WHY HITLER DID NOT DEPLOYE NERVE AGENT IN WORLD WAR II

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Executive Summary

Thoughts of deterrents might influence Hitler not to deploy nerve agent. Lack of spirit or vision (but certainly not resistance, I personally prefer the expression “passivation”) of the chemist and IG-Farben board member, Otto Ambros, might be the reason for his non-recommendation the deployment of nerve agent. Werner von Braun, however, had his vision of landing rockets on the moon, so he used the NS-system for achieving his goals. He was also corrupted by the NS-system. This corruption may be characterized by the quotation of the émigré and Nobel Prize winner Eugen Wigner that “*you need a very long spoon to eat with the devil*”. But military speaking, it was a failure to use V-weapons because they were tremendous resource consuming. But compared to V-weapons and an atomic bomb, how cheap were and are nerve agents?

The role of Ambros during the NS-era is assessed very negatively in general. Because of the Nurnberg trial most “leftist” historian wanted to demonstrate the synergy between high finance and fascism with Ambros (and “Gebechem” Krauch). The Buna IV production which was under the construction of Ambros near Auschwitz was an additional fact to condemn the whole IG-Farben management. Additionally, the indirect ties of the IG-Farben with the Tesch & Stabenow Company which sent Zyklon B to Auschwitz had enabled crimes in not feasibly dimension. It is not intended to excuse their activities during the NS-era, but it is very interesting to think about the possibility that Ambros had at least two times the chance to recommend the deployment of nerve agents against the allies in a killing dimension beyond Hiroshima and Nagasaki. Last but not least NS-Germany had a major head start of at least 10 years belonging in producing nerve agents in an industrial scale.

In political history there were have been only a few examples where technique history had a strong impact on political/military history (e.g. atomic bomb, chemical warfare and submarine tactics in World War I). Belonging to the Manhattan Project there was a very effectively cooperation between military (Groves), scientist, e.g. Fermi, Oppenheimer, Szilard, Compton, Murphree, Wigner, Franck, Seaborg, Teller, Bethe, Alvarez, Urey, Lawrence (more than 31 Nobel Prize winner are counted by Kahlert), managers scientists (Bush, Conant) of the OSRD and the industry (e.g. Greenewald, Carpenter, Du Pont family). The same effective collaboration was existing by the Germans between the scientists (Haber, Franck, Hahn, Hertz), technical chemists (Duisberg, Bosch, Bayer and BASF) and the military (Bauer) in the First World War. But the same quality of cooperation, although individual existing, was certainly not achieved in general during the NS-era. This might be the real cause why not the nerve agents or other modern weapons were not deployed and/or developed by the Germans in the Second World War.

Prehistory of Nerve Agent

Possibly the earliest recorded use of a substance that works like nerve agents, by inhibiting cholinesterase (ChE) was by native tribesmen of western Africa who used the Calabar bean as an “ordeal poison” in witchcraft trials. An extract, “the elixir of the Calabar bean,” was later used medicinally, and in 1864, the active principle was isolated by Jobst and Hesse and called physostigmine. Vee and Leven independently isolated the same substance in 1865 and named it eserine, hence its dual nomenclature. The first *organophosphorus* ChE inhibitor was probably tetraethyl pyrophosphate (TEPP), synthesized by Wurtz and tasted (without any illness) by Clermont in 1854. During the next 80 years, chemists (such as Michaelis, Arbusow, and Nylen) made numerous advances in organophosphorus chemistry, but generally they did not

realize the toxicity of the substances with which they were working[1]. Systematical research of *fluororganic* compounds was started also by the germane chemist Karl Arnold Michaelis (1847-1916) and the Soviet chemist Alexander E. Arbusow (1877-1968). Astonishingly the Soviets were not thinking about any militarily implications of this substance, so that they were surprised shortly after the war, that their own chemists have the capacity to synthesize this agent[2].

Fig. 1 Willy Lange

Willy Lange[3] (Fig. 1) at this time working at the University of Berlin and one of his students, *Gerda von Krueger*, prepared 1932 a few esters of monofluorophosphoric acid and thus felt sure that the isolation of the free acid might be possible under more favourable conditions than the ones he thitherto had used. Upon heating silver monofluorophosphate with methyl or ethyl iodide they prepared the corresponding dialkyl monofluorophosphates which was resulting in a strong interaction with their metabolism: In a well-known scientific journal they described the discovery of the highly toxic nature of certain organic fluorophosphates (later called "nerve agents") that "*the fumes of these compounds have a pleasant, slightly aromatic odour. But a few minutes after inhalation there´s a feeling of pressure to the larynx and difficulty in breathing. Then a disturbance of consciousness develops, as well as blurred vision and a painful oversensitivity of the eyes towards light. Only after several hours the problems wear off. They are apparently not caused by acidic products of a possible decomposition but by the esters themselves. The effects are exerted by very small amounts."* Several homologues were prepared, i.e. the di-n-propyl and the di-n-butyl esters. The amounts of esters to which the human organism reacts in the way described are below one milligram. Their classic report on the toxic effects of these esters is cited in almost every review on "nerve agents"[4].

Systematical research of fluororganic compounds were started by the IG-Farben chemist Gerhard Schrader (1903-1990) in the year 1934 because his chief; Otto Bayer (1902-1982), had intended to enforce the research of insecticides in BAYER Division of IG-Farben. The ester of 2-Flurethanol were enormously poisoning so that this stuff was not appropriate for using as an insecticide, the program had been stopped to focus the research on the variation of organic phosphor-acid-compounds. Schrader wanted to synthesize ester and amide of Phosphorus acid, which was used before as plasticizer and swelling agent, the poising effects of some compounds were accidentally remarked, because Willy Lange and Gerda von Krueger have described 1932 the biological impact of fluor-Phosphorus ester.

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[1] Frederick Sidell: Nerve Agents, in: https://ccc.apgea.army.mil/sarea/products/textbook/Web_Version/chapters/chapter_5.htm: also: http://www.sc-ems.com/ems/NuclearBiologicalChemical/MedicalAspectsofNBC/chapters/chapter_5.htm http://www.bordeninstitute.army.mil/cwbw/Ch5.pdf

[2] Martinetz p. 150; Kahlert p. 316 & 327

[3] Willy Lange, Oct. 31, 1900 - May 19, 1976; studied chemistry at the Friedrich-Wilhelms-University of Berlin, Germany. PhD thesis 1923 on the action of sulfuric acid on fluorspar and properties of fluorosulfonic acid. Prepared sodium monofluorophosphate in 1929. Lange, who since 1925 was married to a colleague at the Chemistry Department, Lilli Baermann (Sept. 6, 1901 - Feb. 1982), was forced "***for political reasons***" to leave the academic career in the time of Drittes Reich. On June 18, 1937, Willy Lange´s authorization to teach at the University of Berlin was suddenly withdrawn by the Ministry of education, without any formal reason being given. With the approval of the Ministry of education, he took a leave from his teaching job and moved to Duesseldorf, Germany, where he worked for Henkel & Cie. Henkel´s director at that time, chemist Dr. Hugo Henkel, a former graduate of the University of Berlin (1905), was setting up a central chemical laboratory for the company to conduct research on new chemical products. Henkel was apparently not a friend of the Nazis, and it is claimed that none of his Jewish or half-Jewish workers became a victim of the holocaust. In 1939, Lange and his wife emigrated from Germany to the United States where he continued to work for Procter & Gamble, Cincinnati. In the late 1960´s, Lange became involved in a controversial discussion on the eutrophication effect of phosphates.

