992, the NRC issued Information Notice (IN) 92-68, "Potentially Substandard Slip-On, Welding Neck, and Blind Flanges" (copy enclosed), to all power reactor licensees, with copies provided to all non-power reactor licensees, agreement states, and major vendors supplying the nuclear industry. Additional NRC licensees will be notified of the flange problem if it is found to be appropriate during the course of our ongoing review. The IN alerted recipients to problems that could result from substandard flanges imported from the People's Republic of China and enclosed an analysis of this issue. Power reactor licensees use the largest number of flanged assemblies in applications with the greatest safety significance. In this IN, the NRC stated that the National Board of Boiler and Pressure Vessel Inspectors (Board) of Columbus, Ohio, received numerous reports of flanges marked "China" that contained cracks, inclusions, and slugged weld repairs, and that were constructed from two pieces of material. The suspect flanges were marked as steel forgings that comply with the American Society for Testing and Materials (ASTM) Standard A-105, "Specifications for Forgings, Carbon Steel, for Piping Components," and the American National Standards Institute (ANSI) Standard B16.5, "Dimensional Standards for Steel Pipe Flanges and Flanged Fittings."

When the IN was issued, the NRC did not have evidence that any suspect China flanges had been installed in U.S. nuclear power plants. However, since that IN was issued, the licensees listed in the enclosure have verbally advised the NRC of finding suspect China flanges in uninstalled piping assemblies for use in planned modifications or installed in nonsafety systems. Because INs do

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not require licensees to take specific action or respond in writing, this list may not bound the extent of the problem but our inspection experience has been that licensees take the actions necessary to address the safety issue. Properly implemented, NRC-required, quality assurance programs should minimize the possibility that licensees have installed China flanges in safety systems. Only the licensee for the Seabrook Station reported finding flanges in a safety system (six 4-inch welding neck flanges installed in the control room ventilation) that could be substandard because they were stamped "China."

The licensee performed insitu evaluations of the flanges installed at the Seabrook Station to assess their quality, integrity, and ability to perform their safety function in a ventilation system. The licensee determined that the China flanges were acceptable for this particular installation. The licensee's actions have not identified China flanges installed in any other safety system. As documented in NRC Inspection Report 50-443/92-25, the NRC resident inspector determined that the licensee was taking sufficient actions to address the issue, including the inspection of about 20 China flanges installed in nonsafety systems. The resident inspector will be reviewing the final results of the licensee action plan upon completion.

During a meeting on August 19, 1992, of the Interagency Working Group for Problem Parts and Suppliers, the NRC's representative discussed the issue of flanges marked "China" that could be substandard. IN 92-68 was issued through the Government-Industry Data Exchange Program (GIDEP) to its members in Agency Action Notice AAN-U-92-115, September 24, 1992. The Board, through its 1992 Special Edition of the Bulletin, Volume 48, Number 2, alerted its membership (state jurisdictional officials) and Bulletin subscribers of the results of its investigation of flanges marked "China."

The NRC and the Board are continuing to review information related to the flange problem. Further inspections are also planned to assess licensee and vendor actions associated with this issue. In addition, the NRC is starting work on a similar problem recently found by the Federal Trade Commission in which stainless steel flanges and butt-welded pipe fittings imported from Taiwan could be substandard. The NRC will continue to provide the industry information on substandard parts, including an update to IN 92-68, if appropriate.

Sincerely,

Original signed by
James M. Taylor

James M. Taylor
Executive Director
for Operations

Enclosures:

1. NRC Licensees Reporting China Flanges
2. Information Notice 92-68

cc: Senator Alan K. Simpson

* Distribution and concurrence see next page

Letter to Senator Lieberman dated March 18, 1993

Distribution:

JTaylor
 JSniezek
 HThompson
 JBlaha
 JKnubel
 HDenton
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 CKammerer
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 CERossi
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 TMurley
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 DRIL R/F
 VIB R/F

NRC PDR (w/incoming)
 PDR (w/incoming)

The descriptions of actions taken at Seabrook were discussed with Wayne Lammington Region 1 3/19/93.

