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TRANSLATION OF EXPERT REPORT

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Expert Report  
About the Formation and Detectability  
of Cyanide Compounds  
in the 'Gas Chambers' of Auschwitz

3<sup>rd</sup> enhanced and corrected edition, November 1992 © Germar Rudolf, Kernerplatz 1, D-7000 Stuttgart  
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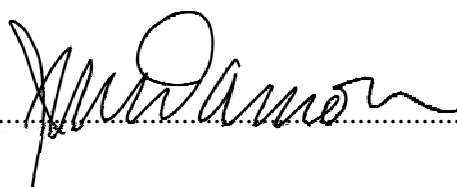
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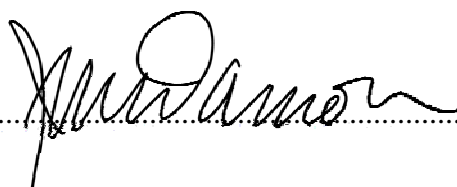
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## Introduction

This report was requested by attorneys whose client is charged with having spread false facts regarding the gassings of human beings in Auschwitz. For this purpose motions to present evidence were submitted to me, about which I, summoned by the court or by the defense, will have to testify as an expert witness, if necessary under oath. It is my task to provide a clarification and answer for the assertions, conclusions and questions of the motions to present evidence (see special enclosure).

First of all, an expert witness is naturally confronted with the question of whether everything connected with the alleged gas chambers in Auschwitz has not long been made clear, or whether there are blank spots in the research in this area. In order to answer this question, I turned first to the Auschwitz trial at Frankfurt in the beginning of the 1960s, which constitutes a particularly clear-cut milestone of Holocaust research regarding the 'gas chambers' in Auschwitz. Hydrogen cyanide (HCN) as the active component of a product with the trade name of Zyklon-B is a highly poisonous gas which in sufficient doses is fatal to humans within a few minutes, as the Frankfurt verdict accurately and in accord with the general opinion stated. A precise description of the action, such as of the speed of release of the toxic gas from the product, attainment of quickly lethal gas concentrations in the air, duration of the gas release until complete dissipation, adsorption and absorption of the gas in the human body and in the masonry and the resultant reactions, all these the court did not allow to be recognized; also, it did not take into consideration material traces of the events, therefore no expert witnesses in the field of chemistry, especially for the analysis of the formation and deductibility of cyanide compounds, were enlisted for reaching a verdict. Until the submission of the Leuchter Report there were no large-scale analyses in the natural sciences, which, in view of the importance of the topic, is astonishing.

It is possible for the expert witness to comment on facts and events cited in motions to present evidence (special enclosure): on the one hand by evaluating analytical results of various material samples from the buildings in Auschwitz which are under consideration, on the other hand on the basis of the methods in the killings depicted by witnesses.

The evidentiary topics are concerned in the one case with signs of the deed, in the other the actions of men who handled the Zyklon-B, or suffered from it, or who entered the rooms alleged to be gas chambers before their operation, be they victims or henchmen, and those who after the operation removed the corpses from the rooms.

Preceding the proceedings, in which this material report is presented, was a trial in 1985 in Toronto, Canada, in which the distributor of the book "Did Six Million Really Die?" [1], Ernst Zündel, was charged because he tried to refute with the book the mass murder of the Jews in the Third Reich. In the course of the trial, the accused succeeded in commissioning Fred Leuchter, the only specialist for the construction and operation of the hydrocyanic execution gas chambers, which exist in the USA since the 1920s, to join an investigative commission which was supposed to examine the localities in Poland for the technical possibilities of their use for mass murder with hydrogen cyanide poison gas, and to detect possible poisonous gas residues in the walls of the presumed 'human gas chambers'. The result, the Leuchter Report [2], was presented to the court in 1988; in the meantime it has been presented as evidence in several other trials. Aside from its many technical arguments, the chemical analysis results of wall material are facts, on the basis of which the American Leuchter believes that he must come to the conclusion that the "alleged" (Leuchter) 'gas chambers' of the tested installations "could not have then been or now be utilized or seriously considered to function as execution gas chambers."

First there appeared in Frankfurt in the newspaper 'Jour Juif' an attempt to refute the Leuchter Report by the pharmacist J.-C. Pressac [3]. His explanations however, due to the lack of any citations

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of sources and precise, scientifically relevant arguments, cannot qualify as an expert answer. He does draw attention to a few flaws of the report, but succumbs, for a lack of sufficient expertise in chemical and engineering issues, to some errors of his own.

On the German side, the Institute for Contemporary History was the first to address this topic[4], which foremost refers to Pressac. Somewhat later there appeared in a book about the Third Reich an article by [SENIOR Social Official (ret.) - Sozialoberrat a.D.] W. Wegner [5] in which the Leuchter report is likewise attacked with partially unfounded conclusions and assertions, instead of consulting experts such as chemists, engineers and experts on the techniques of cremation and ventilation and verifying his assertions with their knowledge of the subjects. Finally, around the end of 1991, a brochure appeared in Austria in which the chemist J. Bailer subjected the Leuchter Report to a critique[6]. This contribution proved to be one in which, on the one hand, the testimonies regarding the alleged gassing events in Auschwitz in broad areas are ignored. On the other hand, the author's insufficient knowledge about the reaction of hydrogen cyanide with masonry materials is astounding. At roughly the same time as Bailer's first publication, a statement by G. Wellers on the Leuchter Report appeared which is impressive in its lack of technical and scientific expertise[7].

Most of the above cited attempts to refute the Leuchter Report are distinguished by uncalled for remarks here and there about the persons who support Leuchter's hypotheses, or by polemical marginal notes, none of which are necessary to the scientific discussion.

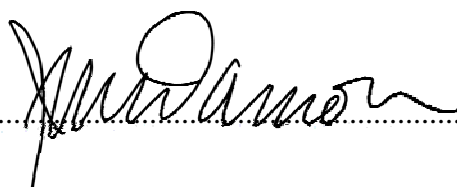
Finally, the State Museum Auschwitz found itself compelled by Leuchter's chemical tests to commission its own report. On 24 September 1990, the Institute for Forensic Research, Section of Forensic Toxicology (named after Prof. Dr. Jan Sehn, Cracow, Poland), under Prof. Dr. J. Markiewicz drew up a report restricted for the time being only to the analysis of masonry samples[8]. On balance, the result of this report is that Leuchter's mostly negative cyanide findings in the samples of the 'human gas chambers' must be attributed to the weathering of over 40 years on the cyanide compounds, which they say would not have survived.

A detailed analysis of the works brought forward against the Leuchter Report will follow in the sixth part of this report.

The course of the trial in Toronto, about which an English publication in book form has become available in the meantime[9], the further discussions arising therefrom, as well as tests on the site underway since 1988, all combined made it possible to portray in greater detail the plastic image of the gassings of human beings which was presented by testimonies relatively briefly at the Auschwitz trial at Frankfurt, and to do so more precisely. In so doing, depictions and opinions from the scientific side were subjected to an examination only insofar as they do not contradict the statements of the verdict, but rather complement it. Where other scientific discoveries go beyond the statement of the verdict, they likewise have been subjected to an examination, but also the opposite views.

In its details, the following will not only use the Frankfurt verdict as a starting point, but also the diverse conclusions of the respective scientists and researchers, in order to provide a more exact understanding of the events than the verdict alone is capable of giving.

After a roughly eight month lasting intensively theoretical as well as practical study of the chemical aspects of the subjects dealt with here, the request was brought to me in late summer 1991 by an attorney to subject the previously produced reports (Leuchter, Markiewicz) and their critiques (Pressac, Institute for Contemporary History, Wegner, Bailer, Wellers, Jagschitz, Fleming) to a scientific analysis. The results of this analysis together with the already worked out research and test results from the



premises of the camp were supposed to be summarized in a report. This report is an expanded version of the one first published in early 1992. The individual fields are looked into in greater depth, and new aspects, worked out with the help of other experts, are added.

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The report is organized in five parts:

1. A description of the manner of construction of the alleged 'human gas chambers', as well as the clothing delousing facilities, and the establishment of the current condition of both facilities. This is necessary since type of material, manner of construction, and outfitting of the facilities can have a substantial influence on the pigmentation formation. On the other hand, the condition of the buildings, or their ruins, during the last 45 years can have an influence on the detectability of the resulting pigments. For this part, sub-expert statements by engineers of different subject areas were obtained.
2. A general chemical investigation of the formation and stability of the Iron Blue pigment in view of the parameters determined by Part 1.
3. Comparison of the procedure of the alleged gassings of human beings and the gassing of material objects with Zyklon-B. After a depiction of the procedure alleged in the literature, inclusive of an attempt to weigh the reliability of these sources, this information is subjected to a critique with scientific calculations and scientific results to determine what is factually possible.
4. Presentation of analyses results of masonry samples of the gas and delousing chambers as achieved by different institutions and/or persons. From the knowledge of the manner of construction and outfitting of the facilities (Part 1), the findings regarding the reaction of the hydrogen cyanide and the ensuing compounds (Part 2), as well as the knowledge of the possible procedures (Part 3), an estimate of the intensity of the pigment formation in the respective facilities as well as the detectability of residues at the present is possible. From the comparison with the factual analytical results, corresponding conclusions will be drawn.
5. Critique of the works brought forward against the Leuchter Report. After a presentation of the main hypotheses, these will be subjected to a scientific investigation for their validity, taking into account the conclusions reached before.

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## Definitions

In the following, the rooms under consideration for alleged mass homicidal gassings with hydrogen cyanide are called (human) 'gas chambers', according to the general use of language, together with the original names of these rooms (e.g., corpse cellar I ('gas chamber')). This is done by ignoring the question whether these rooms indeed were 'gas chambers' or how a 'gas chambers' looks like at all. An answer to the latter question can be found in the first and third Leuchter Report, which describe the existing execution gas chambers in the USA[2,11].

The official term of the war-time for material delousing chambers was gas chambers, which can lead to misunderstandings (see section 1.4, p. 32). Hence, the term (material) delousing facility is used here.

The corpse incineration facilities are subsequently called crematoria. In them, 'homicidal gas chambers' were allegedly located. During the German rule in WWII, the crematories of the camps Ausch-

witz I (main camp) and Auschwitz II (Birkenau) were numbered separately: crematorium I in the main camp and crematorium I to IV in Birkenau. Today, the crematoria are numbered independently from their location. Subsequently, the numbering used today will be used: The crematorium I was in the was camp, the crematoria II to V in Birkenau (see Illustrations 1 to 3, p. 11 to 13.)

If the characterization ‘gas-tight’ occurred in war-time documents for shutters and doors, this generally refers to doors and shutters made of wood, surrounded with felt sealing. By no means hermetically closing, heavy steel doors and shutters are meant with this.

To avoid the use of too many equations and special terms, hydrogen cyanide (German: blue acid) refers to hydrogen cyanide (HCN), although only a solution of HCN in water could correctly be called that way

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**Illustration 1:** Map of the area of Auschwitz during the Second World War.

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**Illustration 2:** Map of the prisoner of war camp Auschwitz I/ main camp, according to a brochure of the State Museum Auschwitz 1991.

Block 1-28: Inmate Barracks

- |                               |   |
|-------------------------------|---|
| a: dwelling of the commander  | h: crematorium I with ‘gas chamber’                         |
| b: Main Guard                 | i: Guard Post with entrance to the camp (Block leader room) |
| c: camp command head quarters | j: camp kitchen   |
| d: administration building    | k: reception building                                       |
| e: SS hospital                | l: material store, theater                                  |
| f,g: political department     | m: new laundry  |

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**Illustration 3:** map of prisoner of war camp Auschwitz II/ Birkenau, some 2 km to the north-west of the main camp. According to a brochure of the State Museum Auschwitz 1991.

- |   |  |
|---|--|
| BI-III: construction sections I – III     | K IV: crematorium IV with ‘gas chamber’      |
| Bla/b: women camp                         | K V: crematorium V with ‘gas chamber’        |
| BIIa: quarantine camp                     | S: central sauna, hot air/steam delousing    |
| BIIb: family camp                         | T: Pond                                      |
| BIIc: Hungarian camp                      | 1: Building 5a – Zyklon B material delousing |
| BIId: men camp                            | 2: Building 5b – Zyklon B material delousing |
| BIIf: gipsy camp                          | 3: inmates barrack no. 13                    |
| BIIf: hospital for inmates                | 4: inmates barrack no. 20                    |
| K II: crematorium II with ‘gas chamber’   | 5: inmates barrack no. 3                     |
| K III: crematorium III with ‘gas chamber’ |  |

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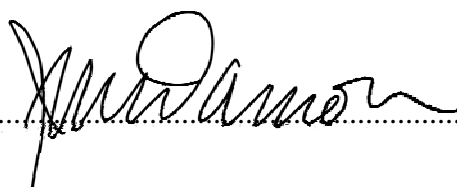
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# 1. Manner of Construction of the Gassing Facilities

## 1.1. Significance of the Camp of Auschwitz

Among the works published after 1988, the work of the pharmacist J.C. Pressac offers the possibility of getting informed about the mechanics of the ‘gas chambers’ of Auschwitz with a large degree of unanimity with the Frankfurt verdict[12]<sup>1</sup>. Reference is therefore made many times to this work, which today is recognized as the standard work regarding the mechanics of the ‘gas chambers’ of Auschwitz.<sup>2</sup>



Reference is also made to critical contributions to this book[15,16].

The history of Auschwitz reads, according to Pressac (see there), inter alia, as follows: The facilities of the camp Auschwitz I/main camp originally were barracks of the Austro-Hungarian monarchy (later of Poland), which were transformed into a concentration camp after the war against Poland. The camp Auschwitz II/Birkenau was built from scratch after the start of the Russian campaign, officially as a prisoner of war camp of the Waffen-SS for the reception of Russian prisoners of war. Both camps belonged to a complex system with over 30 camps which were supposed to provide labor forces for the chemical works of I.G. Farbenindustrie AG, the Upper Silesian BUNA Works for the refinement of coal (coal liquefaction and gasification for synthetics production and fuel production), which were newly established by the Germans (see Illustration 1, p. 11). The Birkenau camp served, among other things, as a receptacle of prisoners unable to work. The camp capacity for 200,000 to 300,000 inmates was unique among the camps run by the Third Reich. The taking in of large numbers of people into such a small area in hygienically backwards Eastern Europe entailed in all of the camps major health problems, since in most cases these humans were heavily lice infested. Lice, however, are the primary carriers of typhus pathogens (typhoid fever). The camps therefore had vast delousing facilities, in which the clothes and possessions of the newly arriving inmates were deloused, for the most part with the insecticide Zyklon-B, an insecticide usually used for this purpose in those days. The inmates themselves had their hair cut<sup>3</sup> and had to thoroughly cleanse themselves in showers (for this see Sections 1.4., p. 32, and 3.3., p. 59). Nevertheless, typhus epidemics broke out again and again to which inmates and guards alike fell victim in large numbers. According to a non-representative sample survey from the official death books of Auschwitz, infirmity was a frequent cause of death even among prisoners of the Jewish faith. Furthermore, it follows that typhus epidemics claimed a large share of the dead of Auschwitz [18]. But according to the previous conception just young and old men were supposed to have been gassed immediately *without* registration in the death books. Due to the high rate of death in the camps they were outfitted with incineration/cremation facilities. In Birkenau, due to a devastatingly fierce typhus epidemic in the summer of 1942, four cremation facilities were built, of which two broke down shortly after being put into operation. Because the capacity was already too high, they were not repaired. The main camp in Auschwitz possessed only one cremation facility, which was shut down when the facilities in Birkenau were put into operation.