[4] Ber. dt. chem. Ges. 65 (1932) 1598, Courtesy to Peter Meiers - http://www.fluoride-history.de/p-mfp.htm

At Germany´s IG-Farben, Leverkusen, chemist *Gerhard Schrader*[5] (Fig. 2, Fig. 4[6]) had been asked again to develop new synthetic insecticides, because of the fact that the preparations then in general use were of plant origin (e.g. nicotine or rotenone), had to be imported and were rather expensive at that time. Compounds of fluorine had just begun to attract the interest of chemists. New fluorine-containing dyes were synthesized, the "FREONS" became famous, fluoracetate was recommended for protection of wool, and fluorides were patented as insecticides already. Moreover, through the Inorganic Chemistry Department of IG-Farben hydrogen fluoride was available in an industrial scale. Therefore, several fluorines substituted organic acids as well as fluoroethanol and its derivatives were tested by Schrader and colleagues for insecticidal activity. While the compounds were of interest from a purely scientific viewpoint, none of them was considered to be of possible practical use. Otto Bayer, then director of research at IG-Farben, was disappointed and assigned Schrader to work in other fields.

At IG-Farben, Gerhard Schrader, Otto Bayer and Hans Kükenthal patented alkyl fluosulfonates as insecticides. The patent claims that alkyl fluosulfonates are more effective against insects than the aryl analogues earlier proposed by Lange in 1930[7]**.**

Discovery of the Nerve Agents of the “TRILON” Family (TABUN, SARIN SOMAN)

Fig. 2 Schrader, 1928

Meanwhile, in the course of a systematic work on esters and ester amides of phosphoric acid, which then were in commercial use for the protection of plastics (against aging etc.), Schrader prepared several new compounds of that kind and his colleague Hans Kükenthal tested them for insecticidal activity to make sure that no useful property escaped their eyes. Some of these compounds were highly toxic. The most effective compounds had two OH-groups of phosphoric acid substituted (ester type) by organic substituents, one more by an acidic group, while the double-bonded oxygen persists or may be replaced by sulphur. Effective acidic groups are Cl, **F**, SCN, CNO, CH3COO-, and others. This discovery led to the development of the highly toxic compound TABUN, in which one of the hydroxy groups of the phosphate was replaced by a CN-group (see Fig. 3).[8]

On December 23, 1936 Schrader achieved the reaction of dimethylaminocyanophosphoracid-ethyl-ester with Na-cyanid and ethanol and obtained the -ethyl-ester of dimethylaminocyanphosphoracid (ethyl-

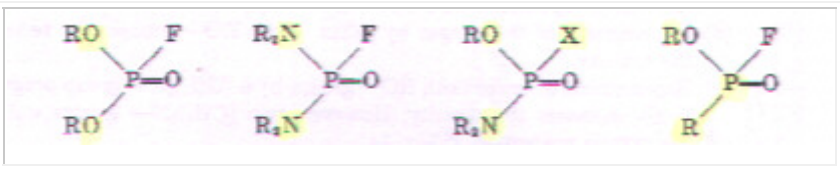
[5] **Gerhard Schrader**, (* 25. Februar 1903; † 1990) Chemist. Schrader grew up in Bortfeld and studied Chemistry at the Technical University (TU) Braunschweig and finished it with a PhD-thesis. 1928 employed by Bayer a division of the IG-Farben. Schrader discovered several very effective insecticides, including Bladan, 1942, the first fully synthetic contact insecticide, and Parathion also knows as “E605”. Aus seinen Arbeiten über organische Phosphorsäureester (ab 1936) gingen zahlreiche Insektizide, darunter Bladan (im Jahre 1942), das erste vollsynthetische Kontaktinsektizid, und Parathion (E 605) hervor, aber auch die nerventoxischen chemischen Kampfstoffe Tabun und Sarin, and after the war (1949) Cyclo-SARIN. Aufgrund der strukturellen Ähnlichkeit kann man in einer Anlage zur Herstellung von Insektiziden auch militärische Kampfgase produzieren. Schrader wurde von den Alliierten nach dem Krieg zwei Jahre lang in der Festung Kranzberg festgehalten, wo er sein Forschungsergebnisse über organische Phosphorsäureester niederschreiben musste („Operation Paperclip“). 1951 silberne Ehrenplakette für Verdienste um die Landwirtschaft. Er bekam 1956 von der Gesellschaft Deutscher Chemiker (GDCh) für seine "hervorragenden" Verdienste zur Auffindung neuartiger Pestizide die Adolf-von-Baeyer-Denkmünze verliehen**.**

[6] Bayer Archiv

[7] From Meiers http://www.fluoride-history.de/p-mfp.htm

[8] Gerhard SCHRADER, assignors to Farbenfabriken Bayer, Leverkusen: "Verfahren zur Darstellung von N-substituierten Aminocyanphosphinsäure bzw. thiophosphinsäureestern.", German Patent DE 767,511; filed July 22,1937; published July 10, 1952; see Meiers http://www.fluoride-history.de/p-mfp.htm

(dimethylamido)-cyanphosphate). As before Schrader and his colleagues tested and diluted this agent 1:200`000 on plant louse to characterize insecticide properties. Within minutes he and his laboratory assistant began to experience miosis (contraction of the pupils of the eyes), dizziness, and severe shortness of breath. It took them three weeks to recover fully. They recognized at Christmas and weeks later at their own that the poising effects (breathing watching) were very unusual strong. The result of additional pharmalogical tests was that this agent was a very strong nerve agent. Officially called an insecticide, this agent was patented, because the biologist Hans Kükenthals realized the percutaneous effect at first. Because of the law of April 24, 1934, to forward invention with military implications, Schrader has informed the Army Ordnance Office ("Heereswaffenamt", HWA) about the military impact of a chemical warfare agent. The code name of this agent was called *Präparat 9/91*, later called *Le100*, *Gelan*, *Grünring 3*, *Stoff 83* or *Trilon 83*, lastly known as TABUN.



Some types of organophosphate compounds

Left to right: **A**: Di-ester type (e.g. DFP, DEFP); **B**: Di-amido type; **C**: mixed amido/ester type, X=CN in Tabun; **D**: Sarin/ Soman type (contains one direct C-P bond!)

Fig. 3 Some organophosphate homologues, with strong Chemical Warfare properties[9]

Schrader has often been claimed to be the father of chemical warfare with nerve agents. Yet his discovery was the result of a search for new and effective synthetic insecticides (Dual Use effect). As required by laws at that time, his discovery of the highly toxic substances had to be forwarded to the HWA which decided on their further "use". In a letter of February 5, 1937, Schrader informed Professor (Rudolf Eberhard ?) Gross of Elberfeld about his discovery. The information was forwarded to the HWA. The HWA asked Schrader to present his invention personally. However, Schrader´s employers regarded his discovery as deterrent for their main business, pharmaceutical drugs. As Hoffmann explained, they didn´t want the name of their company to be associated with the development and manufacturing of war agents. Therefore, Schrader´s laboratory was transferred to Elberfeld, into buildings used only for demolition since the early 1920´s [10].