*See previous concurrence
 Tech Editor's comments have been incorporated

OFFICE	DFIPS:ADM	VIB:DRIL	VIB:DRIL	VIB:DRIL	DD:DRIL
NAME	JMain*	SMatthews*	UPotapevs	LNorris	RZimmerman
DATE	03/01/93	03/01/93	03/07/93	03/07/93	03/4/93
COPY	YES NO	<u>YES</u> NO	<u>YES</u> NO	<u>YES</u> NO	<u>YES</u> NO

OFFICE	D:DRIL	ADT:NRR	UD:NRR	D:NRR	EDO
NAME	CERossi	WRussell	FMiraglia	TMurley	JSniezek
DATE	03/4/93	03/4/93	03/9/93	03/4/93	03/ /93
COPY	<u>YES</u> NO	YES <u>NO</u>	YES NO	YES NO	YES NO

OFFICE	EDO	EDO	OCA		
NAME	JBlaha	JTaylor			
DATE	3/ /93	3/17/93	3/16/93		
COPY	YES NO	YES NO	YES NO	YES NO	YES NO

OFFICE RECORD COPY
 DOCUMENT NAME:GT 8598

**NRC LICENSEES REPORTING
CHINA FLANGES**

1. Virginia Electric and Power Co. (North Anna Power Station/Surry Power Station)
2. Wolf Creek Nuclear Operating Corp. (Wolf Creek Generating Station)
3. Pennsylvania Power & Light Co. (Susquehanna Steam Electric Station)
4. Arizona Public Service Co. (Palo Verde)
5. Southern California Edison Co. (San Onofre Nuclear Generating Station)
6. Omaha Public Power District (Fort Calhoun Station)
7. Pacific Gas & Electric Co. (Diablo Canyon Nuclear Power Plant)
8. Texas Utilities Electric Co. (Comanche Peak Steam Electric Station)
9. Houston Lighting & Power Co. (South Texas Project)
10. North Atlantic Energy Service Corp. (Seabrook Station)

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

September 10, 1992

NRC INFORMATION NOTICE 92-68: POTENTIALLY SUBSTANDARD SLIP-ON, WELDING NECK,
AND BLIND FLANGES

Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert licensees to problems with potentially substandard slip-on, welding neck, and blind flanges. It is expected that recipients will review this information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

On July 9, 1992, the NRC staff met with a representative of The National Board of Boiler and Pressure Vessel Inspectors (Board) to discuss the Board's investigation of problems associated with flanges that originated from the People's Republic of China. The Board has received numerous reports of flanges marked "China" that contain cracks, inclusions, and slugged weld repairs, and that were constructed from two pieces of material.

The suspect China flanges were sold to U.S. suppliers through several trading companies. Three of the trading companies identified were: Billiongold Company Limited of Hong Kong, Tain Gong Company, and Shanxi Province Overseas Trading Corporation. The suspect flanges were marked as forgings that complied with the requirements of the American Society for Testing and Materials (ASTM) Standard A-105, "Specification for Forgings, Carbon Steel, for Piping Components," and the American National Standards Institute (ANSI) Standard B16.5, "Dimensional Standards for Steel Pipe Flanges and Flanged Fittings." However, the suspect flanges were manufactured with ring-inserts welded to the inside diameter of the flange and the outer surfaces were machined. Consequently, a visual inspection would not detect either the welding or the two-piece construction. Other flanges were found with slugged weld repairs to the flange hub and still others failed to meet the material specification requirements for thermal treatment, mechanical properties, or chemistry.