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1 Herr Auerbach from the Institute for Contemporary History calls the pharmacists J.-C. Pressac a “real expert on the gassing procedures”, in contrary to his judgment about the American expert for execution technologies and gas chamber construction F. Leuchter[4].

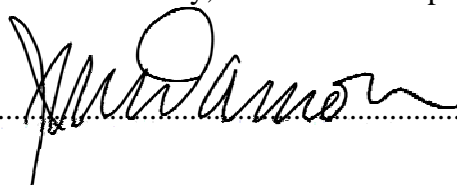
2 G. Fleming’s research in Moscow archives in 1991[12] did not yield any new insight compared to Pressac’s knowledge, even if the media wrote otherwise[14].

3 In the Third Reich, hairs of a certain length alleged were recycled, for which they were deloused beforehand[17]. If cyanide was found in hair after the war, this can be an explanation for this. This does by no means prove homicidal gassing, as Bailer postulates[6]. Even prior to an upcoming execution it would be easier and more reasonable to cut the still clean hair off the humans before they were killed.

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The historical literature today assumes that the large cremation facilities served not only their planned function, but also were later misused for the mass annihilation of the Jews, among others. Accordingly, the term “incapable of labor” applied to the prisoners was synonymous with unworthy of living. That means the arriving men who were incapable of working were killed directly. For that people are supposed to have been killed (‘gassed’) in several rooms of the respective cremation facilities after a few structural changes, by means of Zyklon-B, which was actually meant to be used for combating insect pests, and then burnt partly in the cremation ovens, and partly in open graves.

At war-time, according to witness testimony, in the main camp Auschwitz I there was supposed to have



been one 'gas chamber' in crematorium I, which has been preserved to this day practically intact; in the Birkenau camp or Auschwitz II, approximately two kilometers away, there were supposed to have been an additional four 'gas chambers' in Crematoriums II through V, as well as two farmhouses outside of the camp itself converted for the purposes of gassing.

Apart from twenty-three other buildings[19], the Birkenau camp had rooms used as hydrogen cyanide delousing chambers in one wing of both buildings 5a and b (BW 5a/b). The individual facilities are presented and characterized below. For this, see the maps of the Auschwitz main camp and of Birkenau, Illustrations 1 through 3.

## 1.2. 'gas chamber' in the Main Camp Auschwitz I

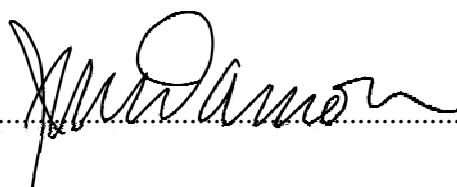
There is no material or documentary evidence of the 'gas chamber' in the crematorium of the main camp, according to Pressac; however, there are many witness testimonies ("As evidence to establish the reality of homicidal gassings there remain only the testimonies of participants, [...]" [20]). According to Pressac, these stand out due to diverse contradictions, technical impossibilities and unbelievable assertions in general. He detects a "general tendency to exaggerate", explains the gross errors and material impossibilities in the testimony and notes of the camp commandant Höss by writing "He was present, without seeing", i.e., that Höss had no idea of the methods, risks and dangers in the handling of Zyklon-B. But this stands in contradiction to an order of the camp commandant Höss, in which he required caution in the fumigation of the barracks with Zyklon-B, the order having become necessary due to poisoning accidents. This special order of the camp commandant warning of gassings accidents by Zyklon-B, which was distributed through the entire camp, speaks for a preventive obligation with regard to those inmates who allegedly were supposed to die sooner or later from this gas[21]. Furthermore, Pressac states that the form and basic tone of the testimony of SS-Mann Perry S. Broad was false on account of his Polish patriotism, his transparent hatred for SS men (he was himself one) and on account of "slight" (quotation in Pressac) revisions of the document by the Poles, whose original is missing. But the basic statement concerning the gassings of people, according to his opinion, is correct[22].

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**Illustration 4:** ground plan of crematorium I in Auschwitz I/main camp in the original planning stage. The morgue was allegedly supposed to have been used later as a gas chamber[19].

1: Anteroom                      3: Wash-room                      5: Oven room 7: Urns  
2: Funeral room                4: Morgue (gas chamber)        6: Coke

The 'gas chamber' of the main camp is a room of a building built at ground level, stemming from working quarters located in the same place of the former barracks from the Austro-Hungarian monarchy [23]. The floor and ceiling of this crematorium I consist of reinforced concrete, the outer walls of brick masonry, which is insulated on the outside by a layer of tar. Except for the entrances to the building it is practically set into soil by an earthen berm at the wall. The inner walls are plastered and whitewashed. Illustration 4 (above) shows the ground plan of the building at the beginning of the war, planned and built as a normal crematorium with a mortuary[24]. Thus explains the earthen berm, which was supposed to ensure a uniformly cool temperature. For the same reason the dividing wall between the morgue and the cremation room is double bricked with a warmth-insulating gap of air in between. Later, the mortuary was supposed to have been reconfigured into a 'gas chamber.' To introduce the Zyklon-B for the gassing of human beings, three to four hatches were supposed to have been punched through the roof afterwards, as well as one or two additional hatches for the installation of ventilators [25]. Pressac shows a photo of the crematorium roof, taken by the Soviets shortly after liberation, on which the roofing felt shows three darkened patches, allegedly the skips of the hidden former insertion hatches [25,26].





In the autumn of 1944, the crematorium was transformed into an air raid shelter. The structural alterations, especially the replacement of the light dividing walls by massive masonry walls, can be inferred from Illustration 5 (p. 18)[27]. The direct entrance to the air raid rooms, resulting from the fourfold subdivision of the mortuary / 'gas chamber', was effected by a porch, which, according to Pressac, is today passed off as the victims' entrance, even though the 'gas chamber' there still had no entrance [25]. Likewise, toilets were installed at this time in the former wash room, as well as ventilation flues, which are still there today, being punched through the roof. The Zyklon-B insertion holes as well as the ventilation holes are supposed to have been sealed at this time.

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**Illustration 5:** Illustration of KI from the air, ground plan of Crematorium I in Camp Auschwitz I/main camp after the conversion to an air raid shelter in 1944[22].

- |                   |                            |                     |
|-------------------|----------------------------|---------------------|
| 1. Sluice         | 3. Former washroom, now    | 4. Air raid rooms   |
| 2. Operating room | air raid room with toilets | 5. Former oven room |

Illustration 6 (p. 19) shows the ground plan of the crematorium in its current state [28]. The entrance from the mortuary/'gas chamber' to the former cremation room was, according to Pressac, newly created after the war next to the original place. The dividing walls of the air raid shelter, inclusive of the wall to the wash room, which never belonged to the mortuary/'gas chamber', were torn out. Accordingly, the confused visitor to this day still sees the waste pipes of the two toilets in the alleged 'gas chamber'. After the war, the roof is supposed to have been newly covered with roofing felt, by which the traces of the Zyklon-B holes, as well as the ventilation holes, of the 'gas chamber' are supposed to have been concealed. The renewed installation of four staggered Zyklon-B insertion nozzles by the Polish Auschwitz Museum after the war is therefore not supposed to have been effected at the original position. This argument of Pressac is astonishing, since the concrete ceiling is unplastered and unlined. Therefore, one could ascertain from the inside the position of the original, possibly sealed holes and could punch them out again.

As the museum administration confirms to the visitors' enquiry, the two cremation ovens in the cremation room and the flue located on the outside also were erected after the war, for museum purposes, without being functionally connected in the positions of the facilities formerly located there [29].

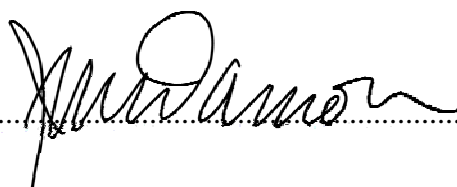
It can be ascertained without challenge that the ceiling, outer walls and buttresses, as well as the foundation of the building are in their original condition. If openings for the installation of insertion nozzles and ventilation units had been in existence in the reinforced concrete ceiling, the damage to the concrete structure at the corresponding point on the unplastered inner ceiling would have to be visible, since this damage could not be undone without leaving behind permanently visible traces. Apart from the current insertion nozzles, there are no signs in the ceiling of any previous openings. Therefore,

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**Illustration 6:** ground plan of crematorium I in Camp Auschwitz I/main camp today, after the later manipulations[23].

- 1: Gas chamber, 2: Zyklon-B insertion shams, 3: Waste pipes of the bathrooms, 4: Former dividing wall between mortuary and washroom, 5: Ventilation flue of the air raid shelter, 6: Air raid sluice, today described as the victims' entrance, 7: Urns, 8: Coke, 9: Reconstructed ovens, 10: Newly bored passage to the oven room; broken line; old passage, 11: Remnants of the old oven, 12: Sham flue

the alleged penetrations at another location never existed! The penetrations through the concrete visible today are neither plastered, nor have the remnants of the severed reinforcing rods been correctly removed. The holes are panelled over with wood and sealed with tar in a makeshift manner. Such untidy work corresponds neither with the caution demanded by the handling of toxic gas, nor with the work of



the German construction industry. If the SS on their part had made these concrete penetrations (others never existed!), an equal distribution of the four nozzles in the ceiling of the original(!) mortuary for the purpose of evenly distributing the Zyklon-B in the room is furthermore to be assumed. But the current nozzles are only evenly distributed on the room ceiling if the wash room, which was included in the main room only after the war, is considered to be an integral part of the mortuary ('gas chamber') (see Illustration 6). The arrangement of the insertion nozzles therefore only makes sense if they were specially produced for the "museum reconstructions" (B. Bailer-Galanda [29]), which are of the wrong dimensions for the current state of the facility, and therefore after the war. Until now it has been assumed without challenge that the insertion holes visible today were only produced after the war, without at the same time going back to allegedly existing vestiges of old, closed up holes.

From all these arguments it can be concluded with certainty that at the time of the alleged period of use of the rooms as 'gas chambers' there were no penetrations for the insertion of Zyklon-B. Moreover, there is no sign of any former setup for ventilating the room.

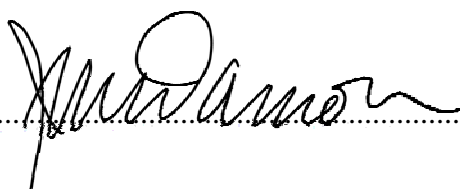
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### 1.3. 'Gas Chambers' in the Birkenau Camp

#### 1.3.1. Crematoria II and III

In size, equipment and manner of construction these crematoria are quite comparable with other facilities built at that time in the Reich, as well as with those of today [30]. This was pointed out at the trial against the architects of the cremation facilities in the Birkenau Camp. The court in 1972 acquitted the two defendants, master builder W. Dejaco and master builder F. Ertl, since the suspicion of being accessories to mass murder could not be substantiated [31].

A specially partitioned morgue with improved ventilation served then, as today in other places, as an area to keep the victims of epidemics (infection morgue). From Illustration 7 (p. 21) the ground plan of Mortuaries I ('gas chamber') of Crematorium II and, corresponding in mirror image, of Crematorium III is to be inferred; Illustration 8 (p. 21) shows the cross-section [32]. As is apparent in the cross-section, these morgues lie to a large degree under the ground. The elongated design of the morgues, their subterranean location, as well as the limited contact to the cremation rooms produces a uniformly cool temperature in these areas. This speaks for their planning as mortuaries, which they are designated as in the construction plans. Pressac endorses this interpretation. According to him the facilities are descended from an earlier plan for a new crematorium in the main camp from the year 1941 [33]. The access road to the crematorium in Birkenau lay on the side of the chimney section, on top of Illustration 7 (p. 21). This necessitated the moving of the entrance away from the corner of both morgues, where they were originally located in the plans for the main camp. Therefore, an entrance staircase to the offices of Mortuary III was created, as well as a staircase at the end of Mortuary II (not drawn in Illustration 7). As a result of the dramatically altered war situation after the defeat at Stalingrad in the winter of 1942/43, a corpse chute here, as was planned in place of the old stairs, apparently was abandoned on the grounds of expense. Possibly for the same reason, Crematorium III, which was begun later, was at many points economized [34], and also the material and qualitative shortcomings of Crematoriums IV and V may have led to their rapid breakdown (see next section). The old morgue exit envisioned for the planning stage of the main camp had already been completed beforehand, even though it was not used later on, since no direct entrance from the street was possible from there. That this staircase was built anyway speaks for an overhasty transposition of the old plans for the main camp to the new situation in Birkenau. The later constructed entrance staircase at the end of Mortuaries II of Crematoriums II and III is today interpreted in the sense that this had been the victims' entrance, since Mortuary II was sup-



posed to have served as the undressing room for the victims. The designation of the premises as an undressing is not evidence of a criminal act, since all corpses would normally be stripped for dissection. The lack of a corpse chute at the companionway which was added later is, according to Pressac, additional proof for the conversion of the crematoria into human annihilation rooms, since corpses could not climb stairs [35]. However, Pressac does not answer the question of how the corpses got from their places of death, e.g. in the hospital, to the crematorium chute and from the end of the chute to their storage areas. But, obviously, the corpses can be carried on a stretcher, and even down a staircase with a few steps.

The floor and ceiling of Mortuary I ('gas chamber') are reinforced concrete. Since the wall plug technology was still very immature then, conically shaped pieces of wood were inserted on the underside of the concrete, which later served as places to fix, for example, wires and lamps. Pressac interprets these pieces of wood as insertion places for dummy showerheads, which were supposed to have been installed in Mortuary I in order to deceive the victims into thinking that it was a shower room [36].

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**Illustration 7:** Ground plan of Mortuaries I (alleged 'gas chambers') of Crematorium II and III (mirror image) in Camp Auschwitz II/Birkenau [32].

- a: Mortuary I/'gas chamber', 30x7x2.41 meters
- b: Mortuary II/'undressing room', 49.5x7.9x2.3 meters
- c: Rooms of the later subdivided Mortuary III
- d: Corpse hoist to the oven room on the ground floor
- e: Ventilation shaft
- f: Concrete support pillars
- g: Concrete supporting beam
- h: Entrance constructed later
- 1-3: Extraction points for Samples 1-3

**Illustration 8:** Cross-section of Mortuaries I (alleged 'gas chambers') of Crematorium II and III (mirror image) in Camp Auschwitz II/Birkenau [32].

