#1 - R. M. Kenady
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#3 - A. B. Greninger
#4 - C. A. J. Wende
#5 - F. F. Gant
#6 - J. E. Maider - E. F. Lee
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NO [redacted]

To: R. M. Kenady

From: F. F. Gant

GRAPHITE CONTAMINANTS

At your request, J. M. West has prepared the attached table which indicates the tolerable amounts of possible graphite contaminants. It is difficult to set a tolerable limit for any one contaminant since the effects of all contaminants are additive.

The presence of one contaminant therefore reduces the amount of other contaminants which can be tolerated.

The table gives the amount of each contaminant which will produce a loss of one unit of reactivity in the pile. Thus 0.028 milligrams of boron will produce the same effect as 30,000 milligrams of oxygen. The effects are proportional to the amounts of contaminant. Thus the presence of 0.014 milligrams of boron will produce a loss of 0.5 reactivity units.

The following example illustrates the way in which the total contamination loss can be estimated:

Amt of contaminant present, milligrams		Amount for loss of one unit, from table	Loss due to contaminant present
0.014	mg., boron	0.028	.5
30	mg., iron	40	.75
200	mg., silicon	230	.87
		Total Loss	2.12

The total loss computed in this manner should not exceed 5 units.

It is evident from the table that boron and cadmium are particularly to be avoided since small amounts of these materials are so effective. Contamination by samarium or gadolinium seems unlikely but these elements have been included in the table since they are also very effective.

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Tests indicate that graphite will take up very little moisture from atmospheric humidity; water in the liquid form should however be avoided.

ELEMENT	MILLIGRAMS PER BAR FOR LOSS OF ONE UNIT OF REACTIVITY
Aluminum	200
Antimony	38
Bismuth	24,000
Boron	0.026
Bromine	24
Cadmium	0.069
Calcium	160
Chlorine	1.9
Chromium	30
Cobalt	3.5
Copper	33
Fluorine	3,000
Hydrogen	5.5
Iodine	32
Iron	40
Lead	2,000
Lithium	0.19
Magnesium	120
Manganese	8
Mercury	0.73
Molybdenum	60
Nickel	20
Nitrogen	15
Oxygen	30,000
Phosphorus	200
Potassium	29
Silicon	250
Silver	3.3
Sodium	92
Sulphur	130
Tin	330
Tungsten	22
Vanadium	15
Zinc	98
Gadolinium	0.0096
Samarium	0.043

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