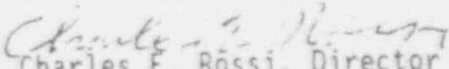
Discussion

The Board determined that one Chinese flange manufacturer, of the several known factories that supply the U.S., shipped more than 110 tons of ASTM A-105, ANSI B16, China flanges to this country. The Board stated that over 7,000 flanges are being removed from refineries and petro-chemical plants as a result of failures that occurred during welding, bolting, and hydrostatic and pre-operational testing. The Virginia Electric and Power Company informed NRC staff that China flanges are installed in two of its fossil power plants and others are in its warehouse. At the time of discussion, Virginia Power had not determined whether any suspect China flanges are installed in its nuclear power plants.

The NRC does not have evidence that any suspect China flanges have been installed in U.S. nuclear power plants. However, specific examples and discussions of the problems are attached for information.

A potentially substandard "China" flange can pass between two or more distributors before reaching the end-user facility. A nuclear power plant could buy a commercial grade China flange from a distributor to dedicate the flange for safety-related use, or safety-related components or subassemblies that contain China flanges could be supplied by licensee-approved manufacturers or fabricators. Establishing and verifying procedures to trace procured equipment and material to the original manufacturer or mill is an important prerequisite to inspecting and testing during the dedication process. It is possible for a licensee to install potentially substandard or defective equipment or material if it does not adequately verify that the product can be traced to the original manufacturer.

This information notice requires no specific action or written response. If you have any questions about this matter, please contact the technical contact listed below, one of the Board representatives listed on the attachments, or the appropriate Nuclear Reactor Regulation (NRR) project manager.


Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical contact: Steven M. Matthews, NRR
(301) 504-3191

Attachments:

1. 1992 Board article, "Failure Analysis of a Slip-On Flange."
2. Selected 1992 Board "NBBInfoletters."
3. List of Recently Issued NRC Information Notices

FAILURE ANALYSIS OF A SLIP-ON FLANGE

The installation of a 14" slip-on flange in a pipeline was recently witnessed by Al Justin, chief inspector for the State of Minnesota. The flange originally had a 14-3/4" inside diameter, which was reduced by welding a 3/4" ring and machine welding. The ring, however, separated from the flange, giving the appearance of a crack. The flange is reported to have been manufactured in the People's Republic of China.

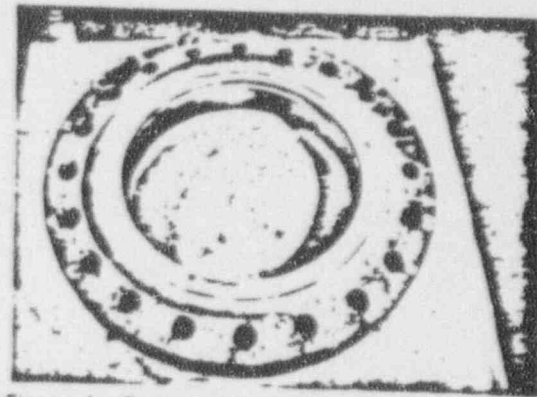


Figure 1: Gasket side of flange

Several such flanges have been reported in the field. All individuals in the industry should be on the alert for these flanges.

The following is a report by Columbus Metallurgical Services, Inc. on the failure analysis of a slip-on flange.

A "cracked" 14" diameter slip-on flange was non-destructively inspected by using magnetic particle, dye penetrant and ultrasonic test methods. The flange was also checked for material chemical analysis and macro and microstructure. On the basis of the results and observations reported, the following conclusion is drawn:

The subject slip-on flange is not an integral forging or a casting. It has been fabricated by welding and machining a ring insert within a large diameter flange. The flange "cracked" because the welds between the flange and the insert were inadequate to withstand the bolting pressures.