- a: Ventilation shaft
- b: Air intake shaft
- c: Soil

The walls are made from double brick masonry with an intervening layer of tar for insulation [34]. The inner walls are plastered with a hard, cement rich material; the reinforced concrete ceiling and the support pillars show the grain of the framework, and therefore are not plastered. The layer of tar between the brick walls seems to be imperative as a water barrier due to the high ground water level in the swampy area of Birkenau. Both mortuaries contained multiple drains. From a document it can be inferred that air tight doors of the size 100x192 cm were ordered for the Mortuaries I ('gas chamber') of Crematoriums II and III [37]. However, on the plan of handover, the final plan of Crematorium II, the door size, as on all previous plans, is marked as 190x200 cm[38]. Even today it would have to be possible to determine from the ruins whether the door was possibly built narrower and if the door frames still exist. In any case excavations are required for this.

In the cross-section drawing of Mortuary I, air intake shafts are visible both at the top and at the bottom on the walls, which according to Pressac were installed as ventilation shafts for mortuaries [39]. In the ground plan one can recognize on the left and right the course of shafts running to and from the main shaft. Therefore, the lower shaft was used for ventilating from the room. This is also supposed to have been retained for the alleged later gassings. All rooms in the rooms of Crematoriums II and III are, according to Pressac, supposed to have had a similar capacity for ventilation from the room, as well as the

oven room [40], but only Mortuary I ('gas chamber') possessed an air intake. Pressac explains for all rooms the power of the pump motors which he allegedly has inferred from the site office of the camp. A 3.5 horsepower electric motor (2.5 Kilowatt) is supposed to have served for Mortuary I ('gas chamber'). Of course, the motor strength indicates only in a small way the capacity of the ventilation [41]. The outflow openings of the air intake shaft of Mortuaries I ('gas chambers') with the dimension 5×10 cm (50 count in Crematorium II, 95 in Crematorium III) were covered with screens, each with around 110 holes of approximately 3.5 mm diameter [42].

A radiator, even though allegedly considered in the meantime, had never been present. Pressac interprets this interim consideration of the installation of a radiator as proof for the existence of gas chambers, since morgues would not have to be heated. He ignores the circumstance that in every

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**Illustration 9:** Enlarged section of Allied aerial photo No. 3185 of the Birkenau camp of 25 August 1944. Scale of original: 1:10,000. Of interest are the dark splotches on the Mortuaries I ('gas chambers') of both crematoria (arrows), of which it is known today that they are not insertion points for Zyklon-B.

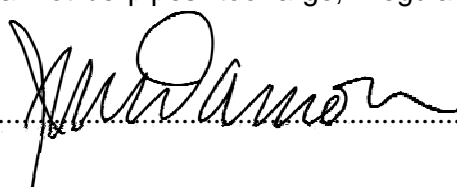
crematorium the bodies are protected against frost. In a proper operation of this facility, the morgues would at least have to be heated during the winter. At the same time, he interprets the removal of the exposed plumbing in Mortuary I ('gas chamber') as referring to the 'gas chamber', since the victims could have torn out the exposed pipe. The simpler non-criminal explanation that the plumbing, which could freeze in the winter since there was no heat, had to be shut down to avoid risking a water-pipe rupture also presents itself [43].

There are also supposed to have been hatches in the roof here for the introduction of Zyklon-B. Pressac shows some outside shots of the crematoria from that time, in which the insertion points are supposed to be recognizable [44]. In the photo of Crematorium II, moreover, only three shadowy reflections interpreted as pipes are recognizable. In accordance with this, the pipes, standing vertically in a row, are approximately 50 cm high and no wider than 30 cm. In the photo of Crematorium III nothing is recognizable, even though the quality of the photo is quite good. (It should be pointed out that it is very easy to alter any photo with traditional retouching techniques. Photos, therefore, possess questionable evidential value.)

According to the testimony of former inmate M. Kula, the insertion points were supposed to have been hollow columns with a square base, 70 mm on a side, fabricated in the central workshop which distributed the Zyklon-B preparation evenly among the tightly packed people on the floor of the morgue by means of an unknown mechanism[45]. There is no documentary reference for these columns. According to Pressac's interpretation, four, not further defined, "wire net push-in devices" [TRANS. note: the German term is "Drahtnetzeinschubvorrichtungen", where "einschub" means "push in", a rather cumbersome term] served as removable wire inserts in the hollow columns of Mortuary I ('gas chamber') described by Kula. However, these "wire net push-in devices" were only entered later by hand in the inventory of Mortuary II of Crematorium II, that is, in the "wrong" morgue. By means of these nets the Zyklon-B is supposed to have been released into the chamber and drawn out again after completion [46]. Pressac shows a drawing of the insertion column, whereby, without explanation, he cites the length of a side as 70 cm instead of 70 mm, and therefore ten times greater than Kula [42]. But these wire net push-in devices could also have served simply to

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**Illustration 10:** Schematic drawing of the aerial photo above, Illustration 9. Marked are Crematoriums II and III (below), as well as three inmates barracks in Birkenau. One can easily recognize that the splotches on Mortuaries I cannot be pipes: too large, irregular splotches with shadows in the wrong



direction.

**Illustration 11:** Schematic diagram of the position and size of the splotches (aerial photo, Ill. 9) on the roof of Mortuary I ('gas chamber') of Crematorium II and the position of the only two holes which can be found (circled). Right: Ill. 16, left: Ill. 15.

push corpses into the cremation ovens. In the case of their use as Zyklon-B nets, they would have more likely been called inlet wire nets [TRANS. note: the German term is "Einlaßdrahtnetze", a phonically much more manageable term].

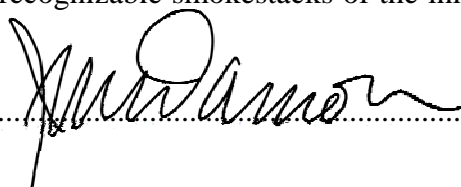
Illustration 9 shows an enlarged section of an Allied aerial photo of the Birkenau camp on 25 August 1944 [47]. On the cross-section, the roof of Mortuary I ('gas chamber') of Crematorium II, one can clearly recognize shadows (arrows). An evaluation of this aerial photo reveals that the dark splotches in Illustration 9 cannot be elevations [48]. If the Zyklon-B insertion columns actually had the 70 mm base length described by the witness, then that cannot be reconciled with either the irregularly shaped, approximately 3 m<sup>2</sup> in area splotches in the aerial photo, nor with the size of the roughly 60 to 80 cm wide punctures on the spot. Besides, they would hardly be visible due to the insufficient resolution of this aerial photo. It should be pointed out that the chimneys of the inmate barracks, as well as the tall crematorium chimneys cast sharply contrasted, symmetrical, straight shadows. The alleged insertion points of Mortuary I ('gas chamber') of Crematorium II and Crematorium III form a regular, easily measured angle of approximately 75 degrees to the alignment of the main section of Crematorium II (see the schematic drawing, Illustration 10, p. 23). But in reality these shadows would have to have the same alignment as the shadows of the cremation chimney of Crematorium II, of one of the chimneys of the inmate barracks, as well as other sharply prominent parts in the picture. These, in contrast to the splotches above, form a 45 degree angle to the main direction of Crematoriums II and III (see Illustration 10).

It is known that the cremation chimneys were 15 meters high [32]. In the picture it casts a shadow which is five times as long as the splotches on the roof of Mortuary I ('gas chamber') of Crematorium III (length of the chimney shadow 20 meters; therefore the position of the sun is 37 degrees; length of the splotches on Mortuary I ['gas chamber'] of Crematorium III: roughly 4 meters.) That can mean nothing other than that the insertion pipes belonging to Mortuary I ('gas chamber') of Crematorium III would have towered 3 meters over its roof, which can be ruled out.

The false shadow cannot be explained by overly long pipes or 4 meter long vents, just as the size of the pipes does not fit the size of the

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pipes allegedly depicted in Pressac's picture [44]. Regarding the objects on the roof of crematorium III one today assumes that these are objects of some 3 to 4 m length and only a few decimeters height. In a shot from 13 September 1944, three weeks later, these splotches are likewise recognizable, even if considerably weaker due to the smoke buildup of the bombing. The splotches on the roof of Mortuary I of Crematorium III point in the same direction as those in the photo of 25 August 1944, despite a completely different position of the sun [48]. Of interest is an available undated photo from the winter of 1944/45 taken during the dismantling of Crematoriums II and III, whose main section roofs are already covered over, but before the demolition of Crematorium V (allegedly in January 1945) [49]. In this photo the exposed furnace room holes of Crematoriums II and III are not recognizable. Therefore, holes of a similar size in the roofs of the morgues of both facilities likewise should not have been visible. In the case of a shadow-casting elevation by approximately 50 cm to 1 meter high pipes, however, something would have to be visible in the aerial photos with higher resolution (25 August 1944, 13 September 1944), since the recognizable smokestacks of the inmate barracks are dimensioned as simi-



larly as the holes in the ceiling of Mortuary I of Crematorium II which can be found today. Accordingly, the splotches arising from these pipes would have to possess a comparable size. The actually visible, much to large splotches must be ascribed to a generally blotchy, possibly overgrown, earthen covering of the mortuaries.

According to Pressac, moreover, the position of the holes which can be found today in the roofs of Mortuaries I ('gas chambers') do not correspond with the position in the aerial photos, which he explains by the warpings of the roof after the demolition of the building by the SS in the winter of 1945 [50]. Since it is established with certainty that the objects in the aerial photos are not insertion holes, the varied position is not really surprising. The longstanding, false interpretation of the splotches in the aerial photos has resulted in the acceptance, without plausible explanation, of a linear arrangement of the insertion columns for Mortuary I of Crematorium II, but for Crematorium III an alternating, staggered arrangement. The staggered arrangement of the columns in the case of Crematorium III would contradict the argument usually brought forward that the columns were camouflaged by being aligned with the concrete support pillars so that the entering victims were not suspicious. But actually, the insertion holes could not have been bored in alignment with the support columns, since the reinforced concrete girder visible in Illustration 7 (p. 21) would have to have been destroyed. An arrangement of the holes staggered around the supporting columns would therefore have been absolutely necessary. And with that it is proved for the shadows on the roof of Mortuary I ('gas chamber') of Crematorium II that there could not have been insertion points.

After the buildings were destroyed – by whomever –, the opinion was hit upon recently that the leftover ruins were a sham and that the original installations disappeared without a trace. This would mean that the Poles would have to have rebuilt the crematoria, true to the original, after the war at the cost of many millions of zloty in order to blow them up afterwards, a grotesque idea. Thus the author was rejected by a court on December 6, 1991 and May 5, 1992 as an expert witness because his investigations were completely irrelevant to the 'gas chambers' since it was known that there were only shams in Auschwitz, the real 'gas chambers' having disappeared without a trace [51]. For that see the letter of the semiofficial Institute for Contemporary History, in which, with reference to the Auschwitz State Museum, the reconstruction of the facilities in Crematorium I is depicted and the state of the original ruins of the crematoria in Birkenau is mentioned briefly [52].

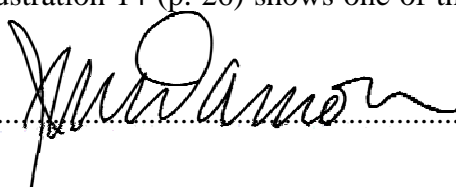
The roofs of the Mortuaries I ('gas chamber') of both crematoria are today broken into pieces and caved in; the roof of Mortuary I ('gas chamber') of Crematorium II, however, is still preserved somewhat intact. The next to last of the seven columns (viewed from the south) of Mortuary I ('gas chamber') of Crematorium II still has a piece of the roof attached. There one can descend through a hole in the roof (allegedly for the Zyklon-B column, Illustration 16, p. 27) into the interior of the cellar (Illustrations 12 and 13, p. 25), in which ground water stands on the floor even during long periods of dry weather in midsummer. Large parts of the masonry and the concrete roof there are in their original condition, protected from wind and weather. There are visible signs neither of erosion nor of corrosion. In his book Pressac shows illustrations of the ventilation pipes

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**Illustration 12:** Interior shot from the ruins Mortuary I ('gas chamber') of Crematorium II. The arrow points to the extraction point of Sample 3 (see section 4, p. 79).

**Illustration 13:** Interior shot from the ruins of Mortuary I ('gas chamber') of Crematorium II. Extraction point of Sample 1 and 2.

leading into the roof of Mortuary II of Crematorium II, as well as in the concrete roof of the oven room of Crematorium III [53]. Illustration 14 (p. 26) shows one of the five oven room openings. In contrast



to these cleanly fashioned holes, the only two holes which can be found in the roof of Mortuary I ('gas chamber') of Crematorium II, alleged to have been used for the insertion of Zyklon-B, clearly had been chiselled through the reinforced concrete roof afterwards, which is obvious in Illustrations 15 and 16 (p. 27). Even Pressac admits that these are the only holes visible today [50]. He shows, moreover, in his richly illustrated book no clear illustration of the two extant holes.

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**Illustration 14:** Cleanly formed ventilation hole to the upper story in the roof of the oven room, Crematorium III. Note the destruction resulting from the explosion.

All openings in the roofs of Mortuaries I ('gas chambers') of Crematoriums II and III visible today are breaches in the concrete originating afterwards. If any of these holes served as Zyklon-B insertion holes, they would have to have been broken through after the completion of the roof. The roof of Mortuary I ('gas chamber') of Crematorium III was poured a few months later than that of Crematorium II (spring 1943 as opposed to the winter of 1942/43 [54]). If the absence of insertion holes for Crematorium II had been noticed and corrected before the completion of the morgue roof of Crematorium III, then this error would hardly have been repeated at Mortuary I of Crematorium III. Consequently, any possible holes in the roofs of both crematoria could have been made in the spring of 1943 at the earliest. At that point in time the operations of mass annihilation in the facilities of Crematorium II were already supposed to have been in progress, an unbelievably stupefying act of idiotic planning. Because of that, the alleged insertion points in the photo [44] depicted in Pressac appear in a different light. Since the photo dates from a point in time when the construction work on the roof of Mortuary I ('gas chamber') of Crematorium III was still not completed, but when the insertion points of the roof of Mortuary I ('gas chamber') of Crematorium II were already supposed to have been present, one must expect to see properly formed holes in the roof of Mortuary I ('gas chamber') of Crematorium III. But these are not present. Therefore, another explanation for the reflections in Pressac's picture of Crematorium II. A recently completed report of a professional aerial photo analyst in Canada has in the meantime proved that the aerial photos were falsified by the CIA\*.