Fig. 4 Schrader, 1958

In the course of experiments to exchange the chlorine of dichlorophosphoric acid dimethylamide in the presence of alcohol for fluorine (from sodium fluoride), Schrader realized to his surprise that the results was not the corresponding fluoric compound but the diethyl ester of fluorophosphoric acid, though in much better yield

[9] From Meiers
[10] Kahlert p. 322; Martinetz p. 151

than originally reported for another way of synthesis by Lange and Krueger. So he continued to synthesize a series of *esters* of fluorophosphoric acid, i. e. homologues (among them DFP) of the type of compounds which Lange and Krueger had described in 1932 and 1933[11]: Their patent, filed on August 2, 1938, but kept secret for a long time, was published only in September 1951. As opposed to some claims, this patent does not refer to SARIN or SARIN-type compounds which Peter Meiers pointed out clearly!

Fig. 5 Richard Kuhn, 1940

At this time Schrader worked and his co-workers in a larger laboratory in Elberfeld worked on the improvement of TABUN and the synthesis of related, more stable compounds. Under the test number “T144” they synthesized the more toxic methyl more fluorphosphoracid-isopropylester (Isopropyl methylfluorphosphonat) on December 10, 1938, which is substantially more well-known under the name SARIN or Trilon 46. According to Paxman & Harris the meaning of “T144” belongs to a building number of Dyhernfurth for conducting a pilot plant of SARIN. The name "SARIN" is probably formed by the initial letters of Schrader, Ambros and [Franz?] Ritter and as well by Hans-Jürgen von der Linde[12]. Other sources indicate that the origin of the name SARIN is related to the nerve gas expert *S*chrader, IG-Farben board member *A*mbros, Colonel *R*üdiger (HWA), to derive and von der L*in*de (HWA).

The Nobel Prize winner of 1938, Richard Kuhn[13] (Fig. 5), was involved by the HWA to discover inhibitors against nerve agent. But in spring 1944 he and his colleagues found the type SOMAN. Its name might be derived either from the Greek verb "to sleep" or the Latin stem for "to bludgeon."[14]

Allied Activities Relating to Nerve Agent

On December 11, 1941, *Bernard Charles Saunders*, University of Cambridge, UK, reported at a Ministry of Supply meeting in London the highly toxic nature of an *ester of monofluorophosphoric acid*, diisopropyl fluorophosphate (DFP), as a lethal inhalant. Inspired by the early report (1932) of Willy Lange, they had prepared several new *esters* of monofluorophosphoric acid and *had tested them for possible usefulness as warfare agents*. The quick "knock-out" action of DFP was stated to be comparable with the one produced by hydrogen cyanide. Another remarkable effect at much lower, and non-fatal, concentrations was stressed at the time: an intense constriction of the eye pupils took place (miotic effect). Their initial observations led them to search for new and simple methods for the preparation of these compounds. Right at the start of the experiments reports were also made available to American workers.

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[11] Gerhard SCHRADER, Hans KÜKENTHAL, assignors to Farbenfabriken Bayer, Leverkusen: "Bekämpfung tierischer Schädlinge", German Patent (DE) 767,153, filed August 2, 1938; granted September 20, 1951

[12] Leiter des Heeresgasschutzlaboratoriums Spandau, der als Chemiker für fabrikatorische Entwicklungsfragen zuständig

[13] **Kuhn, Richard** (b. Dec. 3, 1900, Vienna, Austria-Hungary--d. Aug. 1, 1967, Heidelberg, W.Ger.), German biochemist awarded the 1938 Nobel Prize for Chemistry for his work on carotenoids and vitamins. Forbidden by the Nazis to accept the award, he finally received his diploma and gold medal after World War II. Kuhn took his doctorate from the University of Munich in 1922 for work on enzymes under Richard Willstätter. He spent from 1926 to 1929 at the technical school in Zürich and then became professor at the University of Heidelberg and director of the Kaiser Wilhelm Institute for Medical Research (later renamed for Max Planck) at Heidelberg. Kuhn investigated the structure of compounds related to the carotenoids, the fat-soluble yellow colouring agents widely distributed in nature. He discovered at least eight carotenoids, prepared them in pure form, and determined their constitution. He discovered that one was necessary for the fertilization of certain algae. Simultaneously with Paul Karrer he announced the constitution of vitamin B and was the first to isolate a gram of it. With coworkers he also isolated vitamin B. From 1948 he was an editor of Justus Liebigs Annalen der Chemie ("Justus Liebig's Annals of Chemistry"). (Encyclopaedia Britannica)

[14] http://dtirp.dtra.mil/CBW/references/agents/AgentsCW_nerve.asp

"*Increasing interest in the development of new fluorine-containing substances*" led, during World War II, to an association of Ozark Chemical Company (which possessed the raw material for fluorine compounds, fluorspar) with the Purdue Research Foundation where research on some organic fluorine compounds was to be conducted for the National Defense Research Committee:

"*In the early 1940s, Mr. C. O. Anderson, who was the Ozark contact with Purdue, became acquainted with Dr. Willy Lange, who was at the University of Cincinnati after having emigrated from Germany. Lange had discovered and published on the fluorophosphoric acids while still in Germany (Lange 1927). In discussions with Lange the idea developed that there should be commercial applications for these new fluorine compounds, possibly as mothproofing agents, so he was retained as a consultant to help in a research and development program*"

In England, *Saunders* and *McCombie* of Cambridge, in cooperation with the Ministry of Supply filed patents on the preparation of esters of fluorophosphoric acid (e.g. DFP) via chlorophosphonic esters (a standard method for preparing organic fluoro compounds consists in treating a corresponding chloro-compound with inorganic fluoride, the FREONS)[15]:

During the war the allies' chemists had the knowledge of producing and discovering nerve agents like the Germans had at the beginning of 1930`s. This means that technology gap was about 10 years, a major head start.

Technical Diffusion: Semi-Technical Production of TABUN, SARIN 1937-1939

Since strong pupil contractions occurred when working with these "insecticides", the material was delivered on February 5, 1937 to Professor Gross for tissue-hygienic examination. Due to the already mentioned law of April 24, 1934 to forward invention with military implications, the patent was announced to the OKH. The IG-Farben director and chemist Hörlein passed results of the examination of the *preparation 9/91* on his toxicity to Dr. v. Sicherer (HWA, Berlin). Schrader had to exhibit the production of its TABUN in Spandau (near Berlin[16], see Fig. 7) at the HWA lab on May 1937. Colonel Rüdiger, the director/conductor of the responsible department of the HWA, recognized the military importance of the new material. The HWA tested and evaluated these new stuffs from 1937 to 1939 and began with technical feasibility studies for technical production of one of these new substances (TABUN), code named to *9/91*, later than *Le100*, also aliased in *Gelan*, *Stoff 83* or *Trilon 83*, *Grünring 3* or finally than to TABUN. 1939 built the HWA a test plant in Munsterlager (Heidkrug, see Fig. 6[17]), since the IG-Farben had rejected a more active cooperation. Although sometimes in historical publications mentioned, the HWA reached the decision to select and to produce one of Schrader`s homologues and not by Schrader. In this time the IG-Farben still didn`t want to have any direct military connections in directly war related productions.[18]

According to the after-war information (1947) by the plant leader of Dyhernfurth and chemist of BASF division of the IG-Farben, Albert Palm, the biologist Hans Kükenthal first recognized the effect of the