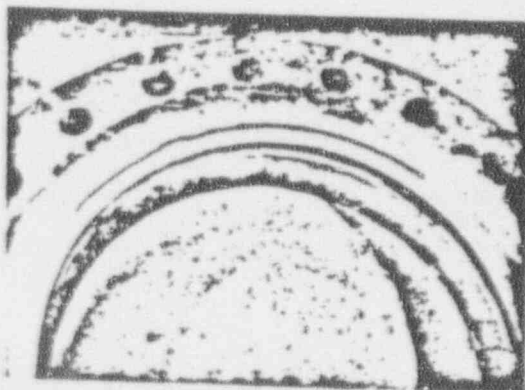


Figure 2: A close-up of the gasket side showing the "crack" indication.

BACKGROUND

The "cracked" slip-on flange was received by Columbus Metallurgical Services, Inc. in one piece. It had two diametrically opposite cracks located on pipe and gasket sides. It has been reported that several such flanges are in the field. The subject flange has the following engraved markings on the outside diameter (OD):

"14 300 SO RF B16.5 A105 848 CHINA 02F"

To identify the cause of the failure it was planned to perform dye penetrant, dry magnetic particle, ultrasonic and radiographic tests on the subject flange.

NON-DESTRUCTIVE TESTS

First, the flange was UT tested from the OD. The indications were rather puzzling because the reflections were consistently from a cylindrical surface about 3.75" from the OD. A dry magnetic particle examination confirmed that the cracks extended more or less continuously in a circular path. The NDT examination was concluded with dye penetrant tests as shown in the photographs in Figures 1 through 4. It was quite evident that the flange was not a single piece component. A large inside diameter (ID) flange was reduced to a 14" ID unit by welding a 0.75" thick ring. The welding faces had been machined.

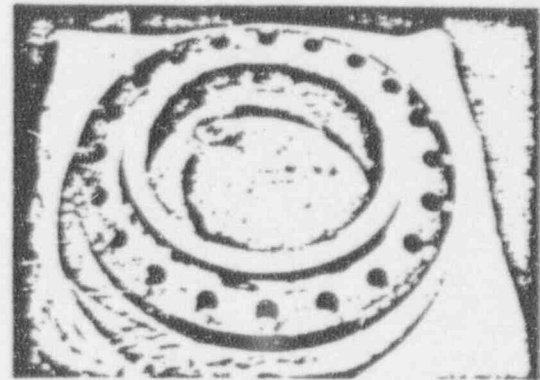


Figure 3: Pipe side of flange

CHEMICAL ANALYSES AND METALLOGRAPHY

The flange was sectioned into four pieces to obtain specimens for chemistry, as well as for macro and microscopic examination. The original engraved markings have been retained on one of the segments. The chemical analyses are as follows:

C	Mn	P	S	Si	Cu	Sn	Ni	Cr	Mo	Al	V
Main Flange Steel											
.23	.62	.024	.038	.24	.27	.016	.094	.079	.026	.006	.003
Welded Insert Steel											
.26	1.02	.017	.039	.28	.063	.003	.050	.046	.032	.008	.000
ANSI/ASTM A 105											
.35	.60-1.05	.040	.050	.35	(listed for reference only)						

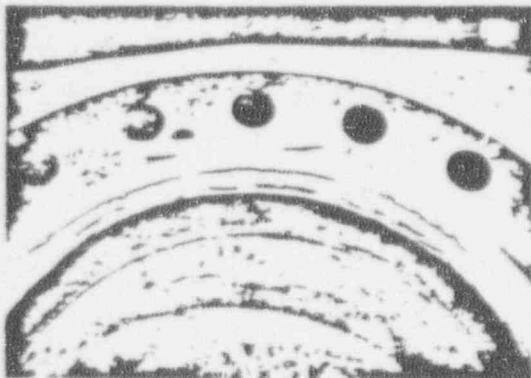


Figure 4: A close-up of the pipe side showing the "crack".

