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NTD-NRC-95-4410
DCP/NRC0279
Docket No.: STN-52-003

February 28, 1995

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTENTION: MR. R. W. BORCHARDT

SUBJECT: ADDITIONAL INFORMATION IN SUPPORT OF WESTINGHOUSE RESPONSE TO RAI 210.121

Dear Mr. Borchardt:

The attachment to this letter provides information requested in a September 2, 1994 NRC letter. The attached figure responds to NRC Request for Additional Information (RAI) 210.121.

The following information is attached:

Y-12 Technical Data Sheet 2.2.10, Uranium-2 Molybdenum Alloy

Please contact Brian A. McIntyre on (412) 374-4334 if you have any questions concerning this transmittal.

Nicholas J. Liparulo, Manager
Nuclear Safety Regulatory And Licensing Activities

/nja

Attachment

cc: R. Hasselberg, NRC
B. A. McIntyre, Westinghouse (w/o enclosures/attachments)

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Y-12 TECHNICAL DATASHEET

These Datasheets are published to provide engineers with a compilation of data on materials as worked at the Oak Ridge Y-12 Plant. The data are from published and unpublished Y-12 work, other DOE-sponsored research, and standard reference material. Some of the values presented are preliminary and are given to provide currently available data for immediate use even though their accuracy is not well established. Requests for additional information concerning this Datasheet should be directed to the Development Division, Oak Ridge Y-12 Plant, P.O. Box Y, Oak Ridge, Tennessee 37830, Attention: N. C. Jessen

OAK RIDGE Y-12 PLANT
Operated By UNION CARBIDE CORPORATION
NUCLEAR DIVISION
For the U.S. DEPARTMENT OF ENERGY

DATASHEET NUMBER 2.2.10
REVISION NUMBER 3ya
DATE October 2, 1978

CAUTION

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URANIUM-2 MOLYBDENUM ALLOY

INTRODUCTION

Uranium-molybdenum alloys with 4 - 6% molybdenum have good tensile test properties, but are susceptible to stress-corrosion cracking in atmospheres containing oxygen. The uranium-2% molybdenum (U-2 Mo) alloy also provides good tensile properties, but without the susceptibility to stress-corrosion cracking.

The tests reported in this datasheet were made to investigate the properties of the U-2 Mo alloy after a selected heat treatment.

METAL PREPARATION

The alloy can be prepared by

comelting

elemental uranium and molybdenum. Melting can be done in vacuum-induction furnaces, but special coatings for the graphite crucibles are required to prevent excessive carbon contamination of the melt.

METAL PROCESSING

The alloy can be fabricated with the metal-working processes normally used with uranium.

CHEMICAL ANALYSIS

The contaminants in the alloy are those usually found in uranium

processed at Y-12. A typical analysis for residual elements is reported in Table I.

SUMMARY DATA

Material Preparation	comelting of elemental uranium and molybdenum.	
Metal Processing	- Conventional metal-working processes.	
Chemical Analysis	- U-2% Mo with incidental elements usually found with uranium.	
Machineability	- Abrasive-carbide tools used.	
Coefficient of Thermal Expansion	Room Temp - TO 250°F	16.4/° C
Toxicity	- Plant acceptable limit of airborne uranium contamination - 1.2 d/s/m^3.	
Mechanical Properties	- Heat-Treated Condition	
	Cast	
Tensile Strength (MPa)	900 (130.5 ksi)	
Yield Strength, 0.2% (MPa)	420 (60.9 ksi)	
Elongation (%)	22.3	
Reduction in Area (%)	20.5	
V-Notch Charpy (J)	TO BE DETERMINED	

Table 1

TYPICAL ANALYSIS FOR INCIDENTAL ELEMENTS IN URANIUM-2 MOLYBDENUM ALLOY

Element	Amount (ppm)	Element	Amount (ppm)
Al	40	U	< 0.2
B	< 0.1(1)	Mg	< 2
Be	< 0.01	Mn	15
Bi	< 2	Ni	2
C	400	P	< 100
Ca	< 10	Pb	2
Cd	< 0.1	Si	450
Co	< 1	Ti	5
Cr	4	V	4
Cu	30	W	< 100
Fe	<100	Zn	< 20
K	< 6		

(1) < indicates the limit of sensitivity of the analytical method used.

matter, is necessary in all processing operations. In Y-12, the airborne contamination of breathing air is controlled to a level below 1.2 disintegrations per second per cubic meter of air.

PROPERTIES

One U-2 Mo alloy casting (22 x 127 x 178 mm) was heat treated as follows: 800° C for 1 1/2 hours, furnace cooled to 500° C, held at 500° C for one hour, furnace cooled to room temperature.

The average mechanical properties of the heat-treated casting are listed in Table 2. All values are much higher than those from unalloyed uranium castings. The carbon in the casting was 370 ppm.

Table 2

MECHANICAL PROPERTIES OF URANIUM-2 MOLYBDENUM IN THE CAST AND HEAT-TREATED CONDITION
(Average of 3 Tests)

Tensile Strength (MPa)	899 (130.5 ksi)
Yield Strength, 0.2% (MPa)	420 (60.9 ksi)
Elongation (%)	22.3
Reduction in Area (%)	26.5

MACHINEABILITY

Recommendations for machining the U-2 Mo alloy are the same as for machining wrought uranium. Conventional machine tools are used. The metal has an abrasive nature and tool wear is greater than is usual for other ductile metals. Without the use of ample coolant, the chips ignite and continue to burn, producing both fire and radiological hazards.

TOXICITY

Uranium is toxic, a property characteristic of many heavy metals, but its radiological effects are also significant. Personnel protection, especially from airborne particulate

Table 6 lists the coefficients of thermal expansion for the alloy. The values represent the averages of three different melts of the U-2 Mo alloy in the wrought and heat-treated condition.

Table 6

COEFFICIENT OF THERMAL EXPANSION FOR URANIUM-2 MOLYBDENUM ALLOY
(Average of 3 Tests)

Range	Coefficient (x 10^{-6}/° C)
Room Temp To 250°F	16.4