Would the Mortuaries I ('gas chambers') under consideration have been dynamited later on, the retroactively knocked out openings in its roof, which would have had damaged the concrete and the steel reinforcement, would have inevitably resulted in breaches and cracks of the roof running predominantly through these openings. The explanation for this is that an explosion is an extraordinarily powerful effect and the formation of cracks predominantly radiate from weak spots, because the stress peaks reach very high values in the area of corners already under tension (notching effect). In particular,

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\* J.C. Ball, *Air Photo Evidence, Auschwitz, Treblinka, Majdanek, Sobibor, Bergen Belsen, Belzec, Babi Yar, Katyn Forest*, Ball Resource Services Ltd., Delta, Canada 1992.

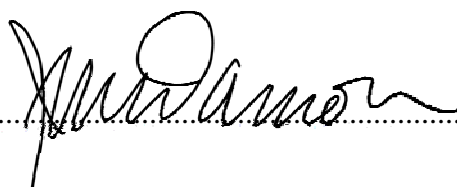
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**Illustration 15:** Alleged Zyklon-B insertion hole in the roof of Mortuary I ('gas chamber') of Crematorium II. It is clearly visible that it was not rid of the reinforcing rods of the reinforced concrete. These were simply bent back.

**Illustration 16:** Alleged Zyklon-B insertion hole in the roof of Mortuary I ('gas chamber') of Crematorium II; entrance to the part of the cellar still accessible today.

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such holes, which have already damaged the structure of the concrete by being installed afterwards, are not only predictable breaking points, but unavoidable cracking points. Refer to Illustration 14 (above)



for clarification. Although the force of the explosion in the ground level furnace room was able to escape on all sides and leave the roof of the top story fairly intact, three of the five furnace room ventilation holes cleanly formed and reinforced in the concrete roof were completely destroyed. With the other two holes, there were clearly visible cracks in the corners, visible in the photos depicted in Pressac[53].

In the mortuaries and Crematoriums II and III the explosive force could only have gone upwards, which would have destroyed their roofs much more thoroughly than the roof of the oven room. The alleged Zyklon-B insertion holes in the roof of Mortuary I ('gas chamber') of Crematorium II, however, are distinguished by their relative intactness, with all cracks and buckling of the roof running around them; see in particular Illustration 15. In Illustration 11 (page 23) the position of two of the openings identified as alleged Zyklon-B holes in the roof of Mortuary I ('gas chamber') of Crematorium II (see Illustrations 15 and 16, p. 27) is marked, inclusive of the shadows visible in the aerial photos. The arbitrary alignment of the openings are immediately recognizable as being located at places where the roof of the morgue is undamaged! The left hole in Illustration 11 (photo of the hole in Illustration 15, p. 27) deviates from the splotches in the aerial photos by at least three meters. This difference is not explained by Pressac's thesis of the roof having been warped in the explosion.

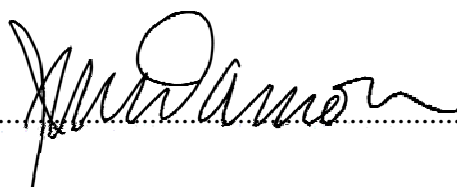
In the opening depicted in Illustration 15, the reinforcing rods are only severed and bent, and they still have their full length. One could bend them back and weld them together with the likewise visible stubs to the left in the picture (covered with snow). These holes therefore could never have served as an insertion holes; they were never completed. Also, the remnants of the reinforcing rods are still at the edge of the hole in Illustration 16. In such crudely bored unplastered holes, from which the reinforcing rods have not been removed, any gas introduction apparatus could never have been installed with stability, let alone sealed on the outside. If it had been tried, the entire surrounding area including the putative perpetrators would have been endangered by massive amounts of escaping toxic gas. The putative victims could only be prevented by force from escaping through these holes, or even from ejecting the poison gas preparation, since these holes were not closeable. Finally, insertion nozzles installed in these holes, similar to the chimneys in the inmate barracks, would have to be visible in the high-resolution aerial photos at the right locations, but they are not. In conclusion, it can be said with certainty that the alleged insertion holes were only created after the demolition of the buildings, thus after the Germans had retreated.<sup>4</sup>

4 Currently, money is collected for projected preservation works on buildings of the concentration camp Auschwitz[10]. If these works should be carried out indeed, then this would result in a destruction of evidence before comprehensive international forensic studies had ever been carried out at the scene.

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In summation, the arguments regarding the insertion points are listed as follows:

Table 1: Argument for Zyklon-B insertion holes	
Testimony Kula: Pipes of 7 cm width.	With 50 to 60 cm, the openings are too large
Hypothesis Pressac: 70 cm wide.	For this the holes are too small
Visible on the air photos of Crematoria II.	The spots on morgue 1 ('gas chamber') of Crematoria II shapeless, fuzzy and irregular. They cannot be geometrically shaped, even elevations. The surface areas of the spots, measuring 3 m <sup>2</sup> , are too big for the openings in question. The location on the line of the support pillars would have necessitated cutting through the concrete longitudinal girders, which is technically





	impossible. The location of the holes which can actually be found do not accord with the location of the spots. According to the dimensions of the holes in question, any shafts actually installed would have to be visible on the air photos, including their shadows, but they are not there.
Visible on the air photos of Crematoria III.	The length of the spots would correspond to a shaft length exceeding the roofs of some 3 m. The directions of the spots does not correspond to that of the other shadows. Thus the cannot be shadows of shafts.
For planned introduction holes cleanly cast and reinforced holes would have to be expected.	The identifiable holes in the ceiling of morgue 1 ('gas chamber') of Crematorium II clearly show chisel marks, the concrete structure was destroyed at a later time. Additionally, there are only two of the four reported holes.
For later break-throughs in 1943, the steel reinforcement rods would have to be removed and the breaks in the concrete would have to be plastered.	In all cases the reinforcement rods still project into the holes; in one case, these were only cut through and bent back. The edges of the holes were not plastered; the tar insulation is openly visible.
The edges of holes in concrete ceilings are necessary locations of fracture during demolition. Cracks and fractures must run through these, especially in cellar ceilings with openings in the concrete pierced following demolition of the building.	The two identifiable holes in the ceiling of morgue 1 ('gas chamber') of Crematorium II lie in an area of the ceiling, which has as a whole remained intact. No cracks or fractures run through the hole. There is no visible crack formation, even at the especially vulnerable corners of the holes.

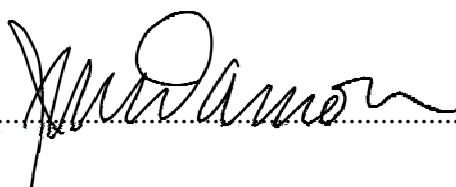
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**Illustration 17:** View of northern side and ground plan (below) of Crematoriums IV and V (mirror image) in the Camp Auschwitz II/Birkenau[50].

- |                                     |                       |                      |                     |
|-------------------------------------|-----------------------|----------------------|---------------------|
| 1. Alleged gas chambers             | 4. Coke room          | 7. Ventilation stack | 10. Cremation ovens |
| 2. Alleged Zyklon-B insertion holes | 5. Physician's office | 8. Drains            |                     |
| 3. Ovens                            | 6. Mortuary           | 9. Oven room         |                     |

### 1.3.2. Crematoria IV and V

From Illustration 17 (p. 30), the ground plan of Crematorium IV and, corresponding in mirror image, that of Crematorium V can be inferred [55]. On the basis of cost considerations, these later buildings were constructed more simply than Crematoriums II and III. Due to shortages of materials the incinera-



tion ovens of both crematoria broke down shortly after the facilities went into operation and were not repaired because of overcapacity. Regarding these facilities, which are considered the least known, there are only a few documents and contradictory, sometimes unbelievable witness testimonies (“... the least known of the instruments of extermination . . . a comparison of such testimonies reveals inconsistencies . . .”[56]). These crematoria were planned from the summer of 1942 and built through the spring of 1943. According to Pressac, in addition to the two western rooms, which have no description at all in the plans, the anterooms were also supposed to have served as ‘gas chambers.’ All of these rooms are supposed to have possessed allegedly airtight hatches in their outer walls, approximately 30x40 cm, for the insertion of Zyklon-B [57]. The two rooms are supposed to have been heated from the anteroom used as a ‘gas chamber’ (heating, see Illustration 17). A ventilation system is not established. Pressac assumes that the ventilation was through natural drafts [58]. Concerning the gassings in the ‘gas chambers’ of Crematoriums IV and V, he states that the “. . . operating sequence . . . had become irrational and ridiculous”

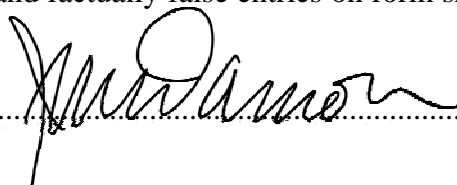
{31}

and that “Introducing the poison resembled a circus act”. He asserts the later installation of a door in the corridor to assist in the ventilation without verifying it [59]. Since it hardly would have cost the SS more to install correct ventilation in these rooms, and because this solution would have been much more effective, Pressac’s thesis of the installation of a door for ventilation can be dismissed as unrealistic. Moreover, it can be recognized that the morgue and oven room possessed ventilation stacks. The rooms named as ‘gas chambers,’ in addition to the coke room and the physician’s office, do not have a single ventilation stack. A physician’s office in crematoria is normal even today, incidentally [30].

According to an older publication of Pressac’s [60] these ‘gas chambers’ are not supposed to have been planned and built as such. As arguments for this he lists:

1. There is no room description in the construction plans.
2. If it were supposed to be a ‘gas chamber’, the general layout of the rooms would have brought an absurd sequence of actions which the victims would have to undergo.
3. To reach the insertion opening for the Zyklon-B a ladder would have been required, even though it would have been simple for a planner to build the opening closer to the ground or to construct a staircase.
4. Originally, small, wood-fired ovens were installed in these rooms, which casts suspicions on their use, for example as shower rooms.
5. The missing ventilation would have led to a gassing of the entire building, so that work would have had to be suspended for hours.

In his new book he continues to accept these arguments [58]. Since at the planning period of Crematoriums IV and V the mass annihilation of the Jews is already supposed to have been in progress, especially in Farmhouses I and II, it is of course absurd to think that these facilities could have been falsely conceived and built. Pressac, therefore, assumes today a “criminal intent” of the crematoria [61]. A piece of evidence for that, besides the airtight hatches, are the documents of a civilian construction firm, in which there is talk of work in a ‘gas chamber’ [62]. As will be shown in the section about delousing facilities, ‘gas chamber’ [TRANS. note: the German term here is ‘Gaskammer’] was at that time the normal designation for material delousing rooms. Conspicuous irregularities and oddities in these documents have been pointed out in a report which questions their authenticity. In addition to many unusual misspellings and factually false entries on form sheets, the documents contain a trimmed



company stamp. As the seventh and last point, the activity “policing of quarters” [TRANS. note: the German term is “Ordnungsdienst Unterkunft”], which allegedly is a normal duty only in military and paramilitary formations, is cited here and in two additional daily reports [63].

The walls of the completely aboveground Crematoriums IV and V were constructed only of simple brick masonry. After their demolition, both crematoria were cleared away down to the foundation walls and concrete foundations. The approximately one meter high foundation wall of Crematorium V is supposed to have been reconstructed [64]. The roughly 50 cm high ground wall masonry of Crematorium IV is likewise supposed to have been reconstructed afterwards from other rubble material [8].

### 1.3.3. The Farmhouses I and II

The two rebuilt farmhouses lying west-northwest of Camp Birkenau, together with the undressing barracks, are, with regard to their situation and construction, not precisely located – Pressac mentions here contradictory witness statements [65]. Regarding the testimony of P. Broad he writes, for example, “ . . . not exploitable . . . , since it has been rewritten by and for the Poles . . . “, and : “It is impossible to make a synthesis of all these accounts.” The report

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by Höss is only superficial [66] – yet the events there of the alleged gassing of human beings is very vividly depicted. So it is cited on page 99 of the Frankfurt ruling on Auschwitz [67] that the people brought into the farmhouses were killed in a manner similar to that described previously in the rooms of Crematoriums IV and V.

The procedure is clearly shown, in particular by the testimony of R. Böck [68], and to a certain extent also by that of M. Buki [69].

Pressac publishes a photo of the alleged foundation wall remains of Farmhouse II [70]. The result of an air photo analysis of the above mentioned allied air photo from Aug. 25, 1944, which was recently prepared, is that neither buildings nor ditches or hills of excavated earth were present in the area under consideration. The only thing that could be noticed were shapes of 4×10 m of either foundation or filled-in ditches[71]. At the time the aerial photos were taken, the annihilation of the Hungarian Jews is supposed to have been running at full speed, with many thousands of victims daily and thick, smoky cremations in large, open pits precisely in the analyzed area [72]. Not a trace of all of this can be found. The flat shapes discovered may be the foundations shown by Pressac. Perhaps this is the new section of the camp which was never finished, or the remainders of much older buildings. Under these circumstances a continued treatment of these houses seems to make little sense. Nevertheless, proof is taken here from the depictions cited above, as other authors, with the exception of Pressac, also do.

## 1.4. Material Delousing Chambers

**Illustration 18:** Illustration of Building 5b Ground plan of the HCN delousing wing of Building 5a before conversion and Building 5b until today; the sample extraction points in Building 5b are marked[70].

a: Delousing wing

d: Wash and shower room

b: Sluice

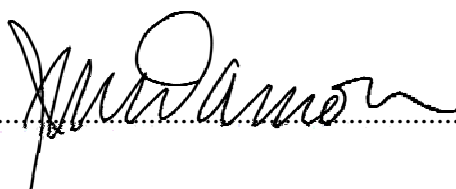
e: Dirty side, undressing

c: Anteroom

f: Clean side, undressing

16, 17, 19 Sample extraction points

Here we are interested only in those facilities in which the delousing of clothes and other material items was carried out [73]. Today such rooms are still located in Buildings 5a and 5b in Building Blocks B1a and b, respectively – the first in the western wing, the second in the eastern wing, of its respective building. In the plans these rooms are indicated as gas chambers, which was the normal designation for



delousing localities in those days. Illustration 18 (p. 32) shows the ground plan of the two chambers in almost original condition. The chamber of Building 5a was converted in the summer of 1943 and received two small hot air chambers, apparent from Illustration 19 (p.

{33}

**Illustration 19:** Illustration of Building 5a Ground Plan of the hot air delousing wing after the conversion in 1943; the sample extraction points in Building 5a are marked[70].

a: Hot air delousing chambers

d: Sauna

b: Anterooms

e: Undressing room

c: Shower room

f: Dressing room

9-15, 18, 20-22: Sample extraction points

33)[74]. The buildings are built at ground level from simple brick walls on a concrete foundation. The room in Building 5b today has no ceiling; the roof truss is covered on the underside with panels of an unknown material. Originally windowless, as with Building 5b today, Building 5a during the conversion received in all outer walls fixed-in windows which would not open.

In the delousing room of Building 5b one recognizes in the gable two circular openings, roughly 50 cm in diameter, of the former ventilation or air intake pipes, Illustration 20 (p. 34). The roof has three ventilation stacks. At the time of operation there are supposed to have been three ovens in this room [75]. In the middle of the room is a sewage drain. Whether it was there from the beginning remains open to question. The inward-opening double doors marked in the plans are today replaced with likewise inward-opening single doors. The outfitting of the delousing chambers must be speculated for now. This will be covered later in connection with the delousing procedures.