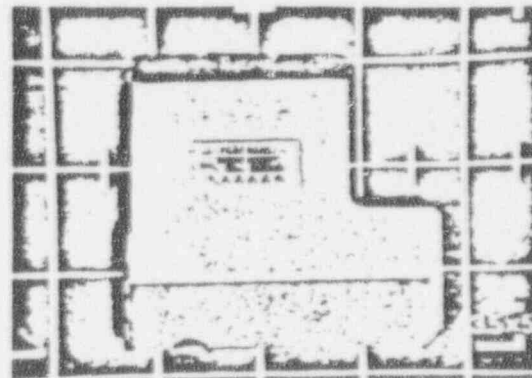
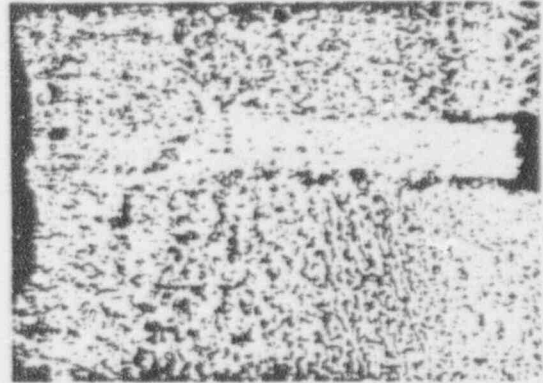


Figure 5: A macro of a radial section. Etched 50% HCl, 15 minutes

Figure 5 shows the radial macro section of the flange. Note the insert ring welded to the main flange. When another similar piece was further sectioned to retrieve specimens for mounting and polishing, the insert separated from the main flange. The general microstructure (ferritic-pearlitic) at 25X (Nital etc.) is shown in Figure 6.



ROCKWELL HARDNESS TEST

Main Flange:	72,69,70 HRB	Ave =
	70 HRB	
Insert:	76,78,80 HRB	Ave =
	78 HRB	

Figure 6: Photo showing general microstructure in the main flange (lower half), insert (upper half) and weld metal (left edge). 25X, Nital etch.

No further work was deemed necessary ♦



NBBI Infoletter

VOLUME 1 - NUMBER 16 - 3/27/92

Alert Continues for Flanges from China

The Winter 1992 *National Board Bulletin* included an article regarding a serious problem found to exist on 14" slip-on, raised-face flanges.

Since publication, NBBI has learned the problem described is only one of many associated with flanges from the Peoples Republic of China.

NBBI has been provided with a lab report for a 4" weld neck flange SA-105N B16-5 with a BHN (Brinell Hardness Number) of up to 500. Also, normalizing and chemistry requirements do not meet SA-105 requirements.

These flanges have been reported to have cracks and other surface discontinuities that might make them unfit for service. In addition, there have been reports that some flanges do not meet thickness requirements. NBBI also has been advised through reinspection reports that some flanges may not bear the markings re-

quired by the ANSI B16 specification, although they do bear the B16 mark.

NBBI advises double-checking all flanges with the marking "China," especially before these flanges are placed in service.

Certainly, flanges that have visible surface discontinuities or incomplete markings may be easy to see. But the machined surfaces of welded flanges can only be detected through a volumetric form of NDE. The failure to meet heat treat, mechanical or chemical requirements of the specifications can only be verified through metallurgic examination.

This update is being distributed in the interest of public safety. Future updates will be published as more facts are learned.

Further questions or concerns should be directed to A.M. "Doc" Matthews, Jr. or R.D. Schueler, Jr. at National Board headquarters.

Number of Suspect Flanges Growing at Alarming Rate

The National Board continues to receive reports of several different types of flanges, ranging in sizes from 2" to 20" and marked "China," that do not appear to be in accordance with ANSI B16 as markings.

As the number of suspect flanges continues to grow, so does the different types of problems related to these flanges.

To date, over 7,000 have been removed from service, including 1,600 recently discovered in a newly-installed pipeline. An injunction has been ordered to cease work on the pipeline until the flange problem has been resolved. The remaining 5,200+ flanges have been found mostly in refineries.