[15] Hamilton McCOMBIE, Bernard Charles SAUNDERS, of Cambridge, and Charles Lawrence WHEELER, Ministry of Supply: "A process for the preparation of fluorophosphonic acids and chlorophosphonic esters", British Patent (GB) 601,210, filed Sept. 15, 1943, granted April 30, 1948 ("This invention relates to the preparation of esters of halogen phosphoric acids and *it is one object of the invention to prepare highly toxic esters of fluoro phosphoric acid*. It is believed, however, that the method is of general application to its preparation of esters of halogen phosphoric acids and that *some of the less toxic compounds may be useful for such purposes as insecticides*. Hitherto compounds of the type herein described have only been obtained by very complicated and devious methods." see Meiers http://www.fluoride-history.de/p-mfp.htm

[16] Courtesy Michael Grube, in: http://www.lostplaces.de/munster-nord/

[17] Courtesy Michael Grube, in: http://www.lostplaces.de/munster-nord/

[18] Kahlert p. 314 & 317

TABUNs as a contact insecticide. This application as a contact insecticide was registered at the beginning of July 1937 as a German “Reichspatent” 767/511 and was patented after the war.[19]

Fig. 6 TABUN Pilot Plant HWA-Munsterlager

On November 1937 the structure of TABUN was clarified. Biologically active phosphoric acid esters were only to be expected, if a suitable "acyl residue" were built into the molecule, so that instead of the cyanogen residue of the TABUN a fluorine residue of the SARIN was implemented[20]. On December 10, 1938 Schrader in Elberfeld found the new material SARIN, which was called by Gross “*Le 213*” (also nick named to *Grünring 4*) and he recognized it as still more toxic. Hörlein of the BASF division transferred a spreadsheet with different classes of nerve agent homologies to Prof. Wirth of the military medical academy of Berlin, and Wirth requested for more substance samples. Schrader and Lutter transferred their recipe handbook (“Laborhandbuch”) to the OKH (“**O**ber**k**ommando des **H**eeres”, High Command of the Army) and a Dr. Reetz of the HWA lab in Spandau prepared a more comprehensive and improved manufacture instruction. On December 15, 1939 a preliminary answer of the OKH came to the IG-Farben to realize a TABUN factory with 1000 tonnes per month (moto) capacity. On December 30, 1939[21] in co-operation with the IG-Farben and the regional council of Breslau the location of Dyhernfurth was specified by Dr. Reinknecht (OKH, Wa Mun). A pilot plant for SARIN production could only start from June 1944 in smaller scale comparing to the TABUN plant[22]. Still two additional plants with a capacity of 500 tons per month were built until the end of war in Falkenhagen near of Fürstenberg (Oder). In Falkenhagen the so called “*N-Stoff*” (burning stuff Chlortrifluorid) was already produced with the help of the Kaiser-Wilhelm Gesellschaft (Inst. für Elektrochemie, KWIPC) since 1938[23]. The plant was managed and controlled by SS-affiliated at the end of the war, so that some frictions between IG-Farben (SARIN construction) and SS (N-stuff production) occurred. The stocks of SARIN have been assumed between 60 and 400 tons at the end of the war[24].

After the discovery of the toxicity of TABUN the poisonousness was demonstrated to the HWA and classified by them immediately as "secret". Yet the existence of TABUN was probably not known the

[19] Kahlert p. 317; Meiers

[20] Nerve agents inhibit acetylcholinesterase (AChE), a key enzyme to normal autonomic functions and muscular contractions. When AChE makes contact with acetylcholine, muscle fibers return to their relaxed state. When nerve agents block AChE and prevent the necessary reaction with acetylcholine that leads to relaxation, muscles that are fatigued from constant twitching weaken. More demands are made on the muscles—particularly the lungs—than the muscles can provide, causing severe fatigue. Additionally, the build up of acetylcholine leads to the constriction of smooth muscle in the respiratory tree, as well as copious amounts of mucosal and salivary excretions, which effectively smother the victim. These, in combination with the involvement of the central nervous system, finally stop respiration completely.

[21] Nurnberg Trial Ambros: “*The idea to build Dyhernfurth came about on 12 December 1939* [Sic! 30.]*, after Hoerlein, ter Meer, and I had been given the order, on 7 September 1939 (by the OKH), to construct a plant for the production of tabun*.” http://www.mazal.org/archive/nmt/07/NMT07-T1262.htm

[22] Pilotanlage für die Produktion von TABUN und SARIN. Bis Kriegsende wurde hier etwa eine 500 kg Sarin produziert. http://www.lostplaces.de/munster-nord/

[23] unpublished PhD of PREUSS, J. & EITELBERG, F. (1994): Rekonstruktion der ehemaligen Fabrik zur Herstellung von Brand- und Kampfstoffen: N-Stoff und Sarin, der MONTURON GmbH

[24] Kahlert p. 318

general staff until 1939 although the chemical warfare experts ("*Gasexperte*") of the army, lieutenant colonel Ochsner[25], mentioned in a communiqué on October 27, 1937 only the warfare agent "*Excelsior*" as a mask disturber ("*Maskenbrecher*") and a not specified new warfare contact agent "*Nr. 100*" (=TABUN) which should behaves like LOST[26] (Yperite, Lewisit, mustard gas). The new quality of nerve agent was at least not expressively mentioned to the general staff. Even in a memorandum of Colonels Ochsner on June 28, 1939 to the first division of the general staff of the army, no suggestions were made for the deployment of nerve agent. However a massive deployment of LOST against the British civilian population was recommended by this memorandum to the general staff, like a similar memorandum of "Gebechem" ("*Ge*neral*be*auftragter für *chem*ische Erzeugnisse", General Plenipotentiary for Special Questions of Chemical Production) Carl Krauch[27] (Fig. 8[28]) was already recommended one year before on July 25, 1938. Not until in a meeting with major general Thomas[29] on September 5, 1939, after outbreak of the World War II, the manufacturing of the "Stoff 100" was noted for the first time, which was mentioned "*as a special desire of the colonel Ochsner*", and it was said, "*that it had to be clarified* [...] *whether the needed phosphorus for the manufacturing of* [stuff] *100 can be supplied* [...]"[30].

Fig. 7 Former HWA-Lab (Spandau)

On October 1, 1939, one month after the beginning of the war, colonel Ochsner gave a lecture in front of a substantially military higher ranked visitors (e.g. chief of the general staff of the army) about the scheduling to start eventually with chemical warfare (CW) agents, the *stuff 100* was briefly expressly mentioned. The *stuff 100* was introduced as an agent of large effectiveness. Only putting on a *Phosgen gas mask* ("Grünkreuzgasmaske", code name for lunge active warfare agent) could prevent the deadly effect. New chemical plants had to be built. Astonishingly the percutanous behaviour of the nerve agent was not taken into account, so that carrying a gas mask was not enough for protecting against intoxication.

Technical production of nerve agent 1940-1945

On January 1940, construction began on a secret plant, code named "Hochwerk", for the production of TABUN at Dyernfurth-am-Oder (now Brzeg Dolny in Poland), on the Oder River 40 km (24.9 miles) from

[25] **Hermann Ochsner** (1892-1951) war seit Ende der Zwanziger Jahre in der Inspektion 4 (Artillerie) verantwortlich für die Aufstellung und Ausbildung der chemischen Verbände (Nebeltruppe), im 2. WK Generalleutnant der Nebelgruppe.

[26] Nick name for the German chemists **Lo**mmel und **St**einkopf

[27] **Carl Krauch** (born April 7, 1887 in Darmstadt; died February 3, 1968 in Beerfelden) Doctor of natural science; professor of chemistry; IG board member and its Central Committee, 1934-40; member and chairman of supervisory board, 1940-45; chief of Sparte I, 1929-38; chief of Liaison Office Wehrmacht; chief, Research and Development Branch, Office for German Raw Materials and Synthetics, Four Year Plan, 1936-38; Plenipotentiary General for Special Questions of Chemical Production, July 1938-45; chief, Reich Office for Economic Development; Military Economy Leader; member of directorate, Reich Research Council; became member of Nazi Party in 1937; member of German Labor Front.