Conspicuous in this room of Building 5b is the filigree construction of water pipes inserted in hooks on the cross joists, apparent from Illustration 21 (p. 34). Some of the pipe openings are fitted with shower heads, and the water pipes are not connected at all. Paradoxically, they end in the ventilation holes mentioned above; therefore they can only have been put in after the removal of the ventilators installed there. In fact, there are shower rooms elsewhere in this building (see Illustration 18, p. 32). There, however, the shower installations are completely removed. Since the doors to these rooms stand open, any visitor can admire this peculiar construction. This construction will be covered again on page 76.

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**Illustration 20:** Ventilation openings of the delousing wing of Building 5b, totally without equipment. The ends of the water leads are recognizable. See also Illustration 21.

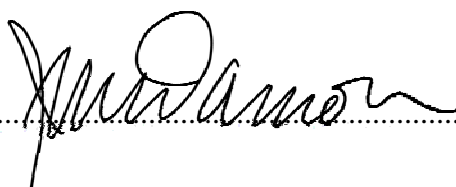
**Illustration 21:** Water pipe system with shower heads in the delousing wing of Building 5b. These water pipes are connected in no way, and they end in the ventilation openings. see Illustration 20.

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## 1.5. The Drainage System in Birkenau

**Illustration 22:** Then and today – the unchanged ground water state in the Birkenau camp, here in midsummer 1991, in a construction trench in front of the central sauna, approximately 70 cm. Incinerations of corpses in pits many meters deep, in accordance with witness testimony, were not possible.

Birkenau lies in the immediate vicinity of the confluence of the Sola into the Vistula. It is a swampy area with a ground water level directly under the surface. A few hundred meters away from the camp there are in midsummer swampy meadows. The drainage system of the Birkenau camp installed by the Germans comprises a multitude of ditches [76]. That system is still functioning to this day. Through it the ground water level is lowered to 60 to 70 cm under the surface of the ground, obvious, for example,



from Illustration 22 (p. 35). The photo, taken 15 August 1991 during a long period of drought, shows a construction trench in front of the central sauna located in the western part of the camp. Also, the water level of the well known small pond in the vicinity of Crematorium IV, which is supposed to have existed the same way in those days, proves the unchanged water level from then until now. The subterranean location of the mortuaries of Crematoriums II and III, as well as some of the building sections of the central sauna, was only possible through the insertion of a waterproof layer of tar. If the drainage system had lowered the water level by several meters, the pond next to Crematorium IV, contrary to many witness statements, would have dried up. Furthermore, an insulation of the cellar walls of Crematoriums II and III would not then have been necessary to a large degree. Since the drainage ditches in the camp are only 1 to 1.5 meters deep, they could not have lowered the water level to less than one meter. This maximum value, though, can only be achieved in the immediate vicinity of the ditches. The large incinerations of corpses at the farmhouses outside the camp, however, are supposed to have been in an area which was never included in the drainage system of the camp, and which thus must have had a ground water level a few decimeters under the surface of the ground. These findings show clearly that the attested burning of corpses in pits many meters deep was impossible under such conditions, since these pits in time would have filled up with ground water. Moreover, no intelligent person would come up with the idea of burning people in pits which could not easily be supplied with fresh air. The first thing which the SS men would have learned in their paramilitary training is that one can keep a fire small and economical by kindling it in a pit (also important for camouflage due to the light, see basic

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training in the Bundeswehr). This means: This is due to the poor flow of air (reduced oxygen intake and no draft) so that the burning advances only slowly and incompletely since the temperature of the fire is relatively low. Any halfway practical-thinking person asked about how corpses could be burned in the open would immediately answer: on a funeral pyre, just as it has been practiced for millennia. The technical basis for this is quite simple: That which caused the firestorm in Dresden during the terror raid of 13/14 February 1945 will be repeated by any funeral pyre: The flammable gasses boiling up generate from the bottom an intense air draft into the heat, which enormously increases the temperature of the fire (see also the bellows in the hearth of a blacksmith). This is not possible in burnings in deep pits.

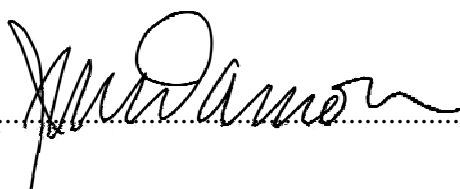
It is known that in Birkenau the corpses which had accumulated during the typhus epidemic of the summer of 1942 were first buried in mass graves. Due to the danger of the contamination of the ground water, however, they had to be exhumed in the spring of 1943. Since the new cremation facilities still were not capable of functioning at that time, it is possible that at least a portion of the corpses were burned on funeral pyres. For this purpose one, as a rule, removes the turf and the upper layer of topsoil in order to preserve them from damage and to absorb the ashes of the wood and the corpses. But holes many meters deep are not dug.

Indeed, one can unearth in excavations west of the Birkenau camp ashes and bone splinters to the depth of several decimeters, intensively mixed with all kinds of refuse (glass and porcelain shards, slag, bits of iron, etc.). Apparently this place served as a rubbish heap for the camp under German administration and/or after the war under Polish administration.

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## 2. Formation and Stability of Prussian Blue<sup>5</sup>

If the hydrogen cyanide of Zyklon-B had been bonded to the masonry by adsorption only, there would be no cyanide<sup>6</sup> residue left today, thanks its volatility (boiling point: 25.7°C). However, a simple glance



into the delousing chambers of Buildings 5a and 5b of the Birkenau camp immediately reveals to the chemist that he is dealing with a known substance: Iron Blue, Prussian Blue or Berlin Blue, aka Turnbull's Blue, an extremely stable ferrocyanide compound. Over the past four decades there has been a flood of publications about this chemical compound, and the literature has been reviewed with regard for our subject. Attention is now directed to:

- 1) The possibility of the formation of Prussian Blue,
  - 2) The long-term stability of Prussian Blue,
- making each consideration with regard for the circumstances established in Section 1.

First, however, there is a short presentation of the source substance, hydrogen cyanide.

## 2.1. Characteristics of Hydrogen Cyanide, HCN

<b>Table 2:</b> Physical Properties of HCN [77]	
Molecular weight:	27.026
Boiling point:	25.7°C
Melting point:	-13.24°C
Specific density of the gas at 31°C: (air = 1)	0.947
Heat capacity (liquid): (water = 4.187 J g <sup>-1</sup> K <sup>-1</sup> )	2.625 J g <sup>-1</sup> K <sup>-1</sup>
Dielectric constant (20°C): (water = 78.5)	114
Vaporization enthalpy:	28 kJ mol <sup>-1</sup>
Vaporization entropy:	190 J mol <sup>-1</sup> K <sup>-1</sup>
Self-ignition temperature:	538°C
Flash point:	-17.8°C
Explosive limits in air:	6% to 41% by volume

Hydrogen cyanide is a colorless liquid which bears a great resemblance to water in its heating capacity and vaporization characteristics. This affinity allows an unlimited solubility of hydrogen cyanide in water and a strong tendency for it to be absorbed in water. The equilibrium concentration of hydrogen cyanide in water will be more precisely investigated in Section 2.3.3 (p. 42).

The opinion is often expressed that gaseous HCN, since it is about 5% lighter than air, must separate from it and rise. But, because it is only slightly lighter than air, it is prevented from separating by the natural and continuous thermal motion of all gaseous particles. For clarity's sake, the major components of air should be discussed: Nitrogen, 78% by volume and the main component of air, is only 1.08 times heavier than hydrogen cyanide. If a separation of hydrogen cyanide and Nitrogen were to take place, then all the more between the main components of air, since oxygen (21

5 Iron Blue is the standardized name for blue iron cyanide pigments of varying consistency, which are also known under names like Berlin Blue, Turnbull's Blue, Prussian Blue, Vossen Blue®, Milori Blue, Paris Blue, French Blue, China Blue, Bronze Blue, Steel Blue, Ink Blue and many more.

6 Cyanides, CN<sup>-</sup>, are salts of hydrogen cyanide (prussic acid, hydrocyanic acid) HCN.

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Graphic 1: Vapor pressure of hydrogen cyanide in percentage of air pressure as a function of temperature.

by volume of air) is 1.15 times heavier than nitrogen. The consequence of this would be that all the

vol.% oxygen would settle in the lower fifth of the earth's atmosphere and the entire surface of the earth would be oxidized (scorched).

Even if, due to the chaotic motion of gasses, separation processes do not occur at the low gas density and altitude variations under consideration here, it must be considered that the mixing of various gasses without convection<sup>7</sup>, i.e., only by diffusion<sup>8</sup>, will proceed very slowly.

Since hydrogen cyanide is only 5% less dense than air (corresponding to a density differential of air at 35°C versus air at 20°C), this causes a density convection and a rising of the hydrogen cyanide, which gradually mixes with the surrounding air. But to concluded from this that hydrogen cyanide vapors always rising upon formation is a fallacy. For example, at 15°C no higher concentration than approximately 65% hydrogen cyanide (as a percentage of air) can be produced due to physical-chemical reasons (see Graphic 1 for the saturation vapor pressure at 15°C). The density of this mixture, however, is only around 3% less than that of air. Moreover, the evaporating hydrogen cyanide extracts a great deal of heat from the surrounding air. The surrounding temperature therefore falls until exactly enough heat can be transported to the evaporating HCN as is required for the most retarded vaporization in the correspondingly lowered temperature. Theoretically, in hydrogen cyanide vaporization one can encounter gases which contain a little hydrogen cyanide but which are cold, and are thus denser, and heavier, than the surrounding air.

From Graphic 1 we can infer the equilibrium level of hydrogen cyanide in air as a function of temperature. Even at 0°C the level is around 36% by volume. A condensation of hydrogen cyanide, which would only occur if the equilibrium level were exceeded, will not occur in the cases under consideration here, in which a level of only up to 10% would occur in the vicinity of the source.

Hydrogen cyanide in the air in concentrations of 6% to 41% by volume forms an explosive mixture. Given a strong ignition, its explosive effect can be compared with that of nitroglycerine<sup>9</sup>[78]. But in the applications under discussion here, a level of only 5% to 6% by volume will only be achieved in the close vicinity of the source.

In addition, hydrogen cyanide is unstable in alkaline medium. It tends to have intense, even explosive, polymerizing reactions[79], but this applies only to high concentrations.

7 The term convection describes all mixing processes not basing on molecular statistic effects (Diffusion, see footnote 6 [8] or on directed force fields (migration, see footnote 29, p. 56). This includes e.g. density convection and forced convection.

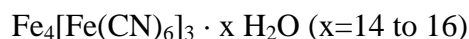
8 The term diffusion describes the statistical movement of particles moving chaotically, which, with time, leads to an even distribution in space. For gases this is called "Brown's movement"

9 Usual explosive in Dynamite.

{39}

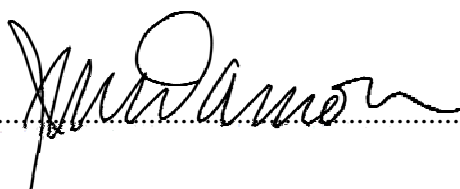
## 2.2. Composition of Iron Blue

It was with support of the Mösbauer spectroscopy [80-82]10 that a long-lasting argument could be decided: Turnbull's Blue,  $\text{Fe}_3[\text{Fe}(\text{CN})_6]_2$ , is actually the same as Berlin Blue,  $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$ , even is the summation formulas suggest they are different. As a matter of fact, the summation formula of Berlin Blue is closest to the reality: In the ideal Iron Blue crystal, 16 molecule of coordination water is included:



Today it is known that the 'soluble' Iron Blue which frequently is referred to in older literature, is mainly a substance with the composition  $\text{MeFe}^{\text{III}}[\text{Fe}^{\text{II}}(\text{CN})_6] \cdot x \text{H}_2\text{O}$ , where Me is the counter ion to the opposite cyanoferrate,  $[\text{Fe}(\text{CN})_6]^{3-/4-}$ , mostly Potassium (K+) or Ammonium ( $\text{NH}_4^+$ ).

According to Buser[82], 'soluble' Iron Blue is formed mainly during quick formation and precipitation



of the pigments, leading to the inclusion of large amounts of water and Potassium- or Ammonium ions in the extremely voluminous precipitate. The resulting crystal is therefore very faulty and more appropriately called a polymer.<sup>11</sup> By filtration, drying and intensive grinding, however, this very inhomogeneous, polluted Iron Blue can be transformed into a pigment which is only hardly colloidal dispersible.<sup>12</sup> This 'soluble' Iron Blue is not soluble in the original sense of the word, but can more easily be colloidal dispersed than the 'unsoluble' Iron Blue, which is very important for its application as a pigment[83-86].

However, these colloids are very instable and precipitate easily when salts are added[87-89]. According to Buser, even in presence of high concentrations of potassium ions, almost pure 'unsoluble' Iron Blue can be obtained, if the formation process is proceeding slowly enough. In case of deeper interest about the structure one might consult the according literature[82,90-94].

### 2.3. Formation of Iron Blue

In aqueous solutions, the formation of this pigment from the cyanoferrates and the complementary iron salts<sup>13</sup> occurs immediately and completely, in contrary to other transition metal salts.[95]

It forms also due to the reduction of  $[\text{Fe}^{\text{III}}(\text{CN})_6]^{3-}$  to  $[\text{Fe}^{\text{II}}(\text{CN})_6]^{4-}$ , which then can react with  $\text{Fe}^{3+}$  to form Iron Blue. Free cyanide can act as a reducing agent. This can evolve from UV-radiation induced photolytic decomposition of  $[\text{Fe}^{\text{III}}(\text{CN})_6]^{3-}$  (caused by light)[96-98].

It can also stem from the adsorption<sup>14</sup> and absorption with subsequent dissociation<sup>15</sup> of hydrogen cyanide. The reduction of  $[\text{Fe}(\text{CN})_6]^{3-}$  by cyanide with subsequent formation of iron Blue is

10 Impulseless resonance absorption of  $\gamma$ -quants (gamma radiation) from a radioactive isotope, here Cobalt:  
 $^{57}\text{Co} \rightarrow ^{57}\text{Fe} + \gamma$  (122 keV).

11 Originally, this term was used only in organic chemistry for chainlike connected, sometimes also branched attachments of equal segments.

12 *Dispersions* (lat.: disperse, distribute) are distribution of two different phases within each other. They are called *colloids* (gr.: glue-like) if the particles are between  $10^{-8}$  and  $10^{-7}$  m small. Such a mixture in liquids scatters the light (Tyndall effect), is thus not clear. But due to electrostatic repulsion (equally charged particles), colloids do not tend to coagulate and precipitate.

13 Iron Blue owes its color to the presence of iron in different oxidation states (bi- and trivalent, Charge-Transfer-Complex). Hence, for its formation, both bi- and the complementary trivalent iron must be present.