The president of the China Association of Boiler and Pressure Vessel Inspection, Center of Boiler & Pressure Vessel Inspection & Research of the Ministry of Labour, P.R.C., Wang Hannuo, has agreed to meet with National Board Assistant Director of

Inspections John McLouglin, late in May in Beijing to discuss the problem.

NBBI continues to advise double-checking all flanges with the marking "China," especially before these flanges are placed in service.

Flanges that have visible surface discontinuities or incomplete markings may be easy to see. But the machined surfaces of welded flanges can only be detected through a volumetric form of NDE. The failure to meet heat treat, mechanical or chemical requirements of the specifications can only be verified through metallurgic examination.

NBBI will continue to publish updates as information is learned. This update is distributed in the interest of public safety.

Further questions or concerns should be directed to A.M. "Doc" Matthews, Jr. or R.D. Schueler, Jr. at National Board headquarters. □

Flange Update: McLoughlin Meets Chinese Boiler/Pressure Vessel Officials

John D. McLoughlin, assistant director of inspections, met with several agencies of the Chinese government during his recent visit to the Peoples Republic of China. The visit was to discuss problems with flanges manufactured in China (and distributed to the U.S.).

Two meetings were held in Beijing.

On May 28, 1992, McLoughlin met with officials of the Center of Boiler and Pressure Vessel Inspection and Research, as well as representatives of Shanxi Province Overseas Trading Corporation, Tian Gong Company and Qing Xinang Nan Xi Li Flange Company.

Mr. McLoughlin learned that Ding Xinang Nan Xi Li has shipped seven to eight containers (each with 17 tons of various types and sizes of flanges) to the U.S. through what is believed to be Jacksonville, Florida. Shipping was reportedly provided by Shanxi Province, Tian Gong and Billiongold (a Hong Kong trader with Beijing offices).

Mr. Yang Li Min of Shanxi Province Overseas Trading Corporation reported that the base material for these flanges was 25 MN and possibly 16 MN (both Chinese forging specifications) and not the A105 identified on both the flanges and material test reports.

It was stated by Mr. Yang Li Min that manufacturing identification on the flanges was specified by Billiongold (the Hong Kong trader) and not the flange manufacturer.

A second meeting was arranged for Mr.

McLoughlin by Mr. Su Rung Ji, vice premier of China. Mr. McLoughlin met with Mr. Zheng You Mei, director of the Reception Bureau, State Council, P.R.C., Ms. Fan Jia Nian, assistant director of the Reception Bureau, and several members of the Center of Boiler and Pressure Vessel Inspection and Research (representing the Ministry of Labor). CBPVIR has been assisting the National Board in its investigation.

The director of the Reception Bureau was given copies of information accumulated during the course of Mr. McLoughlin's investigation and provided with a brief explanation of the documents and the significance of each.

Mr. Zheng You Mei reported that Mr. Su Rung Ji has a great interest in the flange situation. He said the government appreciated the information provided by the National Board. Mr. Zheng You Mei also said that a complete report of the meeting would be provided to Mr. Su Rung Ji.

The meeting concluded after Mr. McLoughlin provided Mr. Zheng You Mei with recommendations on steps the government could take to assure that steel mills and forging makers produce material and flanges that meet ASTM and ANSI specifications. The National Board will be advised when or if these recommendations will be implemented.

Upon his return to the U.S., Mr. McLoughlin received the laboratory results of blind flange and slip on flange tests that were ordered prior to his departure. Results of these tests are as follows:

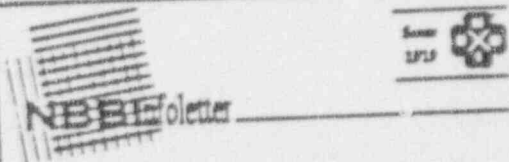
Flanges continued ...