[28] BASF Archiv

[29] **Georg Thomas** (1890-1946), zuletzt General der Infanterie, 1934-43 Chef des Wehrwirtschafts- und Rüstungsamtes im Oberkommando der Wehrmacht, im Zusammenhang mit dem 20. Juli 1944 inhaftiert. Lieutenant general; General for Special Assignments with the chief, High Command of the German Armed Forces (OKW), January l943-August 1944; chief, Military Economy Office, High Command of the German Armed Forces, November 1942-January 1943; chief, Military Economics and Armaments Office, High Command of the German Armed Forces, September 1939-November 1942; chief, Armaments Office, Reich Ministry for Arms and Munitions, May 1942 November 1942; chief, Military Economics Staff, Armed Forces Office (after 1937, High Command of the German Armed Forces), November 1934-November 1939; member, General Council, Four Year Plan; member, Economic Executive Staff East.

[30] Kahlert p. 320

Breslau (now Wroclaw) in Silesia. The plant was large, covering an area of 2.4 by 0.8 km (1.5 by 0.5 miles), and was completely self-contained, synthesizing all intermediates as well as the final product, TABUN. The factory even had an underground plant for filling munitions, which were then stored at Krappitz (now Krapowice) in Upper Silesia. The plant was planned and operated by Luranil later by Anorgana GmbH, both subsidiaries of IG Farben, as were other chemical weapon agent production plants in Germany at the time.

Fig. 8 "Gebechem" Krauch, 1944

The plant took an extraordinary long period, from January 1940 until June 1942, to become operational. This was primarily due to the difficult nature of the production process. Certain intermediates were so corrosive that the Germans were forced to run all reactions in quartz- or silver-lined vessels. The extreme toxicity of TABUN required that the final production units be enclosed in double glass-lined walls, with a stream of pressurized air circulating between the walls. All units were periodically decontaminated with steam and ammonia.

120 French prisoners of war (POW) were starting the levelling and clearing of the area. After the first attempts to get preliminary products the French POW were removed in autumn 1941 because of secret reasons. By cooperation of the mentioned “Gebechem” Krauch in spring 1941 800 Italian immigrant workers were deployed to realize the TABUN plant. The initiative to get the immigrants came from the chemist and chief of the plant, Albert Palm, in co-operation with the OKH under colonel general Fromm (called “Aktion Fromm”). 80 German metal workers and 240 operating workers from different IG-Farben plants became the army status "u.k." (“unabkömmlich” = indispensable), means that they did not do military service anymore. The workforce of the plant rose from 250 persons 1941 to 1000 persons 1943; 1944 the workforce was already 2000 persons. At the end of May 1943 the capacity of the plant (see later) should be increased from 1000 moto plant up to 2000 moto. For this enhancement of the plant, 450 KZ prisoners were deployed 1943 and 1944 2500 of them. The largest technical challenge for realizing the TABUN plant was the industrial production of Dimethylamin. Until this time there were no any plants existing to produce Dimethylamin with Formaldehyde and Ammonia. The IG-Farben subsidiary Anorgana contribute decisively to realize the chemical reactions in a technical dimension. 1944 established the HWA beside the Dyhernfurth plant in Munsterlager a test plants according to the recipes of Reetz (HWA). Until January 1945 altogether 11976 tons TABUN were produced, from which the army received 8000 t, filled in large bombs and shells, and the air force 4000 t respectively. The expense of the Dyhernfurther plant for building and maintenance etc. were about October 1944 approximately 150 million RM, only 48 Mill. RM has been amortized by the German Administration[31].

The Dyhernfurth SARIN plant was variously listed as having a capacity of 40 or 100 tons per month. A 500-ton per month production plant was under construction at Falkenhagen, southeast of Berlin, at the end of World War II. Estimates vary for the total SARIN production from 500 kg to 10 tons; probably the stocks were at the lower limit.

According to the after war information of a chemist of Speer, E. Ehmann[32], the TABUN stock increased to 1500 tons from June 1942 until May 1943, probably produced by the 50 moto pilot plant of the HWA in Raubkammer (Lower Saxony). According to the reliable 1947 data of the plant chemist Palm, the TABUN stocks of 1858 tons were manufactured from June 1942 to April 1943 in the Dyhernfurth plant alone.

[31] Kahlert p. 318 & 319

[32] Ministerialrat Dr. Emil Ehmann was Chief of the Manufacturing and Procurement Department for chemical Preliminary Products in the Army Ordnance Office (Heerwaffenamt)

Considering that the lethal dose for TABUN is in the case of the oral ingestion about LC_{50}^{t} = 100 to 200 and/ for SARIN about 50 to 100 $\frac{\text{mg min}}{\text{m}^3}$ (unfitness to fight begins with TABUN about 10 mg min / m^3)[33], then a rough estimation of the hazard potential for the civilian population can be made[34].

Fig. 9 Otto Ambros, 1944

200 to 1000 mg TABUN (100-500 mg for SARIN and 50-300 mg for SOMAN!) incorporated over the skin are sufficient, in order to kill an adult. Considering the inventory of TABUN in May 1943, which was amounted to be at least 1500 tons, then theoretically altogether 7.5 billion (!) humans could be killed with these stocks at room condition. According to the data of Martinetz (p. 223) 15 t nerve agent of the type of SARIN (TABUN 30 t) are sufficient, in order to contaminate a surface of 60 km^2 to and to reach a 50% probability of mortality within minutes. The hypothetical deployment over a city such as London would be described only with the term "devastatingly" (the state of inability to fight already begins with a lower dose around the factor 20).

Hitler had known about the effectiveness of the "Trilongroup" (TABUN; SARIN, later SOMAN) at the latest on December 2, 1941, shortly before the German declaration of war to the United States, when he had received the following lecture note of the HWA: In this lecture Hitler was clearly informed about the new quality of effects belonging to harm the nerve system (Trilon 46= TABUN, Trilon 83 = SARIN), the sudden and deadly impact, the amount of ammunition and last but not least that **not** "*a single intelligent report shows, that a deployment of this or at least similar stuffs had to be expected by the enemy. This means a clear superiority belonging to the field of chemical warfare which, how requested* [by Hitler], *should be maintained* [(more precise term would be "extended")] *by the pilot plant* [in Dyhernfurth].[35]"

Particularly with the establishment of the Reichs-Ministry for armament and ammunition in the year 1940 (Todt) and after 1942, when this was fundamentally converted into the Reichs-Ministry for armament and war production by Albert Speer (1905-1981), the influence of the HWA on the agent production, and/or even

[33] The term L*Ct* 50 is often used to denote the vapor or aerosol exposure (*C*t) necessary to cause death in 50% of the population exposed (L denotes lethal, and 50 denotes 50% of the population). In the same manner, the term LD 50 is used to denote the dose that is lethal for 50% of the population exposed by other routes of administration. TABUN = LCt_{50}:400 mg • min/m^3 ; LD_{50} (skin):1.0 g/70-kg man; SARIN = LCt_{50}:100 mg • min/m^3; LD_{50} (skin): 1.7 g/70-kg man; SOMAN= LCt_{50}:50 mg • min/m^3; LD_{50} (skin):350 mg/70-kg man, according to Sidell.