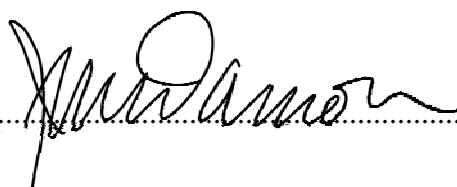
{40}

fasted at pH-values around 9 to 10[99]. This is understandable, since the cyanide is oxidized to Cyanate (NCO). This finding is supported by the fact that hexacyanoferrate(III) is a strong oxidizing agent in alkaline medium, where it oxidizes even Chrom(III) to Chrom(VI)[100]. Driving force of this reaction is the energetically much more privileged hexacyanoferrate(II), if compared to hexacyanoferrate(III)[101]. For this reason, a direct reduction of uncomplexed  $\text{Fe}^{3+}$ , i.e., iron not surrounded by cyanide, is highly disadvantaged and can thus be neglected. Hence, the pigment formation in the case under consideration here is then organized in 5 steps:

- a) Ad-/absorption of hydrogen cyanide (HCN)
- b) Dissociation of HCN to  $\text{CN}^-$  and  $\text{H}^+$
- c) Complexing of  $\text{Fe}^{3+}$  to  $[\text{Fe}(\text{CN})_6]^{3-}$
- d) Reduction of  $[\text{Fe}(\text{CN})_6]^{3-}$  to  $[\text{Fe}(\text{CN})_6]^{4-}$
- e) Precipitation of  $\text{Fe}^{3+}$  as  $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$

The rapidity of formation of the pigment can be influenced by various factors, which will be considered:

1. Water content of the reaction medium





- 2. Reactivity of the iron
- 3. Temperature
- 4. Acid content

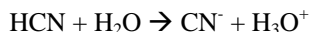
### 2.3.1. Water Content

The formation of cyanide through adsorption and final dissociation of hydrocyanic acid in water is the necessary precondition for a reaction with iron, since the hydrogen cyanide itself exhibits only slight reactivity towards metal ions due to its low nucleophilicity<sup>17</sup>. Aside from the dissociation of the hydrogen cyanide in water, the process of chemisorption<sup>14</sup> on solid surfaces deserves being mentioned, where the hydrogen cyanide releases its proton (H<sup>+</sup>) to an alkaline oxide, and is itself attached to a metal ion.

Absorption and dissociation of the superbly soluble hydrogen cyanide (see section 2.3.3., p. 42) is clearly superior to chemisorption. Finally, the aqueous solution (as solvents) is indispensable for the complex formation and redox reactions of the cyanide with Fe<sup>3+</sup>. Finally, the aqueous medium makes the reacting agents mobile, which do not always form at the same location. And finally, the moisture contained in the solid material works as a trap for hydrogen cyanide, because it intensely binds the hydrogen cyanide. Or the other way around: the drier a solid material is, the easier hydrogen cyanide, which was adsorbed before, will be released into the environment. Therefore, a relatively high water content of the solid material will accelerate the reaction.

Experiments with reactions of hydrogen cyanide (some 4 g per m<sup>3</sup> in air, 15°C, 75% rel. humidity) with mixtures of Fe(OH)<sub>2</sub>-Fe(OH)<sub>3</sub> attached to wet paper strips showed that a blue discoloration occurred after 30 min at \_\_\_\_\_

- 14 *Absorption*: taking up of matter or energy into a medium, e.g., light into a pigment, gas into a liquid;  
*Adsorption*: sticking of matter on a surface, e.g., gas on a solid surface. One distinguishes between *chemisorption*, in which the matter is bound to the surface chemically, and *physisorption*, in which the bonding is only a physical effect. The transition between both is fluent.
- 15 *Dissociation*: is the splitting of a compound, in this case into two differently charged ions (heterolytic) in aqueous medium:



- 16 *pH* (pondus hydrogenii) is a measure for the acid content of aqueous solutions (negative, decadic logarithm of H<sub>3</sub>O<sup>+</sup> concentration: -lg<sub>10</sub>(c(H<sub>3</sub>O<sup>+</sup>)): pH > 7: acid  
 pH = 7: neutral  
 pH < 7: alkaline

- 17 Nucleophily (gr.: core/nucleus loving) is the tendency of a particle to react with positively charged particles. For this, at least a partial negative charge of the nucleophilic particle is required. In this case, cyanide is due to its negative charge (CN<sup>-</sup>) much more nucleophilic towards the positively charged iron (Fe<sup>3+</sup>) than the uncharged hydrogen cyanide.

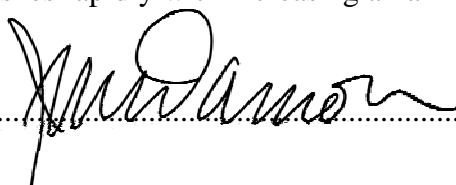
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a pH-value of 2 to 3, since at such low values almost no hydrogen cyanide dissociates to the reactive cyanide (see section 2.3.4., p. 44). At pH-values of 7 to 9, a visible blue discoloration occurred after a few minutes of inserting the sample. At higher pH-values, this time span grew again, because the initially absorbed hydrogen cyanide had to lower the pH-value first, before it could form the pigment (see section 2.4.1., pH-Sensitivity, p. 45).

These experiments show clearly that undissociated, gaseous HCN or HCN dissolved as gas shows no reactivity. An addition of small amounts of KCN to an aqueous sulfuric acid solution of Fe<sup>2+</sup>/Fe<sup>3+</sup>, however, results in the immediate precipitation of the pigment. The cyanide obviously reacts faster with the iron salts than it is protonated by sulfuric acid, i.e., converted into hydrogen cyanide.

### 2.3.2. Reactivity of Iron

The solubility of iron diminishes rapidly with increasing alkalinity (rising pH value). Even in a pH neu-



tral environment, almost all iron is bound as  $\text{Fe}_2\text{O}_{(3-x)}(\text{OH})_{2x}$  (rust) or as its hydrate. The reaction between the iron and the cyanide resulting in the formation of the intermediate product  $[\text{Fe}(\text{CN})_6]^{3-}$  is therefore largely a reaction on the solid-fluid phase limit, that is, between the iron adhering to the solid body and the cyanide ion in solution. This reaction occurs considerably more slowly than those in an aqueous solution. The fastest possible reaction requires a large surface area on the solid-liquid phase limit, that is, a large specific, microscopically rough surface and a fine, highly porous solid material, since in such cases much iron lies on the surface and is less solidly bound and can therefore quickly combine with the cyanide.

Iron salts generally tend to assimilate water, and Iron Blue is no exception to this. A higher water content in the solid body results in increased water accumulation in rust, too. The rust expands, so to speak, and thus becomes more reactive towards competing ligands like cyanide. Freshly precipitated, extremely moist and non-homogenous iron hydroxide precipitations possess extreme reactivity, and together with hydrogen cyanide, as shown in section 2.3.1., they form the pigment in visible quantities in minutes.

For the formation of colloiddally dispersible Iron Blue, the quick formation in aqueous solution with high concentrations of the agents is required (see section 2.2., p. 39), since this leads to heterogeneous crystallites (tiny crystals) with many inclusions (ions, solvent molecules) and a high degree of disorder. These crystallites have only a small tendency to coagulate.

The slow interface reaction liquid-solid with quite low concentrations of the reacting agents will suppress the formation of colloiddally dispersible iron Blue. The process described here, occurring in walls exposed to hydrogen cyanide, strongly resembles the formation of monocrystals as described by Buser[82], since in this case also, one reagent ( $\text{Fe}^{2+}$ ) had to be formed by slow reduction by excess cyanide. Thus, except from the inhomogeneous material, the conditions here under consideration are suitable for a slow crystal growth of insoluble Iron Blue without large amounts of inclusions and the formation of crystal faults.

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18 In complex chemistry, *Ligands* refer to in most cases negatively charged Particles (Anions) surrounding an in most cases positively charged central particle (Kation, in general a metal atom). In this case, the central atom iron ( $\text{Fe}^{2+/3+}$ ) is surrounded by the Ligand cyanide ( $\text{CN}^-$ ).

{42}

### 2.3.3. Temperature

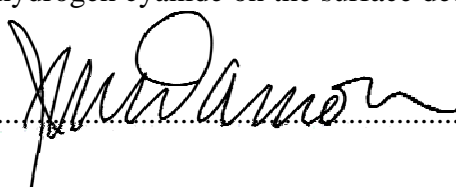
The environmental temperature influences several properties in quite a different manner:

- a) Adsorption on the solid material
- b) Absorption of hydrogen cyanide into water
- c) Dissociation of hydrogen cyanide
- d) Water content of the solid material
- e) Complexing and reducing velocity

**Graph 2:** Degree of coverage of the surface of a solid material with an adsorbed gas as a function of temperature (schematic)

**Graph 3:** Saturation concentration of hydrogen cyanide in water as a function of temperature at a partial pressure<sup>19</sup> of  $p(\text{HCN})=0.01$  (10 mbar hydrogen cyanide at 1000 mbar total pressure).

**As to a.:** The adsorption of hydrogen cyanide on the surface decreases with rising temperature, accord-



ing to Langmuire (see graph 2)[102]

$\Theta$  = **Error!** (1)

$\Theta$  = Degree of adsorption

K = variable

T = temperature

p = gas pressure

$\Delta H$  = adsorption enthalpy (negative)

R = universal gas factor

e = Euler's number (2,71828...)

The intensity of the decrease of the coverage in equilibrium as well as the point of approximate saturation, however, are unknown for the problem at hand.

**As to b.:** Graph 3 shows the maximum solubility of hydrogen cyanide in water at various temperatures with a partial pressure of hydrocyanic of 0.01, this is, 1 Mol or particle percent, which corresponds to some 13 g hydrogen cyanide per m<sup>3</sup> air[103]. It increases, as with any gas, with decreasing temperature and lies between 0.065 mol per l at 30°C and 0.2 mol per l at 0°C. These high concentrations prove the extreme solubility of hydrogen cyanide in

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19 The *partial pressure* of a gas is it fraction of the total gas content.

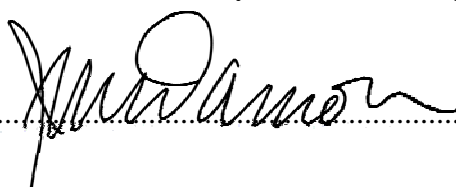
{43}

water. It decreases by approximately half every 20°C. It is therefore approximately 10,000 times more soluble than oxygen (O<sub>2</sub>) and approximately 250 times more soluble than carbon dioxide (CO<sub>2</sub>). The reason for this is the polar character and the possibility to form hydrogen bridge bonds as in water. However, und norm conditions (1 atm, 25°C), hydrogen cyanide is not a gas.

**On c.:** According to the literature, the dissociation behavior of acids as a of function temperature is not unanimous[104]. Although there is a tendency of increasing protolysis<sup>20</sup> with rising temperature, this tendency turns upside down at higher temperatures for some acids, others show generally falling values. Since the changes are in general in the range of low percentages only, this can be neglected here.

**On d.:** The moisture content of materials with high hydrophily<sup>21</sup> and a large specific surface is very strongly dependent on the relative humidity of the air and the temperature. Since, with rising temperature, the water vapour pressure rises and, as a rule, the relative humidity of air decreases, and since both leads to a drop in the water content, any increase in the temperature has a cumulative effect. Reductions of the water content by a power of ten due to a temperature increase of 10°C have been proven in the temperature ranges of 10-30°C (see section 2.5. Building Materials, p. 49).

**On e.:** Only an acceleration in the slowest of the five steps described in Section 2.3 can be responsible for a change in the rapidity of the entire reaction. In the neutral or alkali medium, this is the complexing of Fe<sup>3+</sup> to [Fe(CN)<sub>6</sub>]<sup>3-</sup> (step c.) as well as the final reaction of [Fe(CN)<sub>6</sub>]<sup>4-</sup> with Fe<sup>3+</sup> to form the pigment. Although the iron (III) cyanide [Fe(CN)<sub>6</sub>]<sup>3-</sup> itself is stable in a moderately alkali medium (see p. 40, reference [100]), the complexing of Fe<sup>3+</sup> is cinetically hindered. An increase in the temperature by 20°C usually doubles the rapidity of the reaction, if the other marginal conditions remain unchanged. This is, however, not the case in an extreme way, since, as shown above, the rapidity of reaction is very strongly negatively influenced by the strong drop in the water content in case of increased temperatures (see above): the deficient mobility of the reaction partner, the low reactivity of iron, more



**Graph 4:** Degree of disassociation of hydrogen cyanide as a function of the pH value at room temperature.

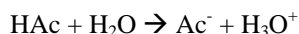
**Graph 5:** Cyanide equilibrium concentration in water as a function of the temperature and pH value at a partial pressure of  $p(\text{HCN})=0.01$  (10 mbar hydrogen cyanide at 1000 mbar total pressure).

rapid desorption of ad/absorbed hydrogen cyanide etc. (section 2.3.1. and 2.3.2, pp. 40ff.). A strong reduction in pigment formation must therefore be expected at increased temperatures.

A decisively higher water content of the solid material and the considerably better absorption and solubility properties of hydrogen cyanide in water are the reasons for the tendency towards cyanide enrichment in solid material at falling temperatures. Additionally, with a higher water content in the solid material, an increase in the reactivity of iron oxide with regard to hydrogen cyanide must be anticipated as well as with a general increase in the reactivity of all reacting compounds. A cooler and therefore moister solid material is therefore more suited to the formation of iron blue than a warm, dry body. In immediate proximity and beyond the freezing point of water, however, the reactivity decreases again, of course.

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20 *Protolysis* is the splitting of acids (HAc) into their corresponding acid anion (base,  $\text{Ac}^-$ ) and Proton ( $\text{H}^+$ , or with water to  $\text{H}_3\text{O}^+$ ):



here  $\text{HCN} + \text{H}_2\text{O} \rightarrow \text{CN}^- + \text{H}_3\text{O}^+$ . See also footnote 15, p. 40.

21 *Hydrophilic* (gr.: water loving) are substances which have in common with water its strong polar character. Oxididic compounds belong to them, which are the chemical components of wall material.

