

Chicom 45/16

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U.S. DEPARTMENT OF STATE
Director of Intelligence
and Research

Research
Memorandum

RES-29 - November 2, 1964

To : The Secretary
Through : S/S
From : INR - Thomas L. Hughes *Thomas L. Hughes*
Subject : The Chinese Test

Our pre-October 16 estimates did not anticipate that the Chicoms had the capability of producing the U-235 isotope. This paper canvasses current explanations for the use of U-235 in the Chicom nuclear device, and examines the difficulties that prevent our achieving a firm estimate now. It also touches on the problem of handling public discussion of Chicom nuclear capabilities.

Until the Chinese October test proved otherwise, it had been expected that the first Chicom device would use plutonium, rather than U-235, mainly because it was strongly felt that the Chinese did not have the facilities for production of weapons-grade U-235.

The most practicable way of getting U-235 is through the gaseous diffusion process, which separates the rare isotope U-235 from the much more abundant U-238 by "filtering" a gaseous uranium compound through an appropriate screen or barrier. There are formidable engineering problems and high costs involved in building a gaseous diffusion plant. However, the alternatives, such as the gas centrifuge and electromagnetic (calutron) process, also involve difficult technical problems, and the US, UK, USSR, and French have all chosen the gaseous diffusion method.

Lanchou Gaseous Diffusion Plant

A single large gaseous diffusion building, unmistakably of Soviet design, was photographed at Lanchou in 1959. It could not have been operating at that time because it lacked electric power. In September 1963, it was again photographed, and different but equally reasonable arguments again led to the judgment that it was not operating. All outward appearances, however, indicated that it was complete and ready to go.

From a purely technical standpoint, it has been the opinion of most -- but not all -- experts who examined the problem, before the blast, that the single cascade building at Lanchou could not produce weapons-grade material; that either a second

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building would have to be built (the photographs suggest that such a building was envisioned at Lanchou) or that an electromagnetic or gas centrifuge process, either at Lanchou or elsewhere, would have to be used to raise the U-235 enrichment. No such facilities have been identified anywhere in China.

The experts made a reevaluation of Lanchou after the 16 October test and have put forward additional alternative explanations for the appearance of U-235. All start with the assumption that Lanchou is the only facility available and that it did not start operating until about a year ago. None of the explanations are very satisfactory, either because of the 12-month time limit or because the available buildings do not seem to have space for the necessary equipment.

In short, the alternative explanations are feasible, but only just feasible, and they by no means overcome satisfactorily the objections that can be raised against them.

Other Possibilities

Other theories that look beyond the Lanchou establishment have also been considered. For example, prior to the 1959 split the Soviets might have supplied enough U-235 for a nuclear device. However, it is difficult to imagine that the Soviets would supply weapons-grade U-235; furthermore, it is difficult to explain the Chinese public accusation that the Soviets refused to provide a "sample of an atomic bomb and technical data concerning its manufacture," if the Soviets had in fact given them its most important component - the fissionable core.

Another possibility would be that there exists elsewhere in China a second gaseous diffusion building, an electromagnetic facility, or a gas centrifuge. The gas centrifuge has been generally ruled out on the basis that the technological problems involved are more difficult than those of either gaseous diffusion or electromagnetic separation.

A second diffusion building elsewhere in China cannot be completely ruled out on the basis of available photography, but the large amounts of power (100MW) needed for this process are difficult to reconcile with our knowledge of the Chinese power grid and consumption.

An electromagnetic facility is a better possibility and could go undetected. From a technological standpoint, however, it is an expensive and not very efficient way of producing U-235, except in small quantities. It is a process the US investigated, but ultimately gave up in preference for the diffusion method.

Future Capabilities

An estimate of what Chicom capabilities are and will be over the next few

years depends to a large extent on which of the possible alternatives or combinations of them one chooses. The estimates will range from very low, if the U-235 came from the Soviets and they supplied only enough for one or two devices, to very high, if one credits the Chinese with another as yet unidentified cascade building. To this must be coupled great uncertainties about Chinese missile development and somewhat lesser ones about plutonium production. At one extreme, it is quite feasible to postulate a variety of warheads and delivery systems, which while limited in number, would present a formidable military asset. At the other, it is equally possible to argue that the Chicom have pulled off a tour-de-force of more psychological than military significance, and that their actual capabilities to produce advanced weapons remain, as we have previously estimated, quite limited. Resolution of these unanswered problems is not likely to come quickly, since it depends in part on additional and time-consuming technical analysis of data we already have and in part on the acquisition of new data that will be extremely difficult to get.

Problems of Public Discussion

The fact that U-235 was used in the first Chinese communist device is now a matter of public record. In such technologically sophisticated countries as Japan there is a tendency to credit the Chinese with far greater capabilities than the evidence now at hand will support. However premature such conclusions may be, they cannot be rejected summarily, given the uncertainties enumerated above. On the other hand, to emphasize heavily the unknowns and uncertainties could have undesirable results in countries like India. In this situation, meaningful public discussion of Chinese communist capabilities will be difficult for some time to come.