[34] Kahlert p. 321

[35] Brauch & Müller S. 174f. Dokument 44 *Vortragsnotiz des Heerswaffenamtes für Hitler betreffend Trilon 46 vom 2. Dezember 1941. Bei Kriegsbeginn waren die Entwicklungsarbeiten an dem Kampfstoff Trilon 83 (früher G*[elan oder Grünring]*. ... genannt* [Stoff 100, oder TABUN]*) so weit abgeschlossen, daß die Errichtung einer Großanlage zur Herstellung von 1000 moto* [Monatstonnen] *Trilon 83 in Auftrag gegeben werden konnte. Die Anlage wird im Frühjahr 1942 in Betrieb genommen. Trilon ist ein Kampfstoff, der sich von den bisher in allen Staaten bekannten Kampfstoffen dadurch grundsätzlich unterscheidet, daß die Wirkung sofort, das heißt noch während der Kampfhandlung, eintritt. Trilon 83 schädigt vorwiegend das Nervensystem. Es verursacht zunächst Sehstörungen und asthmaartige Atembeklemmungen. Längere oder stärkere Einwirkung ruft Schwächegefühl, Trübung des Bewußtseins, Zuckungen und Krämpfe hervor, die tödlich enden können. (…)Der neue Stoff (=SARIN) hat grundsätzlich gleichartige Wirkung wie Trilon 83; die Wirkung* [genauer: der toxische Äquivalenzfaktor] *ist jedoch* ***sechsmal stärker*** *(…) Mit 100 moto des Stoffes können gefüllt werden: rd. 120 000 F*[eld].*H*[aubitzen].*Gr*[anaten]*. oder rd. 40000 15 cm Gr*[anaten]*. Als Standort der Anlage ist Dyhernfurth bestimmt, wo ein Teil der Vorprodukte und der Gebäude zur Verfügung stehen. Die restlichen Vorprodukte werden in verschiedenen anderen Werken erzeugt.* ***Es kann weder aus den erbeuteten Akten und Dienstvorschriften noch aus sonstigen Nachrichten entnommen werden, daß mit dem Einsatz dieser oder ähnlicher Stoffe mit gleicher Wirkung von Seiten des Feindes zu rechnen ist*** [Bold Kahlert]. *Das bedeutet eine klare Überlegenheit auf dem Gebiete der Kampfstoffe, die, wie gefordert, durch den Bau dieser Versuchsanlage gehalten werden soll.* See Kahlert p. 323

on the agent research, became ever smaller. Speer had apparently a higher opinion of the manager qualities of members of the enterprises, compared with military and regulatory authorities, particularly with view of more efficient handling of resources.

After a “Führerbesprechung” on July 24, 1942 with Albert Speer it was thus intended to intensify the relationship of industry, science and military by a working group `”K”. The working group “K” (probably alias for “Kampfstoff”) should have originally been formed by Dr. Boettler of the Munitions department, Dr. von Sicherer (OKH), and Dr. Ulrich of IG-Farben (BASF division). On initiative of the "Gebechem" Krauch, simultaneous chairman of IG-Farben supervisory board, one of the best IG-Farben manager and chemist, Otto Ambros[36] (Fig. 9[37]), was sent instead of Ulrich, probably an indicator for the importance of the whole program.

Nerve agent production nevertheless did not receive the same top production priority ("DE") by Speer, like the substantially more resource consuming synthetic mineral oil production, as a letter of the HWA to Speer on August 6, 1942 indicates. Even the failure, caused by to low priority, to reach the productions goals were taken in account by the HWA, which certainly demonstrate that chemical warfare was not on highest priority even for the HWA![38]

Hitlers Dilemma – why Hitler did not deploy Nerve Agent

The reason why Adolf Hitler did not order the deployment of nerve agents in WWII is still a subject of controversy. The most popular explanation for Hitler's apathy stems back to the previous World War where chemical warfare agents were used in combat (Hitler was temporarily blinded by mustard gas). Hitler had been victimized by these chemical agents and was unwilling to introduce new and more toxic agents.

According to Gellermann (p. 208), the IG- Farben also worked unsuccessfully on the development of an effective protective filter against nerve gases. The absence of such a protection played an important role in the decision of Hitler and the army in the end not to use chemical weapons. Other aspects were: the chemical groups of the army, the support troops, were still in their infancy in 1939. Later it was hardly possible to withdraw regiments from the front and to convert them into chemical warfare and defence units which would have been necessary for gas warfare. With the defeat of the Luftwaffe, the most important possible means of deployment of gas warfare agents was finally lost.

Hitler's Minister of Production, Albert Speer[39], said after the war, "*All sensible army people turned gas warfare down as being utterly insane, since, in view of America's superiority in the air, it would not be long before it would bring the most terrible catastrophe upon German cities.*[40]"

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[36] **Otto Ambros** (1901-1984) 1920 Chemiestudium in München, Professor of chemistry; IG board member, Technical Committee, and Chemicals Committee of I. G. Farben, 1938-45; chairman of three Farben committees in the chemical field; plant leader of eight of the most important Farben plants, including Buna-Auschwitz; member of control bodies in several Farben enterprises, including Francolor; member of Nazi Party and German Labor Front; Military Economy Leader; chief of Special Committee “C” (Chemical Warfare) of the Main Committee Powder and Explosives, Reich Ministry of Armaments and War Production; chief of a number of units in the Economic Group Chemical Industry. Ambros was sentenced to 8 years in prison, later consulter of Grace imperium.

[37] BASF Archiv

[38] Brauch & Müller S. 176 Dokument 46: *Schreiben des Heereswaffenamt an den Reichsminister für Bewaffnung und Munition, Albert Speer, betreffend Dringlichkeit der Kampfstoffprojekte vom 6. August 1942*, see Kahlert p. 324 & 325

[39] Reichsleiter; cochairman, Jaegerstab (special staff organization for fighter plane production) March 1944-45; member of Central Planning Board, Four Year Plan, April 1942-45; Plenipotentiary General for Armament Tasks, Four Year Plan, March 1942-45 Reich Minister for Armaments and War Production, 1942-45 (before 2 September 1943, Reich Minister for Arms and Munitions); Inspector General of German Highway System, February 1942-45; Inspector General for Water and Power Industry, February 1942-45; Chief of Organization Todt, February 1942-45; Inspector General for the reconstruction of Berlin.

