Control Board

Commission de contrôle de l'énergie atomique

Ontawa Canada K1P 559 Directorate of Fuel Cycle and Materials Regulation

Your file Votre référence

Our file Notre rélérence

36-3-1-0

November 24, 1989

Dr. Andrew J. Oliver Manager - Technical Services Cameco Port Hope Conversion Facility One Eldorado Place Port Hope, Ontario L1A 3A1

Dear Dr. Oliver:

UF₆ Shipping Cylinders with Non-specification Stiffening Rings

AECB staff has reviewed the Cameco request to have the prohibition on the use of 66 UF₆ shipping cylinders with non-specification stiffening rings rescinded (reference: September 27, 1989, letter from Mr. W.M. Crawford of Cameco). As a result, we hereby revoke the prohibition subject to the following conditions:

1. When shipping cylinders are filled and when they are returned to Port Hope, they shall be inspected visually to ensure that no gross cracking has occurred in the stiffening rings or the attached lifting lugs. In addition, inspections for evidence of fine cracking and brittleness shall be done annually. If any brittleness or cracking is detected, the cylinder shall be removed from service and the occurrence reported forthwith to the Board.

2. Cameco shall obtain assurance that the Ontario Ministry of Consumer and Commercial Relations independently agrees that these 66 cylinders are suitable for further service.

Cameco also expressed some concern about the position the United States Nuclear Regulatory Commission (USNRC) would take with respect to the AECB's cancelling this prohibition on the 66 cylinders. The USNRC confirms that all 248 cylinders, including the 66 still at Cameco, originally affected by the USNRC Order are now acceptable for use in the United States. This is evident from the recisions of the Orders that the USNRC issued to the Sequoyah Fuels Corporation (SFC) and Allied-Signal. (Note: Cameco already has a copy of the SFC recision, and AECB staff will send Cameco a copy of the Allied-Signal recision after we receive it.)

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Dr. Andrew J. Oliver

To summarize, Cameco may again use all those UF₆ shipping cylinders which the W.H. Stewart Company of Oklahoma City, Oklahoma manufactured with non-specification stiffening rings in 1975. More particularly, the following manufacturer's serial numbers identify the affected cylinders:

- 2309 through 2333, - 2442 through 2617, and - 2782 through 2828.

Yours truly,

L.C. Henry

Manager Fuel and Heavy Water Plant Division

cc: W.A. Grant, AECB-CQAD W.G. Martin, AECB-FWD J.J. McLellan, AECB-RTD W.S. Pennington, USNRC





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September 27, 1989

Mr. W. G. Martin. Atomic Energy Control Board. P.O. Box 1046. Ottawa, Ontario K1P 559

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UF, Shipping Cylinders Re: Serial Nos. 2442 to 2481, 2535, 2782 to 2828

This letter is to raise, for your consideration, the situation regarding certain UF, cylinders, purchased by Cameco in 1975, which came under a 1987 NRC order prohibiting their use. We believe that a review of the evidence surrounding these cylinders should allow their release for normal use and, therefore seek your approval based on the evidence presented in this letter.

In May, 1987, the U.S.A. Nuclear Regulatory Commission issued an order prohibiting the use of certain 48" dia. UF, cylinders manufactured by W. H. Stewart in 1975. These cylinders had been fabricated with stiffening rings of a material (ASTM A306 Gr.75 Steel) not specified in ANSI Standard N14.1 - 1972. The serial numbers of the 248 cylinders in question were:

> 2309 through 2333 2442 through 2617 2782 through 2828

Cameco purchased, from W. H. Stewart, 87 of the 248 cylinders in question. Later on, we purchased another one of the cylinders from Sequoyah Fuels. The serial numbers of these 88 cylinders are 2442 through 2481, 2535, and 2782 through 2828.

As you are aware, on November 13, 1987, Sequoyah Fuels Corporation requested a rescission of the order and submitted an evaluation which concluded that the cylinders could be used in this condition without compromising their safety. We have learned that on February 27, 1989, the NRC acccepted Sequoyah's conclusion and rescinded the order.

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The original NRC order of May 1987 prohibited the filling with UF, or heating or shipping of the cylinders in question until either of the following two conditions were met:-

- It was determined that the stiffening rings were not fabricated from ASTM A306 Grade 75 steel or.
- It was shown that the safety of the identified cylinders would not be compromised during operations.

