THE DOW METAL PRODUCTS COMPANY
A DIVISION OF THE DOW CHEMICAL COMPANY
MIDLAND MICHIGAN

40-17

August 28, 1959

Mr. Lester R. Rogers, Chief
Radiation Safety Branch
Division of Licensing and Regulation
United States Atomic Energy Commission
Washington 25, D. C.

Dear Mr. Rogers:

During our visit in your office on August 14 with Mr. Nussbaumer, we discussed the welding of magnesium base thorium alloys and mentioned that in our production facilities we had not found the need for local exhaust ventilation. A review of previous data and the inclusion of more recent survey results indicate conditions of natural convection in shops with high ceilings plus time factors of operation which permit production welding without resorting to the local exhaust methods as recommended on pages 11 through 14 of our Bulletin No. 141-179 (copy attached).

Information available to date has been assembled in the attached table. With the exception of the check made on an automatic welder using a filter, all samples were taken with an electrostatic precipitator. The thorium content of the samples was obtained by spectroscopic analysis and reported as micrograms of thorium per cubic meter of air. These values may be compared with the limit shown in Appendix B of 10 CFR 20. The airborne limit of 5×10^{-11} µc/ml is equivalent to 70 µg/m^3 based on a specific activity of 0.67 µc/g. According to the proposed amendment of 10 CFR 20, the permissible level would be 137 µg/m^3.

The position of the air sampling device in relation to both the point of welding and the welder's mask is very critical... When the samples are taken as close as possible to the face mask in the welder's breathing zone, the thorium values are below the proposed limit of 10 CFR 20. If the sample is taken half way between the mask and the point of welding, some visible welding fume is taken into the precipitator tube with resultant variable and higher thorium recorded, although some values are still low. Where the welder operates in a manner such that his breathing zone is at arm's length from the arc, he receives a very low exposure to thorium, approaching the level in air measured 10 feet away.

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While the presence of zinc in magnesium base thorium alloys appears to increase the amount of thorium that becomes airborne during welding, the varied position of the sampling device in relation to the visible fumes and welder's breathing zone results in greater variations in recorded thorium. The measurements made nearest to the true breathing zone do not indicate any increase in airborne thorium in the presence of zinc in the alloy.

The values of airborne thorium were obtained during hand welding operations under conditions of continuous arcing. Except on an automatic welder, this is not possible due to the time required for loading and unloading the jig, hand cleaning the weld and other delaying factors. Based on our own experience, actual hand arc operation for non-thorium containing alloys may reach 50% of the time in production while typical welding of magnesium-thorium alloys is likely to be in the range of 5 to 20% of the time. Assuming the 20% maximum, the airborne limit during arc operation could be 5 x 137 or 685 $\mu g/m^3$. This is in excess of any values measured.

This information on the welding of magnesium-thorium alloys may be of some assistance to the AEC in considerations related to radiation protection and is presented for your files. We suggest that the data also be reviewed prior to making proposed changes in 10 CFR 40 dealing with the exemption of completed or component parts from licensing except where subsequent "heating" is involved. Occasional welding (a form of heating) would not cause sufficient air contamination to warrant exclusion of parts to be "heated" from the proposed exemption. Parts which may be heated for forming purposes do not reach a temperature which is high enough to cause any vaporization of the metal. Typical forming is carried out in the range of 650 to 700°F.

We would appreciate hearing from you if any clarification of this information is necessary.

Very truly yours,

John A. Peloubet
Safety Engineer

Encl: (1)

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Air Sampling During the Welding of Magnesium Base [illegible] Alloys

Helium Shielded Arc

Percent Thorium	Percent Zinc	Amperes	Spectroscopic Analysis micrograms Th/cubic meter air Without Exhaust	With Exhaust	Total Fume mg/m³	Building	Remarks
3			448 (c)			1	Argon gas shield
2	6	160	24 (c)			1	
2	6	320	400 (c)			1	
[illegible]			113 (c)			1	
3		180	24 (c)			1	
3		180	71 (c)			1	
3		320	194 (c)			1	
3		320	59 (c)	17 (c)		1	*point of weld 6" from exhaust
3	2	320	353 (c)	96* (c)		1	
3	2	320		17 (c)		1	
2	6	240	193 (c)	104* (c)		1	
3		90	100 (d)		30	2	
3			52 (d)		15	2	
3			29 (d)		6	2	
3		145	38 (e)			2	Automatic welder
2	[illegible]		2.3 (b)			[illegible]	
2	6		5.1 (b)			[illegible]	
3				5.9 (b)		[illegible]	
[illegible]				5.2 (b)		[illegible]	
3			2			3	Area sample at 10 ft. from welder

Bldg. 1 roof height 40 ft.---experimental welding.
Bldg. 2 roof height 20 ft.---production welding.
Bldg. 3 roof height 35 ft.---production welding.

(a) Gelman AM-5 filter---all other samples obtained with an electrostatic precipitator.
(b) Welder's breathing zone at arm's length from arc.
(c) Sample tube approximately half way between point of weld and breathing zone. Frequently, this position included visible welding fumes with higher recorded values of thorium than in the actual breathing zone.
(d) Sample taken close to welder's mask.
(e) Sample taken 8" above unit.