[40] http://www.chm.bris.ac.uk/webprojects2001/sharp/new_page_2.htm

The May 15, 1943 meeting of Ambros with Hitler is often mentioned in literature, but lastly the content – Ambros didn't recommend the beginning of chemical warfare (CW) - are based on affidavit of Ambros in the Nurnberg trial[41] (see FN 43, Fig. 10[42]) which, historically speaking, should be taken with care. For the most "chemical warfare historians" the May 15, 1943 meeting applies as the "decisive conference", whether to deploy nerve agent or not. This is described in details in Joseph Borkin's popular book "The Crime and Punishment of the IG-Farben"[43]:

[Albert] *Speer, who was strongly opposed to the introduction of tabun, flew Otto Ambros, I.G.'s authority on poison gas* [chemical warfare], *as well as synthetic rubber* [BUNA-Synthesis], *to the meeting. Hitler asked Ambros, "What is the other side doing about poison gas?" Ambros explained that the enemy, because of its greater access to ethylene, probably had a greater capacity to produce mustard gas than Germany did. Hitler interrupted to explain that he was not referring to traditional poison gases: "I understand that the countries with petroleum are in a position to make more [mustard gas], but Germany has a special gas, tabun. In this we have a monopoly in Germany." He specifically wanted to know whether the enemy had access to such a gas and what it was doing in this area. To Hitler's disappointment Ambros replied, "I have justified reasons to assume that tabun, too, is known abroad. I know that tabun was publicized as early as 1902* [Sic!, 1951], *that Sarin was patented* [Sic! SARIN was not patented], *and that these substances appeared in patents. (...) Ambros was informing Hitler of an extraordinary fact about one of Germany's most*

[41] see: http://www.mazal.org/archive/nmt/07/NMT07-T1040.htm

[42] Kahlert P. 329

[43] Interrogation IG-Farben Process: *On 15 May 1943, as the last conference, there was a discussion with Hitler and this concerned the treatment of the chemical warfare agents. Q. Were you alone? A. Shortly before this date I was notified by telegram by the Armament Ministry, and I was told to come to Berlin, and I was taken to the supreme headquarters in East Prussia by airplane. There were representatives of the General Staff, Speer, Schieber, and various directors of central committees from the armament industry. Q. And what did Hitler want from you? A. As the last point on the agenda of this conference there was a one-hour conference about the situation in the poison gas field. Mr. Speer and Mr. Schieber reported, first of all, about the military aspect, about the general situation, and then I was given the floor; and I showed, on the basis of a table: (a) the requirements of poison gases by the General Staff, (b) the actual production, (c) the stocks. Thus, I discussed objectively all types and described the situation as it was. Q. Did Herr Hitler ask you — one could practically gather this — whether one could use poison gases, or what was the situation? A. The first reaction was a disappointment, since, in most types, not even half of the requirements of the General Staff had been met. There followed a discussion about the reasons for this, and he asked the question: "What is the other side doing?" Q. Before that, I would like to ask you a question. Did you have the impression as if Hitler wanted to use the poison gases? A. No, Hitler himself did not, but around him there were people who did. Q. Well, go ahead, please; describe to us what happened at this conference. A. He discussed the main types, always with a point of view of "How does it look on the other side?" and I reported objectively that, for example, in the Lost [mustard gas] field, countries which have a lot of ethylene would perhaps have the possibility to produce larger quantities of these substances than we could. Thereupon he said: "I understand that the countries with petroleum are in a position to make more, but Germany has a special gas, Tabun. In this we have a monopoly in Germany." At that moment I said: "I have justified reasons to assume that Tabun, too, is known abroad. I know that Tabun had been publicized as early as 1902, that Sarin was patented, and that these substances appeared in patents," and I said, "I am convinced that other countries, in case the German side might use these gases, would very shortly not only be able to imitate these special gases, but even produce them in much larger quantities.* […] *Mr. Ambros, before the recess we were talking about this conference with Hitler in May 1943. Is there anything important to say about this conference other than what we have already said? A. During this conference an expansion was also discussed which the OKH had suggested for Tabun. This plan was to be put into execution, but a few months later it was withdrawn. Q. Mr. Ambros, we can draw our own conclusions about your attitude at this meeting. I do not want to go into that much further. I have another question in this connection. You said that certain circles, or certain people in Hitler's entourage, would have been glad to use poison gas. Do you have any indications that after you took an objective point of view at that time you were not doing these people a favor and that later attempts were made to gain your assistance? A. In August* [Sic! 1. March]*1944, I was called to Mr. Speer, and again there was a suggestion from the people who wanted gas warfare, but the situation was exactly the same, and my attitude was exactly the same again about the objective of a technical expert. Speer had the same attitude, and so it was again possible to prevent the use of this terrible weapon. Q. Mr. Ambros, for absolute clarity on this point: your point of view was objective? A. Yes.* [Sic! Certainly his recommendations were not objectiv] *Q. In addition to that, did you tell the people who were in favor of gas warfare that you were against it, or was that not possible, or did you think it advisable not to do so in your own interests? A. Those who were in favor of it were Ley, Goebbels, and Bormann. I did not know any of these men. I did not speak to any of them, and I never spoke to Hitler again. "* See http://www.mazal.org/archive/nmt/07/NMT07-T1044.htm pp.

secret weapons. The essential nature of tabun and sarin had already been disclosed in the technical journals as far back as 1902 [Sic!, essential nature were not known until 1940]*, and I.G. had patented both products in 1937 and 1938. Ambros then warned Hitler that if Germany used tabun, it must face the possibility that the Allies could produce this gas in much larger quantities. Upon receiving this discouraging report, Hitler abruptly left the meeting* [although Hitler got before a memo from the HWA which decribed the opposite, see FN 35]*. The nerve gases would not be used, for the time being at least, although they would continue to be produced and tested.*

At the meeting with Council of State Dr Schieber[45], Dr. Ambros and Hitler on May [15.], 1943, it was decided that as soon as possible, i.e. until at the end of 1944, the TABUN production in Dyhernfurth should be increased from 1000 to 2000 moto and the production of SARIN from 100 moto to 500 moto. It was stated that this enhancement should have a comparable right-of-way precedence like the tank program of Speer. Relating the question of the raw material situation it was stated by Dr. Mureck[46] that for the production of TABUN around 40% of the German annual phosphorus production was already used (50000 t/a P_2O_5). Thus, the production had been clearly limited by the phosphorus supply[47].

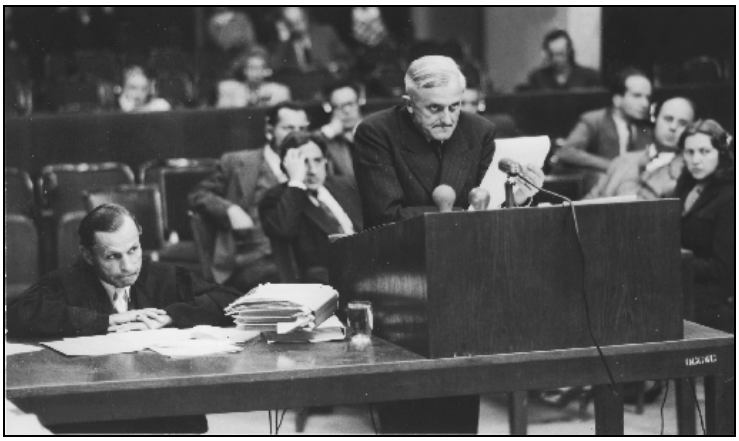

Fig. 10 IG-Farben Trial[44]: Defendant Otto Ambros in cross-examination with the chemist N. M. Elias, witness for the prosecution, 9/30/1947

On March 1, 1944 Ambros (1901-1984, Fig. 9) gave his second lecture to Hitler and others relating to the situation of the German CW program in the "Führerhauptquartier". He explained that the decided amounts of 1000 ton per month (moto) TABUN of the meeting of 15 May 1943 were fulfilled to 70%. It was indented to fulfil the production target to 100 % in the next month. After this lecture Hitler enhanced the production quota to 2000 moto without considering that the amount of phosphorus did not exist in Germany. Almost 40 % of Phosphorus stock had already been used by the TABUN production, the great demand to Phosphorus was, however, the agricultural sector and Phosphorus could and can not be substituted by another material in both cases! In this lecture mentioned, Ambros referred to Hitler "*about the demoralise impact, which were occurred by application of these types TABUN and SARIN, and the use of these stuffs was characterized as a means of very last decision. It was referred to the* ***possibility*** [bold author]*, that the opponent* [=allies] *had drifted the development in a* ***similar*** [bold author] *direction. In literature is has been known, that – especially in America* [=USA] - *scientific investigations were carried out with matter related constitution* ["*Körper verwandter Konstitution*"]"[48]!