Of the 88 cylinders in question purchased by Cameco, we have met Condition 1 above for 22 of these cylinders. In the intervening period between the issuance of the NRC order and its rescission to Sequoyah Fuels in February 1989, we had cylinder numbers 2443, 2444, 2446, 2447, 2448, 2449, 2451, 2453, 2454, 2459, 2461, 2463, 2464, 2465, 2466, 2469, 2472, 2473, 2474, 2477, 2479 & 2535 sent to the W. H. Stewart Company where the stiffening rings were removed and replaced to meet ANSI N14.1 requirements.

We believe that the case put forward to the NRC by Sequoyah Fuels on November 1987, a copy of which you have, adequately addresses Condition 2 above, and demonstrates that the safety of our other 66 cylinders would not be compromised by using them in their present condition.

Our examination and evaluation of the condition of these cylinders is the same as Sequoyah's. The case for concluding that the cylinders are acceptable for use is based on the operating history and examination of the cylinders and the metallurgical considerations in comparing A306 Grade 75 steel with A36 steel.

1. History & Examination of the Cylinders

Since the manufacture of the 248 cylinders in 1975, there have been only 3 instances of cylinders with any stiffening ring-related damage. These were reported at the Cameco plant in Port Hope. Extensive examination performed on the 3 cylinders found that damage was limited to a single ring in each cylinder. The nature and location of the damage was similar in all three cases - a brittle fracture of a portion of the ring at the 6.00 or 12.00 o'clock position. In two of the cases, the piece of ring had broken off. In the other, the crack observed outlined the same shape as the broken pieces and there was some deformation, but this portion of ring had not broken off. There was a common feature to the brittle fractures in that fracture was confined to the stiffening rings and propagated away from the shell. It was concluded that the damage was caused by a lateral load inflicted on rings during handling by a lateral movement of the cylinders against their storage cradle.

Inspection of all stiffening ring welds, especially at the lifting lugs, was carried out not only on the three cylinders in question, but also on other cylinders of the identified group in Cameco's possession. No indications of any damage or cracks were observed.

2. Metallurgical Considerations of A306 Grade 75 & A36 Steel

Metallurgically, the difference between the A36 steel specified in ANSI N14.1-1972 at the time of fabrication of the cylinders, and the A306 Grade 75 steel used, is that the latter has a higher carbon content. This means that the A306 steel can be expected to have, on average, the lower toughness of the two. A36 steel, however, is not manufactured to any toughness requirement and has a wide variation in toughness which overlaps with that of A306 Grade 75 steel. While the nil-ductility temperature (NDT) of A36 can be expected to range lower than A306, it is still well within the design temperature range of the cylinders. Thus even cylinder stiffening rings of A36 steel could show the same brittle behaviour that was exhibited by the three cylinders reported.

> In specifying A36 steel, ANSI N14.1-1972 does not intend to design against brittle failure of the stiffening rings. It order to guarantee ductile behaviour of stiffening rings the ANSI standard would have to specify a material with a nil-ductility temperature lower than the operating temperature of the cylinders. It is obvious that the ANSI specification does not require this condition to be met. Cameco believes that requiring discontinuation of the use of cylinders with rings made of A306 Grade 75 steel on the basis of potentially brittle behaviour and not those of rings made of A36 steel is illogical.

The consequences of a brittle fracture in a stiffening ring would be no different for either A306 Grade 75 or A36 steel. The cylinder shell is constructed of a steel which is significantly tougher than either of the ring materials. Fractures arising in a ring or ring weld would take the path of least resistance and propogate either along the weld, or along the ring side of the weld heat affected zone or in the ring itself rather than into the shell. Thus, such fractures are not critical to the functioning of the cylinder and maintaining its integrity.

For a fracture to propagate from a ring into a lifting lug, with the risk of it breaking off and dropping the cylinder, the loading conditions would have to exceed the critical stress intensity of the material. These conditions are highly improbable, a fact confirmed by the lack of any such failure in the more than 10 years of operation of the 248 cylinders.

Conclusions

Evaluation of the identified cylinders manufactured with A306 Grade 75 steel stiffening rings supports the conclusion that these cylinders have handled normal in-plant and shipping operations. In all the years of use since 1975, there have been no instances of brittle fractures in the stiffening rings which have compromised the safety of the cylinders. The characteristics of A306 Grade 75 steel overlap those of A36 steel. All the evidence from the usage of the cylinders, and the inspections that have been done, provide reasonable assurance that safety will not be compromised by the further use of these cylinders.

Cameco believes there is no valid reason to prohibit using the previously noted cylinders and requests permission to have them released for normal operations under AECB or NRC regulations.

Yours faithfully,

CAMECO.

W. M. Crawford

Superintendent of QA & Metallurgical Services

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cc: RTT TWK AJO ASF DCC

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