July 12, 1989

Atomic Energy Control Board
ATTN: Mr. J. P. Didyk
P.O. Box 1046
Ottawa, Canada
K1P 5S9

Dear Mr. Didyk:

On July 5, 1988, Mr. Abe Ghosh of your staff requested information from Scott Pennington of my staff on the actions being taken by Superior Valve Company and the U. S. Nuclear Regulatory Commission (NRC) to resolve a cracking problem with packing nuts in Superior 1-inch UF_6 cylinder valves. Mr. Ghosh enclosed a letter dated June 16, 1988, from CAMECO (formerly Eldorado Resources Limited) informing Superior Valve Company that a total of six in-service Superior cylinder valves had been discovered with cracked packing nuts. CAMECO also requested Superior to disclose the extent that the cracking problem had been identified by other users of the 1-inch valve and any efforts initiated by Superior to have the American National Standards Institute (ANSI) N14.1 specifications revised. Mr. Ghosh also enclosed a letter dated June 21, 1988, from CAMECO informing the Atomic Energy Control Board (AECB) of the cracking problem and stated that they were attempting to determine the scope of the problem and if widespread, would seek corrective action through revision of ANSI N14.1. Subsequent to these communications, discussions on the packing nut issue have been held with you and members of your staff by my staff. As you are aware, this issue has been brought to the attention of the ANSI Subcommittee N14-1 but no actions have been taken.

We would like to apprise you of a recent problem identified with Descote 1-inch cylinder valves. Allied-Signal has found three unused Descote valves with cracked packing nuts. One of the identified valves has been tested by the U. S. Department of Energy's (DOE) contractor, Martin Marietta Energy Systems (see enclosed report). A second valve has also been tested at Descote's manufacturing facility in Lyon, France. Enclosed is a copy of Descote's preliminary report dated June 14, 1989, to Allied-Signal describing their findings.

Although the NRC has not viewed the cracked packing nut to be a major safety issue, we have kept UF_6 cylinder users (NRC and State licensees) informed of the problem and stressed the need to have operators check for cracked nuts before and after valve use and to review their torquing procedures. We will keep you apprised of further information that we may receive on this matter and of any actions taken by the NRC.

OF03
1/1

If the AECB or CAMECO has received any additional information from Superior, Descote, or ANSI related to cracked packing nuts, we would appreciate your keeping us informed.

Sincerely,

Original Signed By

Leland C. Rouse, Chief
Fuel Cycle Safety Branch
Division of Industrial and
Medical Nuclear Safety, NMSS

Enclosures: As stated

Distribution w/encls.

PDR	NRC File Center	NMSS R/F	IMUF R/F	IMSB R/F
VLTharpe	WSPennington	CHRobinson	GHBidinger	LCRouse

IMNS Central File

DF03
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OFC:IMUF:	IMUF:	IMUF:	IMSB:
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DATE:6/29/89	6/29/89	6/30/89	6/7/89

OFFICIAL RECORD COPY

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EXAMINATION OF DESCOTE PACKING NUTS

The Technical Services Division, Paducah Gaseous Diffusion Plant (PGDP), has examined a cracked packing nut from a one-inch Descote cylinder valve, Serial Number 1675. The failure mode of the nut was intergranular cracking. The metallographic structure of the cracked nut (material heat R 91) was different from other product heats of Descote nuts and nuts from Superior Valves. The hardness profile of the nut indicates that significant residual stresses could have been present after the processing of the original bar stock.

A residual stress analysis was performed on one of the side faces of the cracked nut using the procedure and computations described in ASTM E 837. The maximum and minimum principal stresses were -11.0 ksi and -16.7 ksi. These are significantly higher residual stresses than are measured in nuts that have been stress relieved at 700°F. Since the exterior surface stresses are compressive, it is expected that the material at the base of the root of the interior thread would contain high residual tensile stresses. The physical appearance of the surface suggests that the faces of the nut were ground. It is suspected that surface finishing operations had induced the high residual compressive stresses. Failures of nuts with similar serial numbers and the findings of the investigation suggests that nuts produced from material designated R 91 and/or surface ground are susceptable to stress corrosion cracking.

40-3392

descote U.S.A.

Mark S. Fucich
Vice President/General Manager

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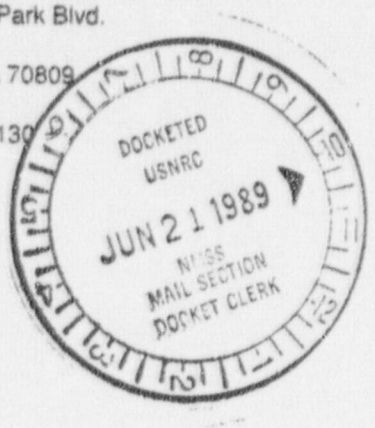

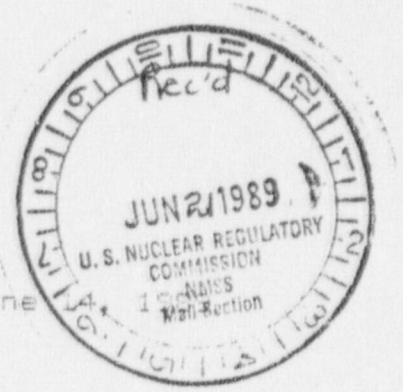

June 14, 1989

Allied Signal
Mr. Jerry Bishop, Plant Manager
P. O. Box 430
Metropolis, IL 62960

RE: Preliminary Report on
Descote Packing Nut
Failure on 1" UF6,
Serial Nos. 1675,
1689, 1694, Heat R91

Dear Mr. Bishop:

Attached please find the above referenced Report produced by the mother company Descote S.A., Feyzin, France.