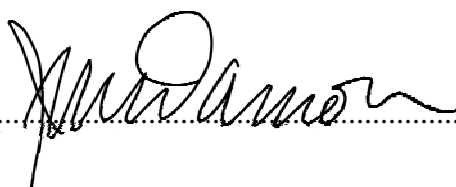
{44}

### 2.3.4. pH Value

The pH value influences the formation of various ways. In section 2.3. (p. 39) reference has already been made to the higher reduction power of cyanide and hexacyanoferrate(III) in the basic environment. The pH value also influences the reactivity of the iron in the solid material (section 2.3.2., p. 41). As remarked above, dissolved hydrogen cyanide hardly exhibits reactivity (nucleophilily too low). The formation of cyanide by absorption and dissociation of hydrogen cyanide only starts in sufficient degree at neutral pH values and above, since cyanide as the corresponding base to the weak acid hydrogen cyanide (pKA-value 9.31)[104] is protonated by the stronger acid water. At a pH value as high as 9.31, 50% of hydrogen cyanide is dissociated, the rest is dissolved gas, see graph 4. If one establishes the saturation concentration of hydrogen cyanide for each particular temperature (Graph 3, p. 42), the result is the correlation between temperature, acid content, and cyanide saturation concentration as shown in Graph 5 (below), valid for ideal solutions. At neutral pH values, equilibrium concentrations of  $\text{CN}^-$  are within the range of  $3 \times 10^{-4}$  to  $1 \times 10^{-3}$  mol per liter, according to the temperature. An increase in the pH value by one point results in a ten-fold increase in the cyanide equilibrium concentration. The actual cyanide concentration in masonry is determined by the rapidity of absorption of the gas, adsorption effects within the solid material, and possible reactions of the cyanide. The result of all these factors is that pH values in neutral to slightly basic range are favourable to the formation of the pigment.

{45}

**Table 3: Formation of Iron Blue**



Parameter	Effect
Water content	Increase in the water content results in the following: increased absorption of hydrogen cyanide; long-term retention of adhering and/or absorbed hydrogen cyanide; increased mobility of the reaction partners; increased reactivity of the iron oxide; water is the basic precondition for disassociation and reduction reactions; generally positive influence with increasing water content. The water content is dependent above all upon the temperature.
Reactivity of the iron	Factors determining rapidity; apart from the type of material and pH value (see below), influenced positively by increasing water content.
Temperature	Increased ad- and absorption of hydrogen cyanide as well as under otherwise identical conditions decrease of speed of the individual reaction with <b>falling</b> temperature; strong increase in water content, and therefore a strongly positive net influence upon all other factors with <b>falling</b> temperature.
pH-value	Increased iron reactivity with falling pH, but massive reduction in the cyanide enrichment and reduction reactivity of hexacyanoferrate II; compromise between iron reactivity and cyanide formation/Fe <sup>3+</sup> reduction at a neutral to weakly alkaline pH value.

## 2.4. Stability of Iron Blue

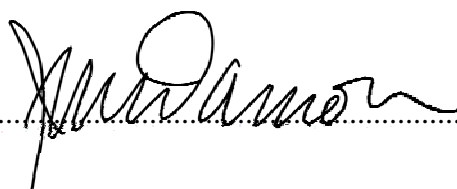
### 2.4.1. pH sensitivity

The initial compounds forming the pigment, the hexacyanoferrates, are bases of very strong acids[105]. It is therefore not astounding that Iron Blue is a acid resisting, but alkaline-decomposing pigment. Hydrogen cyanide is only released by warm, thinned sulphuric acid, while hydrochloric acid, by contrast, has no effect[106]. However, the pigment is reversibly soluble in concentrated hydrochloric acid, i.e., the pigment is not decomposed, but simply dissolved; no hydrogen cyanide is released[82]. At clearly alkaline pH values, Fe<sup>3+</sup> is noticeably precipitated as Fe(OH)<sub>3</sub>, which, in this environment, is even less soluble than Iron Blue (see table 4, p. 47), which results in the destruction of the complex Fe<sub>4</sub>[Fe(CN)<sub>6</sub>]<sub>3</sub>.

The literature contains authenticated cases of studies with iron at pH values of 9 and 10, in which it is still stable[99]. The pH range around 10 to 11 can be considered the critical limit for the stability of iron blue.

Suspensions of Iron blue have a pH value of roughly 4[86]. Hence, at its own slightly acid medium, which is for instance formed in surface waters by acid rain, iron Blue is most stable.

In technical applications, the alkaline resistance is increase by adding Nickel[83,84,107,108].



### 2.4.2. Solubility

Iron blue is considered one of the least soluble cyanide compounds, which is the precondition for its widely-varied application as a pigment. This feature is used in the industry e.g. for passivating steel pipes against aggressive waste water, where the content of CN<sup>-</sup> covers the pipe from inside with an insoluble layer of Iron Blue[109]. The DEGUSSA AG lists its ‘soluble’ Iron Blue simple as “*insoluble*”[110], and states that

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22 Suspensions (lat.: to float) are coarsely dispersed system with particle sizes bigger than 10<sup>-6</sup> m, see footnote 12 on page 39.

{46}

its solvent authenticity durability is “very good”[67]. Not at last, pigments are by definition dye compounds virtually insoluble in solvents and binders (DIN 55 943 and 55 945).

Tananaev[111] examined the solubility of metal hexacyanoferrate(II) and discovered a solubility product<sup>23</sup> of  $3 \cdot 10^{-41}$  (pK<sub>S</sub> =40.5) for the solubility product of Prussian blue, without mentioning the unit used.

Assuming he used the summation formula of (Fe<sub>4</sub>[Fe(CN)<sub>6</sub>]<sub>3</sub>, unit being mol<sup>7</sup> l<sup>-7</sup>), one attains a solubility of 0.5 mg per liter water. Thus, it would be 14 times less soluble than the nearly insoluble calcium carbonate (CaCO<sub>3</sub>, 7.1 mg per liter water, K<sub>S</sub> = 4.95 · 10<sup>-10</sup> mol<sup>2</sup>l<sup>-2</sup>)[112]. Later publications support these findings[95], although attention must be paid to deviations in the stoichiometry (composition) of Prussian blue with impurities, leading to an increased solubility.

Tananaev precipitated the complex metal cyanoferrate from an appropriate metal salt solution with Li<sub>4</sub>[Fe(CN)<sub>6</sub>], probably acquiring a high rate of inclusions (lithium, water) as well. Thus, in spite of the four hour-long accumulation of the precipitation, the filtrate should still harbor colloidal dispersed Iron Blue. Since he finally determined the amount of free Fe(III) in the filtrate by precipitating it with ammonia as Fe(OH)<sub>3</sub>, he will undoubtedly also have precipitated the Fe<sup>3+</sup> of the colloidal, dispersed Iron Blue, as ammonia raises the pH value so much that Iron Blue is no longer stable (see section 2.4.1., p. 45).

Therefore, he did not determine the solubility of Iron Blue, but the measure of stability of the dispersion of fresh precipitations of the pigment.

By using the solubility product of Pb<sub>2</sub>[Fe(CN)<sub>6</sub>] as referent calculus in order to determine solubility products, Kezla[95] found a far lower result, which, when applied to Tananaev’s calculations, produced a solubility of only 0.05 mg per liter. Kezla however, finds similar results for the solubility of most of the other metal compounds, including the Iron Blue. Since the conventional methods of analysis, such as gravimetry and titration, are extremely unstable in view of the minute solubility, one must but wonder over the correlation provided.

However, one can escape this dilemma by thoughtful reasoning:

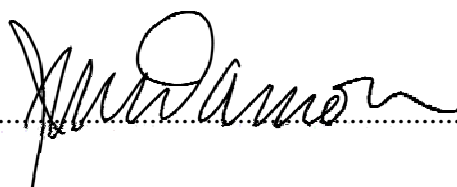
It is safe to say that Iron Blue is stable at a pH value of 7, i.e., in a neutral aqueous medium. The free iron concentration is extremely low, since Fe(OH)<sub>3</sub> is nearly insoluble (see table 4, p. 47).

A pH 7 medium would harbor the following free Fe(III) concentration:

c(Fe<sup>3+</sup>) = **Error!**

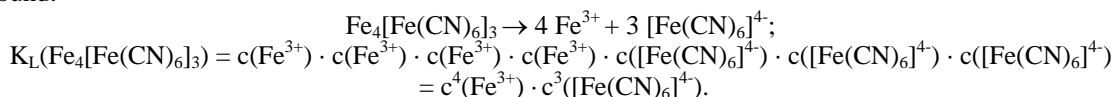
$$= \frac{2}{67 \times 10^{-39} \text{ mol}^4 \text{ l}^{-4}; 10^{-21} \text{ mol}^3 \text{ l}^{-3}} = 2,67 \times 10^{-18} \text{ mol l}^{-1} \quad (2)$$

Should the free Fe<sup>3+</sup> concentration surpass this product due to a better solubility of Iron Blue, then this Fe<sub>3+</sub> would precipitate as hydroxide, and would be increasingly removed from the pigment, thereby destroying it in the end. Since this does not happen, the concentration of the Fe<sub>3+</sub> ion must lie below 10<sup>-18</sup> mol liter. Thus, the solubility of Iron Blue must also have a value below 10<sup>-18</sup> mol per liter (actually:



¼ of the free Fe<sup>3+</sup> concentration, K<sub>S</sub> less than 4.1 · 10<sup>-124</sup> mol<sup>7</sup> l<sup>-7</sup>, pK<sub>S</sub> larger than 123.6) which, at a mol mass of 1110 g mol<sup>-1</sup> ((Fe<sub>4</sub>[Fe(CN)<sub>6</sub>]<sub>3</sub> · 14 H<sub>2</sub>O) would correlate to 10<sup>-15</sup> g. With this, the complex iron pigment does indeed deserve to be called insoluble, as only one part of dissolved Iron Blue can statistically be found in 10<sup>20</sup> parts of water (100.000.000.000.000.000.000). The actual solubility would therefore be less by a factor of 10<sup>11</sup> as determined by Tananaev, which would still be much for so-called insoluble compounds like mercury sulfate

23 The solubility product of a compound is defined as the product of the entire ionic concentration of the totally dissociated compound:



The pK<sub>S</sub> value correlates to the negative decimal logarithm of the product of solubility (see footnote 16, S. 40).  
{47}

(HgS). However, one must consider that the chemistry of Fe<sup>3+</sup> in aqueous solutions doesn't justify the terms 'dissolved' or 'precipitated', since a multitude of complexes do exist in the broad pH-spectrum, partly as polymer hydroxo-aquo-complexes (compare section 2.3.2., p. 41).

**Graph 6:** Free Fe<sup>3+</sup> concentration in dependency of the pH value and the resulting minimal pK<sub>S</sub> value of Iron Blue conditional to its stability at the corresponding pH value. pK<sub>S</sub> value acc. to Tananaev: 40.5; according to reflections made here: greater than 123.

Graph 6 shows the correlation between the pH value of the free Fe(III) concentration (s. notation above) and the respectively resulting least pK<sub>S</sub> value possible for Iron Blue, which it must possess, should stability prevail at the given pH-reading. Tananaev's pK<sub>S</sub> value given, it is obvious that the pigment would remain stable only up to pH 3. Accordingly, it would dissociate itself by its own pH value of 4 (see section 2.4.1), which is formed in its own dispersion. Thus the magnitude of error in the results of Tananaev and Krleza is apparent.

These reflections show that iron, bound as hydroxides or oxides in solid materials, tends to dissolve in a neutral medium more readily than Iron Blue, since its equilibrium concentration is much higher than that of Iron Blue.

In addition to the solubility of a compound in water, the condition and quantity of the water added are decisive in determining the actual rapidity of dissolution of a substance. Waters nearly or entirely saturated in iron are no longer capable of dissolving further iron. Water permeation is extremely slight on the interior of finely porous solid bodies, even at high water levels; the iron saturation concentration is quickly attained, which, in addition, as remarked above, is generated by the slightly soluble iron oxides of the solid body rather than by the iron blue having once arisen. Water running down the exterior surfaces is considerably more aggressive, exerting, in particular, an erosive effect.

### 2.4.3. Competing Ligands

OH<sup>-</sup> ions may, due to the low solubility of Fe(OH)<sub>3</sub>, noticeably precipitate the Fe<sup>3+</sup> of Iron Blue in pH media above 9 to 10. The residual hexacyanoferrate(II), on the other hand, would only decompose in a strongly alkaline media, because Fe(OH)<sub>2</sub> is simply more soluble (compare table 4).

Tartrate<sup>24</sup> has, in contrast to oxalate, hardly any effects so that Fe<sup>3+</sup> can

Table 5: Dissociation constants and solubility products of iron compounds		
Compound	Constant	Source

$K_L(\text{Fe}_4[\text{Fe}(\text{CN})_6]_3)$	$3 \times 10^{-41} \text{ mol}^7 \text{ l}^{-7}$	[111]
$K_{D(6)}([\text{Fe}(\text{CN})_6]^{4-})$	$10^{-24} \text{ mol l}^{-1}$	[113]
$K_{D(6)}([\text{Fe}(\text{CN})_6]^{3-})$	$10^{-31} \text{ mol l}^{-1}$	[113]
$K_L(\text{Fe}(\text{OH})_2)$	$4,79 \times 10^{-17} \text{ mol}^3 \text{ l}^{-3}$	[112]
$K_L(\text{Fe}(\text{OH})_3)$	$2,67 \times 10^{-39} \text{ mol}^4 \text{ l}^{-4}$	[112]
$K_L(\text{FeCO}_3)$	$3,13 \times 10^{-11} \text{ mol}^2 \text{ l}^{-2}$	[112]

{48}

be quantitatively removed from sour wine with  $[\text{Fe}(\text{CN})_6]^{4-}$ , a usual procedure to remove iron ions from wine[114]. Concentrated alkali carbonate solutions may precipitate  $\text{Fe}^{2+}$  of the  $\text{FeCO}_3$  complex and aside its alkalinity (precipitating  $\text{Fe}^{3+}$ ) may also destroy the hexacyanoferrate(II) salt  $[\text{Fe}(\text{CN})_6]^{4-}$ [106]. Calcium carbonate solutions would not be sufficient, due to their marginal saturation solubility. Besides that, Kohn[115] examined the supportive effect of most of the organic ligands to disperse or dissolve Iron Blue.

#### 2.4.4. Effects of Light

Certain wave lengths of ultraviolet radiation may set free  $\text{CN}^-$  from hexacyanoferrate(II) and -(III), the preliminary stages of Iron Blue. As far as hexacyanoferrate(III) is concerned, this leads to the formation of Iron Blue[96-98]. As far as hexacyanoferrate(II) is concerned, wave lengths of 365 nm offer sufficient quantum efficiency, guaranteed onwards from 0.1 to 0.4[98,116].

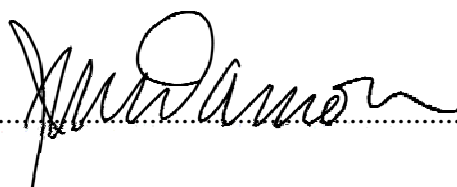
Lately, discussions are held whether complex cyanides can be removed from industrial waste waters by ultraviolet radiation. The unbound cyanide will be oxidized and destroyed by hydroxide radicals originating from the parallelly occurring photolysis of water.<sup>26</sup> However, results are not unequivocal [117,118].