[44] August 1947 bis zur Urteilsverkündung am 29./30.7.1948

[45] Dr. Ing. Walther Schieber, 1896-1960, 1931 NSDAP-Mitglied, zudem SS Oberführer, Gauwirtschaftsberater für Thüringen, von 1942 bis 1944 Chef des Rüstungslieferungsamtes im Reichsministerium für Bewaffnung und Munition unter Speer. Chief, Armament Supply Office (Ruestungslieferungsamt) in Reich Ministry for Armaments and War Production (before 2 September 1943, Reich Ministry for Arms and Munitions), 1942-44; Referent for Chemistry in Reich Ministry for Arms and Munitions, 1941-42; deputy chief of Reich Group Industrie; brigadier general in SS.

[46] Oberregierungsrat Dr. August Mureck, Leiter des Referats Chemie in der Rohstoffabteilung des Rüstungsamtes.

[47] Brauch & Müller S. 181 Dokument 48: *Aktenvermerk über eine Besprechung beim Generalbeauftragten für die Regelung der Bauwirtschaft am 26. Mai 1943 über den Ausbau von Dyhernfurth*, see Kahlert p. 325

[48] Brauch & Müller S. 182ff Dokument 49: *Auszug aus der Denkschrift von Otto Ambros über die Lage auf dem Kampfstoffgebiet vom 20. März 1944*. In this lecture of Ambros, it was stated the „*demoralisierende Wirkung, die bei Anwendung dieser beiden Typen TABUN und SARIN auftreten wird, verwiesen und der Einsatz dieser Stoffe als ein Mittel der allerletzten Entscheidung gekennzeichnet. Es wurde auch auf die Möglichkeit hingewiesen, daß die Gegenseite Entwicklungen in ähnlicher Richtung treibt.*

What Hitler understood presumably with the formulation “matter related constitution”? Or differently asked what kind of rhetoric effect of this chemical expert will be attained by such a chemical layman like Hitler as a listener? To my opinion, there might be only one answer: Hitler might or more probably had to get the impression that the opponent had the same quality of chemical weapons with nearly the same amount, but the allies did not have nerve agents as well known historical matter of fact and the allies noticed lately it, despite of ENIGMA, not until June 1943! This is an other example, like in the lecture before (May 15, 1943), what in colloquial called a “half truth”: When non-specialists like Hitler heard, what extent of the “constitution” (spatial arrangement of atoms in a molecule) was crucial for its toxicity, then Hitler would certainly not have doubled the TABUN production, because he would have realized that not enough Phosphorus would have been available. Otherwise, exaggerated formulated, Ambros lied "with the truth". It may have been correct that there were materials already published in "similar direction" - however for chemists this does not mean anything. For a greenhorn or layman it, however, suggested that production and/or an imitation of these materials can be copied easily, like during WWI with the compounds chlorine and phosgene. It cannot be forgotten when interpreting this lecture notes that Ambros was an outstanding chemist - he had attained a doctorate with the Nobel Prize winner Willstätter in Munich. That the “constitution” is decisive for its toxicity, this was a very well-known matter of fact also in this time. Last but not least Hitler wanted to increase the TABUN production to 2000 moto without considering that this was not possible because of the lack of Phosphorus. I think this was for Hitler only a detail, but for an expert this is crucial. Further Otto Ambros maintained before Hitler[49] on March 1, 1944, “*it would exist the fears that the opposing side would works also in this area* [in the nerve agent production], *so that also this deployment may not to be overrated*”, i.e., Ambros speculated explicitly before Hitler upon (not existing) a secondary strike option of the allies with nerve agents, although all indicators were showing before that the allies possessed "only" agents of the WWI! Thus, it was clear also for Hitler that his *special gas, Tabun, the monopoly* had gone. Hitler did not have to think further about a deployment of this *special gas* or not. If he would have known, how weak the clues had been, which supported the Ambros` statement, and then he would have considered something else.

As we know today, this was a wrong statement of Otto Ambros. The patents, to which the chemist referred with Hitler, described very far chemical forerunners of TABUN and SARIN. To nerve agent materials they were only developed further in the IG- Farben labs by Gerhard Schrader, as I already pointed out. It is therefore easily understandable, if Paxman & Harris (p. 90) write that a substantial deployment of TABUN would have been war decisive for Germany. If Ambros would had been an equal vehement “chemical warfare fighter” like Fritz Haber (1868-1934) at WWI, would not be the following (hypothetical) formulation in this lecture with Hitler on May 15, 1943 more probable?

"I believe, my “Führer” that the early described organophosphorus compounds do not approach our toxicity of the Trilon family. Even if they could discover the chemical composition after our initial deployment of our volatile offensive nerve agents, they might need at least 3 years, in order to realize an industrial production of nerve agent too. Thus, my ”Führer”, we have a strategic superiority in relation to the enemy, which however will answering with other "conventional" chemical warfare agents. To circumstance this, we have

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Aus Publikationen ist bekannt geworden, daß - besonders in Amerika [see. Chap. Allied Activities Relating to Nerve Agent] - *mit Körpern verwandter Konstitution wissenschaftliche Untersuchungen laufen“*. See Kahlert p. 325

[49] Nach der Denkschrift vom 20.3. 1944 (Brauch & Müller S. 184 Dokument 49) von Ambros: [...] *Die deutsche Wehrmacht verfügt über die wichtigsten Typen des vergangenen* [1.] *Weltkriegs. Es ist aber anzunehmen, daß die gegnerische Seite von diesen Kampfstoffen ungleich höhere Mengen gespeichert hat bzw. laufend produzieren kann. Dies wird vor allem bei Lost vermutet. Wie weit die deutsche Wehrmacht im neuen Typ jetzt* [1. 3. 1944] *und im SARIN ab 1945 eine Monopolstellung hat, ist nicht sicher zu beurteilen.* ***Es bestehen Befürchtungen, daß die gegnerische Seite auf diesem Gebiet*** [der Nervengasherstellung] ***arbeitet, so daß auch dieser Einsatz nicht überschätzt werden darf***. [bold Kahlert], see Kahlert p. 327

to launch our weapons strategically against the Royal Air Force (RAF) for killing the pilots - the consequence would be a surrender of Great Britain ".[50]

In the 1980`s Ambros stated to Gellerman (p. 159) that *"this perception of the experts of the chemical industry* [on May 15, 1943 of Ambros] *appears to have a certain impact to Hitler"*, and Ambros had the following impression after the lecture *"that Hitler and its environment felt relieved of a burden, need not to meet a decision in the chemical warfare area".*

The scientists focused their attention to the fact that since the beginning of the war in American technical periodicals there had not been any reference to "nerve-agent-similar compounds" (what that ever means). This situation was repeated with the building of the atomic bomb. They pulled themselves to the correct conclusion that this was the result of the US-American censorship (the German censorship in scientific magazines however were not very strong!). What they did not realize, that it this happened at the secrecy of the insecticide DDT, which was developed straight forward and it is not relating to the nerve-agent-similar compounds which Paxman & Harris (p. 86) implicitly mean[51].

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[50] Kahlert p. 331
[51] Kahlert p. 327