We are working very hard to find out every detail. Descote is committed to working with Allied Signal and other users of this product to produce the highest quality product under the most stringent quality control.

We are also committed to working with the ANSI Standards Committee as a partner to work towards improving current design.

Should you or your staff have any questions, please do not hesitate to contact our office at 1-800-666-3140.

The following is a list of all valves delivered in North America from Heat R91:

	Heat	No. of Valves	Serial No.
Westinghouse	R91	60	1539-1578
Allied Signal	R91	200	1629-1828
El Dorado Canada	R91	1	2079
El Dorado Canada	R91	50	2426-2475

Shipments made 1986 - 1987

25646

addt info

We have this information and will submit our report to other users appearing on this list.

Respectfully submitted,

Mark S. Fucich

Mark S. Fucich
Vice President/General
Manager Descote USA, Inc.

MSF:lde

cc: Jack Honey, Allied Signal
Matt Kosmidar, Allied Signal
Mr. Rouse, NRC
Scott Pennington, NRC
Randy Reynolds, Martin Marietta
Steve Blue, Martin Marietta

Enclosure

SUBJECT: REPORT ON PACKING NUTS FAILURE - ALLIED CHEMICAL
1" UF6 VALVES - SERIAL NO. 1675-1689-1694

1. HISTORY

November 86: Order placed by ALLIED CHEMICAL for 200 valves, 1" UF6 (P.O 054/95250).

Nov.20th 86: Shipment from FRANCE, Valves S.N. 1639-1838. Packing nut Heat Number R91.

January 87: Valves received by ALLIED CHEMICAL.

July 28 87: MR. KOSMIDAR informed us about the failure on the Valve packing nut, S.N. 1690.

Sept.2nd 87: Phone conversation between MR. KOSMIDAR and HERVE CHATANAY; the conditions are clearly mentioned:

April 87 : Installation of the valve on a container after filling and cooling.

July 87 : When the container is ready for shipment, the packing nut is failed on all the circumference.
The NRC is informed. The valve has not been heated and the packing nut torque has been checked: 140 ft. lbs.
The container has been stored outside from April to July, 1987.

Sept.14 87: DESCOTE answer to ALLIED CHEMICAL (attached).
After return of the Valve, S.N. 1690, a metallurgical examination has been made:
The material is in conformity with the specification but it shows a large but acceptable INTERGRANULAR PRECIPATION (photographs to be mailed separately).
Since that time, DESCOTE and its main french customer have conducted an in depth study.

March 89: Report X-423 has been mailed to MR. J. HONEY of ALLIED CHEMICAL.

Apr. 18th 89: DUSA is informed by ALLIED that packing nuts of Valves, S.N. 1675-1689 and 1694 are cracked. The valves have never been used.

2. ANALYSIS OF VALVES, S.N. 1675-1689-1694

2.1) 1 of the 3 valves has been examined by MARTIN-MARIETTA. (see their report and DESCOTE's answer).

2.2) The Valve, S.N. 1689 has been returned to DESCOTE.

2.2.1) After visual examination, no other apparent failure except the packing nut.

2.2.2) PARTS EXAMINATION

Stem (2) - Body (1) -OK. A dye penetrant control of the packing box does not show any cracks or swelling.

Packing Ring (7) -there is a burr on the inside.

Either it was at the drilling or it has been caused by an over tightening of the stem in back seat (full opening).

Packing Gland (5) -there is a bending of 0.10 mm at the upper part.

Possible Causes:
1) too high torque
2) thrust due to PTFE dilatation (expansion).

2.2.3) PACKING EXAMINATION

-Packing rings are flattened out and the volume between packing ring, packing gland, stem and body is completely filled. It also shows the PTFE cold flow along the stem and packing gland. It is comparable to photo # 20 of Report X 423.

2.2.4) PACKING NUT EXAMINATION

-There is a large fracture on 5 faces of the hexagon.

-Except for the fracture itself, the dye penetrant control does not show any other surface defects.

-The surface finish of the hexagon faces is not normal. The metal has been grinded or linen faced on tne faces and angles. It has not been shipped as it is.

-The machining marks on the hexagon have disappeared. It is proof that something happened after the shipment because:

DESCOTE buys round bars.
DESCOTE machines the hexagon from the round bars to guarantee:

- -perfect stress distribution on the round bar.
- -perfect dimensionnal control and surface finish on the hexagon.

