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APPENDIX "G"

UNITED STATES
ATOMIC ENERGY COMMISSION
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December 7, 1959

TO : A. A. Wells, Director
Division of International Affairs

FROM : C. L. Marshall, Director
Division of Classification

SUBJECT: COOPERATION IN THE FIELD OF GAS CENTRIFUGE

SYMBOL : C:CLM

As you know, a topic of the new AEC Policy Guide provides that experimental work on the detailed mechanical design for the centrifuge method of isotope separation may be considered declassifiable to date. There is, however, a restrictive paragraph attached to the topic which requires that we classify that work when it becomes apparent that it could reasonably be used for the production of large quantities of U-235.

One of the factors that influenced the determination to classify this program in this way was the fact that at least two other countries (West Germany and The Netherlands) are vigorously pursuing studies in this field and that they have, moreover, advanced their technology to the point where it is equal to or better than ours.

In considering the proper classifications to be assigned to this program, not only now but in the foreseeable future, a number of facts inevitably made themselves felt. Important among them is the fact that the Germans have now already so far progressed in their development of the gas centrifuge method that they could, without any further advancement in their technology, build a working plant for the mass production of U-235. The attached table, which represents steps in the development of their program, indicates very clearly that in a period of approximately 14 years they have been able to increase the separative potential of their machines by better than an order of magnitude, while at the same time reducing their costs also by more than an order of magnitude.

Another of the important aspects of this method of separating isotopes is its very low power consumption, as compared with the gaseous diffusion method. One might say that for an approximately equal total outlay in dollars (that is, power plus plant), one could build equally productive plants. However, to a nation short on power, the low power-consumption for the gas centrifuge method could make possible a productive plant at a time when a gaseous diffusion plant would still remain a desirable but impossible goal.

~~S E C R E T~~

We all, I know, realize that a large-scale plant for the separation of heavy isotopes is an important part of a weapons program. Therefore, a method of separating isotopes, which would make such a program possible for an unfriendly nation, is clearly one which should be classified.

The presence of China among the nations inimical to the United States gives that view both point and substance. This re-awakening nation of several hundreds of millions of people is already significantly increasing its industrial potential, with the help of the Soviet Union. It should be expected that as soon as possible China will attempt to embark upon a weapons program that, significantly, may be without Soviet help. When one considers that the Chinese built an advanced civilization many years before our so-called Western civilization existed, the probability of their succeeding in such a venture must not be under-estimated. China is, however, still power-poor and probably will be for some time to come. The gaseous diffusion process for separating heavy isotopes is not, therefore, within their grasp for many years to come. The gas centrifuge method, however, with its low power consumption, is not nearly that far in the future, if one remembers, as I pointed out earlier, that present technology would already permit the construction of a working plant. It is not impossible, therefore, that in a relatively short time China could, unless steps are taken to prevent it, purchase on the open market a producing isotope-separation plant for heavy isotopes.

In imposing classification on information and material in the field of the centrifuge separation process, it is not sufficient to think only in terms of U. S. work since, as I have said before, both Germany and the Netherlands are known to equal or excel our own state of the art in this field. In order to insure that such nations as China would not be allowed to accelerate their weapons programs by the use of this isotope separation method, it would be necessary also to prevent them from obtaining the information or the material from other knowledgeable nations.

I therefore recommend that immediate consideration be given to amending the classified bi-laterals with West Germany and the Netherlands to include full cooperation in this field with both nations on a classified basis. Because, I am sure, full cooperation with both these countries will depend, at least in part, on economic considerations which might involve the purchase of the fruits of German and Dutch labor, and because of other powerful considerations involving our relations with the British, of which I am sure you are well aware, I would also strongly recommend that the bi-lateral existing with the United Kingdom (and possibly that with Canada in the future) also be amended to permit the same full cooperation. This would not only help to maintain our friendly relations with the U. K. and increase substantially the potential market for Dutch and German products, but, by helping to obtain the cooperation of the West Germans and the Dutch, would enhance the security of the nation by denying to unfriendly nations, such as China, information and materials which would enable or assist them to establish a nuclear weapon program.

Enclosure:
Table, as stated

Enclosure to
Appendix "G"

ENCLOSURE TO APPENDIX "G"

	Year Circa	Length cm	Radius cm	L/R	Peripheral Speed m/sec	Separative Potential Kg U/yr	Specific Power Cost Kwh/Kg U	Specific Investment DM*/Kg U/yr
UZ 1	1946	40	6.0	3.33	302	0.582	12,050	17,200
UZ 3B		63.5	6.7	4.74	302	0.935	8,380	11,950
ZG 3		66.5	9.25	3.60	302	0.97	6,300	10,300
ZG 5		113.0	9.25	7.03	302	1.64	3,710	6,100
ZG 6		240.0	20.0	6.0	302	3.5	1,750	2,860
					340	5.32	1,150	1,880
ZG 7	1960	316.0	22.5	7.03	302	4.77	1,285	2,100
					340	7.25	845	1,380
Gaseous Diffusion							9,000	2,350

* German marks