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CENTRAL INTELLIGENCE AGENCY

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COUNTRY USSR (Kalinin Oblast)

SUBJECT Development of Kraftstoff "A" at Zavod No. 1, Podberezye

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SUPPLEMENT TO REPORT NO.

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SPECIFICATIONS OF ROCKET FUEL, KRAFTSTOFF "A"

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1. the German specialist group, Zavod No.1, Podberezye, special rocket fuel problems in connection with the 346 aircraft (Me 163) specifically for use in the Walther liquid rocket engine. Among the fuels investigated was a sodium metal-kerosene type fuel which was designed to give hypergolic action with either T-Stoff (80 per cent hydrogen peroxide) or 98 per cent nitric acid (Salbei).

2. For the preparation of this fuel, a kerosene (referred to in the Gost specification as Kerosene "A") was used. The Gost specification number was not available . No specification properties of this kerosene are recalled. However, the specific type of kerosene was not important. The only consideration was the removal of water.

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3. The first step in the manufacture of this fuel was the production of a concentrated sodium suspension in the kerosene. Therefore, sodium particles of 0.05 to 0.12 millimeter diameter were necessary. The purity of the metal itself was not determined. Sodium of unknown origin arrived in sheet-metal containers and was covered with paraffin, approximately 10 kilograms to the batch. This material was placed in a container surrounded by a 120° C oil bath, which was sufficient to melt the metal. After melting, oil pressure from underneath forced the molten sodium through a small nozzle at the top of the container and into a stream of cold, flowing kerosene.

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There it condensed as small particles of approximately the aforementioned diameter. This mixture was then filtered. At this stage of the manufacture, the concentrated suspension consisted of approximately 20 to 30 per cent sodium metal in kerosene and was given the the name of Pena, a compound name of petroleum and natrium (sodium). It must be emphasized that this was a mechanical suspension only and no stabilizers were incorporated.

4. Pena, a thixotrope consisting of kerosene containing sodium sterate, sodium oleate, with stearic and oleate acid was prepared as a diluent for the concentrated sodium suspension. The concentrations used for this thixotrope were 0.3 - 0.5 per cent of a 50/50 mixture sodium stearate and sodium oleate, with 0.03 - 0.05 per cent stearic and oleatic acid. These materials were dissolved in kerosene which had been heated to 170 -180° C. When cooled, the mixture formed a thin jell. It was impossible to manufacture batches of this material in vessels larger than 10-20 centimeters in diameter for the simple reason that the jell's own weight was sufficient to cause self destruction.

5. The next step was to mechanically destroy this jell. In order to do this, it was filtered through a 0.05 millimeter mesh screen using either a vacuum or gas pressure to aid filteration. The result was the finished thixotrope. A test to determine exact strength of the thixotrope, used by the laboratory for a standard control was as follows: Approximately 10 ccs. of material was placed in a cylinder and loaded with 50 mgs. of calcium carbonate. This was allowed to stand for 24 hours, after which time a clear layer of kerosene had formed above the thixotrope. The height of this layer was compared to the original height of the sample before loading. No more than 10 per cent separation of kerosene was allowed. Viscosity measurements were made using a falling ball, a tensiometer attached to a paddle, and by pumping the mixture through standard sized tubes.

6. Mixing of the two components to form the final production was accomplished in open vats using 90 per cent thixotrope with 10 per cent of the 20 - 30 per cent sodium suspension (Pena). This final fuel was given the name Kraftstoff "A" (because it was made with Kerosene "A) by the Germans and the name Goryuchye "A" ГОРЮЧИЕ А by the Soviets. The method was very primitive and no allowance or control of moisture in the air was made. Although the particles of sodium were larger than colloidal size, the viscosity of the suspension was sufficient to prevent settling out. It was found that the kerosene thixotrope, without sodium, could be stored for as long as two years without being destroyed, however, with sodium the minimum life was about two to three months. In the final product and following a longer storage period, the sodium particles absorbed a kerosene film or layer which interfered with hypergolic combustion. Common iron tanks were used for storage.

7. Kraftstoff "A" was tested with 98 per cent nitric acid in the laboratory at Zavod No. 1. MICHEALIS designed the test motor used. The thrust which was small was approximately 10 to 20 kilograms or less. It was learned by experimentation that the nitric acid should be admitted to the combustion chamber first when using this fuel. Kraftstoff "A" was used merely as a starting medium and arrangements were made to switch the fuel flow to standard kerosene once combustion had begun. It was necessary to install a small screen in the fuel line between the control valve and combustion chamber nozzle to remove oversized sodium particles, i. e., particles that had been flattened by the high rate of flow through the valve. This was to prevent clogging of the combustion chamber nozzle.

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8. The aim of the entire program was to develop a method making kerosene hypergolic with nitric acid. [redacted] intermi- 50X1-HUM
tent firing in a missile, which would thereby allow a longer controlled power flight. The original order to investigate a method of making the hypergol came from the Soviets (about 1948). At that time, the Soviets did not appear to have a particular development in mind. Chemists from the Air Ministry carefully checked progress on the work but were never friendly enough to discuss projects. Flow of the thixotrope to the laboratory test motor was achieved by use of nitrogen gas pressure alone. No method of vibration was used to make the material fluid. It was impossible to know whether or not use of this fuel in the USSR will be continued. [redacted] very little was to be done with the fuel and that the Soviets did not even understand the manner in which it might be used.

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9. In addition to the laboratory test motor used in the development of Kraftstoff "A", one other test stand existed. This was a Walther-Kiel motor of the design used in the 346. The only fuel used in this motor was T-Stoff and C-Stoff. This motor was built in Zavod No. 1 and not received as captured equipment from Germany.

10. /Transmitted to ATIC under separate cover is a speciman of a 1T metal [redacted] This was made according to the 50X1-HUM
same specifications as German V2A and was used for the manufacture of 50X1-HUM
instruments, pump parts, and rocket combustion chambers which utilizes T-Stoff or concentrated nitric acid as an oxidizer. [redacted]
this material, when welded, corrodes primarily around the edges of the well. The usual method of making a weld was with acetylene type of equipment. V2A corresponds roughly to 18-8 stainless steel./

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