We have particularly checked this point since it is mentioned in MARTIN MARIETTA report, conclusion of which are questionable.

Test with Mercurous nitrate on bars and finished parts have shown no residual stress.

A metallurgical analysis has been ordered. We are waiting for the results but do not expect new information since investigations were already made earlier on it concerning a packing nut cracked by a french user.

The metallurgy is totally in conformity with the specifications.

3. INTERPRETATION AND CONCLUSION

3.1) Awaiting the metallurgical report, the fundamental element is the complete and total compression of the PTFE packing.

The report X 423 confirmed that with a torque of 150 ft/lbs, the packing fills up the volume between the stem, body, packing ring and packing gland only after retightening cycling operations at temperature.

The Valve, S.N. 1689 has certainly been subject to several retightening of the packing nut, even if the valve has never been installed.

It has been possible that:

1.) Either by DESCOTE before shipment; at that time we were analyzing the effect of tightening and these valves could have been retightened 3 - 10 times.

2.) Either by the customer as a preventive action.

3.) Or by both, 1 and 2

Facts are evident:

The chamber is full and the PTFE cold flow is the result of a too important stress. This is the phenomenon described in the Report X 423.

3.2) We are interested to know some additional points:

-Is there a systematic retighteneing procedure of the Packing nut applicable by ALLIED? If YES, at which torque? How often?

-Did ALLIED modify its procedures or operations further to the incident on the Valve, S.N. 1690.

-Although the grinding on the surface of the hexagon is not directly at the origin of the failure, we would like to know what could have generated this operation.

-Are the valves with packing ring heat R91 installed? If YES, How many packing nuts cracked?

3.3) TEMPORARY CONCLUSION

An excessive tightening of the packing nut has caused the fulfillment and the implementing of high efforts due to thermic dilatation of the PTFE.

We think that the metallurgical analysis will show a certain density of intergranular precipitation in the material.

The combination: Strength + Intergranular precipitation is the cause of the rupture.

Mr Matt KOSNIDER
ALLIED CHEMICAL
P.O.B. 430
METROPOLIS, IL. 62960
USA

HC/IML

UF6 valve nr 1690

packing nut crack

September 14, 1987

Dear Mr KOSNIDER,

It has been a pleasure to talk to you on the phone and to discuss about the failure of the packing nut of the 1 inch UF6 cylinder valves manufactured by DESCOTE under serial number 1690 dated October 1986.

Based on the information gathered during our conversation i.e. :

- the valve has never seen hot UF6
- the valve was installed in April 1987, when the cylinder was prepared for shipment after solidification of UF6 at ambient temperature
- the packing nut was found cracked (slipped all around) in July 1987
- the torque was checked during assembly on the packing nut at 140 ft.lb

We wish to inform you about the following :

a) DESCOTE has sold about 25 000 pieces 1" inch UF6 cylinder valves that are strictly manufactured according to the ANSI 14.1-1982 (now 1986) according the uS ERDA Specifications : JSP-531 and EJ 11246.

b) The quality controls and tests carried out by DESCOTE on each valve meet more than the ANSI requirements : this is shown on the attached comparative chart between ANSI/DESCOTE.

c) DESCOTE acting as a manufacturer and not as a designer can only improve the quality of the fabrication by implementing a very strict Quality Assurance program : it has been done for

d) However we have numbered 12 cases of packing nut failure among the 25 000 UF6 valves manufactured.
In all these cases (including yours) the alloy 636 delivered is perfectly conform to the US ERDA Specifications and the dimensions of the parts are in conformity with the drawings.
Attached are all the material certificates pertaining to the valves of your PO 054/9525 : it proves the accordance of our supply with the specifications.

e) Pursuing our investigations we have noted that a simple calculation shows that the torque value required by the ANSI (150 ft.lb) on the packing nut generates a tensile strength which is very near of the yielding point.
At this limit the Alloy 636 might be subject to either quick and bad aging provoking the grain dislocation or a stress corrosion cracking which lead consequently to the destruction of the metal.

f) Based on the analysis made on the 12 cases of packing nut failure we can be sure that :

- there is no reference to the heat number since there are different heat numbers involved

- there is no reference to the age of the valve : 2 valves manufactured and put in service in 1985 have had a packing nut failure in June 1987

- there is no reference to the conditions of use : these incidents happened to several customers who are not using the same procedures.

Therefore we think that we can guarantee the very exceptional nature of this not systematic phenomenon.

In conclusion we think that the risk of failure of the packing nut can only be definitively eliminated by a new design or by a material change. DESCOTE is decided to make the necessary changes and has already worked on possible technical proposals : such ones must first be discussed and approved in their principle(s) with the end users before the modification is submitted to the US ERDA for analysis and approval.

Should you agree with our approach and wish to let us know about your experience and technical ideas please inform us accordingly so that we can ensure coordination at our end.

Remaining at your disposal,

Yours Sincerely,