1. Blind flange with an identifier of "PF" and marked A105 is reported to be a plate material.

2. Slip on flange with an identifier of USC or US10 and a heat #1-406 contains slugged weld repairs. The W weld repair indicator required by A105 is not stamped on the flange. The chemistry does not meet A105. The mill report does not indicate any type of heat treat even though the flange is marked A105N and has also been "weld repaired." Finally, photo micrographs indicate plate material. The flange makers name is Shou Gang Machinery Engineering Company.

According to Mr. McLoughlin: "This office has probably accomplished all it can at this point, with the resources available. The National Board will publish a special edition of *The National Board Bulletin* that will address this problem. Hopefully, we will be able to report steps the Chinese government are taking to insure that their flange products meet specification."

The National Board will be providing various appropriate agencies of the U.S. government with information it has acquired through the investigation process. □



The NBBInfoletter is published monthly by
The National Board of Boiler and Pressure
Vessel Inspectors, 1055 Crupper Avenue,
Columbus, Ohio 43229, (614) 888-8320

D.J. McDonald,
Executive Director
A.M. "Doc" Matthews, Jr.,
Assistant Executive Director
P.D. Brennan, APR,
Director of Communications
L.C. Nixon,
Publications Assistant

LIST OF RECENTLY ISSUED
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
92-67	Deficiency in Design Modifications to Address Failures of Hiller Actuators Upon A Gradual Loss of Air Pressure	09/10/92	All holders of OLs or CPs for nuclear power reactors.
92-66	Access Denied to NRC Inspectors at Five Star Products, Inc. and Construction Products Research, Fairfield, Connecticut	09/01/92	All holders of OLs or CPs for nuclear power reactors and all recipients of NUREG-0040, "Licensee, Contractor and Vendor Inspection Status Report" (White Book).
92-65	Safety System Problems Caused by Modifications That Were Not Adequately Reviewed and Tested	09/03/92	All holders of OLs or CPs for nuclear power reactors.
92-64	Nozzle Ring Settings on Low Pressure Water-Relief Valves	08/28/92	All holders of OLs or CPs for nuclear power reactors.
92-63	Cracked Insulators in ASL Dry Type Transformers Manufactured by Westinghouse Electric Corporation	08/26/92	All holders of OLs or CPs for nuclear power reactors.
92-62	Emergency Response Information Requirements for Radioactive Material Shipments	08/24/92	All U.S. Nuclear Regulatory Commission licensees.
92-61	Loss of High Head Safety Injection	08/20/92	All holders of OLs or CPs for nuclear power reactors.
92-60	Valve Stem Failure Caused by Embrittlement	08/20/92	All holders of OLs or CPs for pressurized water reactors (PWRs).

OL = Operating License
 CP = Construction Permit



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

ACTION

EDO Principal Correspondence Control

FROM: DUE: 03/11/93 EDO CONTROL: 0008598
DJC DT: 02/16/93
FINAL REPLY:

Sen. Joseph I. Lieberman, Chairman
Subcommittee on Clean Air and Nuclear Regulation

TO:
James Taylor

FOR SIGNATURE OF: ** PRI ** CRC NO:
Executive Director

DESC: ROUTING:
REQUEST IN-DEPTH ANALYSIS OF METAL FLANGES MADE BY
PEOPLES REPUBLIC OF CHINA AND USED AT NUCLEAR
POWER PLANTS Taylor
Sniezek
Thompson
Blaha
Knubel
Denton, IP
Scinto, OGC
Kammerer, IP
TMMartin, RI
SECY
OCA

DATE: 02/18/93
ASSIGNED TO: CONTACT:
NRR Murley

SPECIAL INSTRUCTIONS OR REMARKS:

MRK Rec'd: 2/18/93
MRK Action: ~~DET Richardson~~ DRILL/REPS
MRK Routing: Murley
Murphy
Russell
Partlow
Body
Crutchfield
Mail Room
126K

ACTION
DUE TO NRR DIRECTOR'S OFFICE
BY 3/8/93

Copy already made
for Gene

10/10/10