In general, however, Iron Blue itself is a photo-stabile pigment[86,119-122]. Thus, patents exist, whereby Iron Blue is employed as an ultraviolet absorbing pigment, which only makes sense if its resistance against ultraviolet radiation suffices[123]. As for Iron Blue, one knows of the bleaching effect under strong, perpetual sun radiation and the ensuing re-darkening during the night[91,120,122]. Here also, the liberation of  $\text{CN}^-$  is responsible, which reduces parts of the  $\text{Fe}^{3+}$  ions to  $\text{Fe}^{2+}$  ions. For the latter, however, this process will reverse during the night under the influence of oxygen and moisture. The Iron Blue concentration will eventually be reduced by the loss of the liberated  $\text{CN}^-$ , either by evaporation of hydrogen cyanide, by washing out as  $\text{CN}^-$ , or by oxidation through  $\text{Fe}^{3+}$ /atmospheric oxygen or from hydroxide radicals from the natural photolysis of water. The latter process is minute and can therefore be omitted. At any rate, most of the cyanide freed by photolysis will again be complex bound to iron.

#### 2.4.5. Long-Term Test

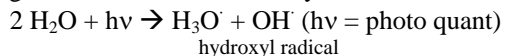
In a 21 years long lasting test in the industrial city of Slough, located to the west of London, the color durability of Iron Blue was tested besides of other pigments[124]. Aluminum sheets, covered with a protective oxide layer, were alternatively dipped into a solution of  $\text{K}_4[\text{Fe}(\text{CN})_6]^{3-}$  and a solution of  $\text{Fe}(\text{NO}_3)_3$ , during which the forming pigment was adsorbed on the surface.

Since this experiment was supposed to test the corrosion protecting effect of pigments on a sheet of aluminum. Some samples were subsequently treated for some 30 min in boiling water, partly with additions of small concentrations of Chromate, Vanadate or Molybdate, in order to test whether this would lead to an improved pore-closing effect of the pigment. The colored test sheets were then mounted in a 45° angle on the roof of a building, pointing towards southwest.





- 24 Tartrate, corresponding base of tartaric acid. The mixed potassium-sodium-salt is the famous tartar (potassium bitartrate), which crystallizes on the cork of wine bottles (Seignette salt)
- 25 Quantum efficiency is that part of the absorbed light quants which leads to photo reactions under scrutiny, here from 10 to 40%
- 26 Photolysis of water leads to the splitting of water into uncharged parts with unpaired electrons (formation of radicals through destruction of the homolysis, see also dissociation):



{49}

During a middle-term pre-experiment, the only Iron Blue sample lost almost all its color after 5 ½ years. In the consecutive long-term test, during which the samples were exposed for 21 years, eight iron blue samples, in particular, followed by iron ochre (Fe<sub>2</sub>O<sub>3</sub>) exhibited only minimal alterations after this period of time. One sample of iron blue and iron ochre was removed only after 10 to 11 years in each case. Whoever, this Iron Blue sample is not referred to as Prussian Blue in the literature, since it was assumed to be the chemically different Turnbull's Blue or ferrous ferricyanide. All other samples still exhibited an intense blue color, independent whether or not they had been treated with hot water. Half of the seven remaining iron blue samples received the value 4 out of a maximum of 5 points for the best retention of quality, on the gray scale used there in the determination of color changes. Only minor alterations were detected. Additions of transition metal oxides (Vanadate, Chromate, Dichromate) to the sealing process had a negative influence on the durability. An explanation for this can be that transition metals like Molybdenum, Chromium or Vanadium have a decomposing effect; there exists a research series on that for Titanium[122].

The exhibits were therefore exposed to the environmental conditions of a strongly industrialized area, with full effects of precipitation, direct sunshine, and wind erosion for more than 21 years. Under intense summer sunshine and in the absence of wind, the temperature of the dark-blue colored aluminum metal sheets rose steeply (iron blue is only stable up to approximately 140°C[86,125-127]). Snow, frost, hail, storms, and the finest, driving acid drizzle were obviously just as little able to damage the pigment as the UV radiation of direct sunlight.

What is remarkable is that, in determining the degree of destruction of the pigment, no unexposed samples were used, since these had been lost over the 21-year period; rather, places on the surface of the exhibits which had been relatively well protected from direct environmental influences by the frames and by rubber rings on the screw joints, were used as control samples. These exhibited almost no alterations.

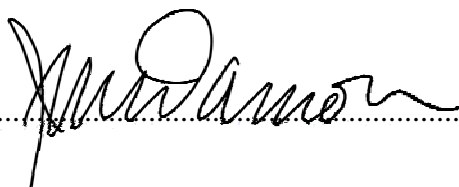
In comparison to the environmental conditions which are of interest here, this long-term test involved considerably more severe conditions, since in this case, the externally formed 'soluble' iron blue was only superficially adsorbed upon the aluminum sheets. The pigment nevertheless resisted extremely well. The clear deviation of the pre-experimental series from this experiment (bleaching already after 5 ½ years) was not explained, but may be a result of a mistake during the formation (wrong stoichiometry).

Under the circumstances considered in this case, a half-value period of the reduction of pigment concentration of some 30 years is to be assumed. This means that after 30 years still some 50% of the original pigment concentration must be expected on a free surface.

## 2.5. Influence of Various Building Materials

### 2.5.1. Brick

the chemical composition of bricks varies massively due to the different sorts of mar and loam used as initial material. The content of clay (included in this are 20 to 60% Kaolinite, consisting roughly of



47% SiO<sub>2</sub>, 40% Al<sub>2</sub>O<sub>3</sub>, 13% H<sub>2</sub>O) may lie between 20 and 70%, the rest being Carbonate, finest sand and iron oxides[128]. The latter content may, according to my own analyses, vary between 2 and 4%.

The porosity values of bricks lie between 20 and 30 vol. %[129], according to other sources up to 50%[130]. According to mercury penetration tests, the pore size of bricks lies heavily concentrated around 1 μm. Due to the decreased specific surface (0.5 to 1 m<sup>2</sup> per g, BET<sup>27</sup>, own tests), the reactivity of the iron oxide is strongly reduced. However, partly dissolved iron at brick

{50}

surfaces immediately exposed to weathering can be set free for reactions in bigger amounts.

The normal free, i.e., not chemically bound water content of bricks in dry rooms (20°C) is in the area of one volume percent, but it can rise up to 4% at a relative humidity of over 90%[131].

## 2.5.2. Cement Mortar and Concrete

Al <sub>2</sub> O <sub>3</sub> : 5 -10 %	K <sub>2</sub> O: 0.2 – 0.6 %
SiO <sub>2</sub> : 20 %	Na <sub>2</sub> O: 0.5 - 3 %
CaO : 60 %	Fe <sub>2</sub> O <sub>3</sub> : < 5 %

The chemical composition of Portland cement, the most frequently used cement for concrete and water mortar, can be seen in Table 5.

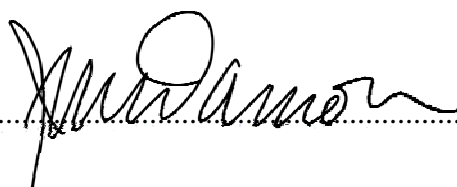
The specific surface of the cement powder is in the order of 3000 cm<sup>2</sup> per g. Concrete and cement mortar get their stability by hydration of the cement compounds Calcium oxide CaO (burnt lime), Silicon dioxide SiO<sub>2</sub> (Quartz), iron and Aluminum oxide Fe<sub>2</sub>O<sub>3</sub>/Al<sub>2</sub>O<sub>3</sub> to mixed, microfibrinous Calcium Aluminosilicate-Hydrates with a chemically bound water content of some 25 mass % [133]. It then has a specific surface of up to 200 m<sup>2</sup> per g when measured with water adsorption, which is an extremely high value. Other methods (e.g. BET-measuring with nitrogen) yield only a value of only 1/3 of this or less[134]. The porosity of mortar and concrete heavily depends on the amount of water added during preparation, and lies at a minimum of 27% according to the literature[135], in which case the microcapillary pores between the silicate fibers are included as well, which cannot be determined with mercury penetration measurements.

Aside from the absolute porosity, the pore size distribution is decisive for the reactivity towards gases. If the main pore volume is formed by micropores, then the gas diffusion into the material is more inhibited than if the main pore volume is formed by larger pores. Graph 7 shows the accumulated pore volume distribution of concrete and one wall mortar (exact composition unknown, since taken from an old wall).

**Grafik 7:** accumulated pore volume distribution of concrete, according to "Forschungs- und Materialprüfungsanstalt, Abteilung 1: Baustoffe" (Research and Material Testing Agency, Department 1: Building Materials), Stuttgart, and of wall mortar, own analysis. In each case determined by Hg penetration.

Having a similar total pore volume like the wall mortar (here only 14 % due to the test method), the concrete's largest portion of pore volume lies between a pore radius of 0.01 and 0.1 μm, whereas the wall mortar's largest portion lies between 0.1 and 10 μm. Hence, if compared with the wall mortar, the gas diffusion into the concrete will be disadvantaged. In general, the average pore size of cement building materials changes to larger values when increasing the content of sand and lime.

Fresh concrete are relatively strongly alkaline, caused by the high content of Calcium hydroxide, which, however, binds up rather quickly. However, depending on the type of cement, a certain amount of it is released as time goes by. The pH value of non-carbonated concrete is around 12.5. It later falls,



however, due to the binding of carbon dioxide from the air.

---

27 Method to determine the specific surface with nitrogen adsorption following Brunauer, Emmet, Teller. {51}

The speed of carbonatization into the depth of the concrete depends strongly on the consistency and porosity of the material and follows a square root relation[133,134,136]:

$$D = c \cdot \sqrt{t} \quad (3)$$

d = depth of carbonatization  
c = constant  
t = time

In water tight concretes it takes many years for the limit of carbonatization to advance only a few centimeters due to the inhibition of diffusion in this highly compact material.

In the area of carbonatization, the pH value decreases to roughly 7, the equilibrium value of saturated calcium carbonate solutions. But if the wall is wet, this results in a proton exchange and therefore no sharp pH border is formed. If a large portion of the air pores (size in the order of tenth millimeters) flooded with water poor in carbon dioxide, the carbonatization advances less fast, because compared to the gaseous phase, diffusion in aqueous phases is much slower, by some orders of magnitude. In the case of waters rich in carbon dioxide, however, this can accelerate the carbonatization.

Concrete and Mortar in principle have a higher water content than bricks, in the range of 1% at 20°C and 60% rel. humidity and up to 10% in air saturated with humidity[131]. In case of permanently high humidity eventual penetrating wetness from outside, a huge part of the pore system can be filled with water[135]. Poorly insulated buildings built underground always have one cool and humid wall due to their great exchange surface area with the ground, partly because of their absorbance of humidity from the ground, and partly because of the condensation of humidity in the air on the cool walls when the temperature falls below the thaw point. The water content of these walls therefore lies around 10%, that is, around a factor of 10 or more above that of dry walls of heated rooms built above ground.

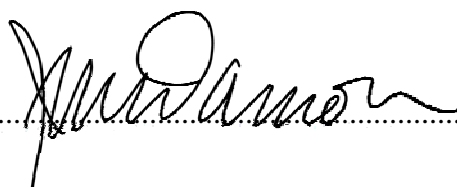
### 2.5.3. Lime Mortar

Air or lime mortar is manufactured using only CaO and sand, and it acquires its solidity through the binding of slaked lime (Ca(OH)<sub>2</sub>) with atmospheric carbon dioxide to lime. This process The iron content of air mortar or lime mortars is based, in particular, on the admixed sand (up to 4 % Fe<sub>2</sub>O<sub>3</sub>). Due to the coarser pore system, which supports gas diffusion, this process takes only weeks or months, the final pH value being at 7. Since this medium no longer provides sufficient protection for steel reinforcement rods and offers only slight environmental resistance, it is usually used for the plastering of interior walls and brick walls only, in the latter case often mixed with cement[135]. Due to the lack of formation of fine crystalline alumo-silicates, the specific surface of air mortar lies considerably beneath that of cement mortar.

The iron content of lime mortar is mainly due to the addition of sand which has up to 4% of Fe<sub>2</sub>O<sub>3</sub>. The water content is similar to cement mortar. For fresh air mortar an extreme high water content can be damaging, as the carbon dioxide necessary for the binding process can no longer penetrate into the wall.

### 2.5.4. Effects Upon the Formation of Iron Blue

Being only fairly resistant against alkaline medium, Iron Blue Due is only restrictively used for paint-



ings on concrete/cement due to its alkaline behavior[84,137]. Hence, Degussa describes the lime durability as “not good”[86], meaning the durability on non-carbonatized, alkaline plaster and concrete[138]. The carbonatization limit in concretes and mortars can be considered to be the limit of pH-stability of the pigment. As in case of the carbonatization, the formation of Iron Blue in the wall exposed to hydrogen cyanide gas is a reaction, where on educt (initial compound) is transported in the gaseous phase, and which can react only at the liquid phase[136]. However, in contrary to the CaCO<sub>3</sub>-formation, the pigment forms only very slowly, so that there is no sharp limit

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of reaction. Due to diffusion, the pore system can therefore be deeply filled with cyanide. A high water content, which does not inhibit the diffusion of gaseous hydrogen cyanide into the wall, is therefore supportive to the accumulation of cyanide. The conversion of cyanide into Iron Blue lasts years, accelerated by a high water content in the building material.

A distinction can be made between three areas of different reactivity in masonry:

1. Larger quantities can become enriched with CN<sup>-</sup> in the non-carbonatized portion, due to the alkaline medium, further favored by the increased absorption of hydrogen cyanide by the still-humid material. The cyanide is only slowly bound as [Fe(CN)<sub>6</sub>]<sup>3-</sup>. Due to its strong oxidation behavior, this is converted quite rapidly into the more stable [Fe(CN)<sub>6</sub>]<sup>4-</sup> in the alkaline medium. An accumulation of [Fe(CN)<sub>6</sub>]<sup>4-</sup> will therefore take place over a longer time period.
2. In the limit range of carbonatization, the tendency to enrichment of the cyanide is reduced, since the disassociation equilibrium lies increasingly on the side of the hydrogen cyanide. The oxidation strength of the [Fe(CN)<sub>6</sub>]<sup>3-</sup> is also diminished. On the other hand, the pigment itself now becomes stable, so that [Fe(CN)<sub>6</sub>]<sup>4-</sup> increasingly combines with Fe<sup>3+</sup>, which is now somewhat more easily soluble, to form Iron Blue, intimately mixed with the CaCO<sub>3</sub>, which is now also forming in this area.
3. In the pH-neutral, carbonatized part of the masonry, the formation is considerably dependent on the available cyanide concentration, which is strongly reduced there. Already formed iron (II) cyanide is gradually converted into iron blue in the presence of humidity.

Table 6: Absorption of hydrogen cyanide by various building materials in 2 vol.% HCN over 24 hours.[141]

MATERIAL	HCN [mg m <sup>-2</sup> ]
Clinker.....	55.2
Brick.....	73.0
Slag stone.....	2880.0
Alluvial stone.....	3790.0
Lime sandstone, naturally humid.....	2 2740.0
Lime sandstone, briefly dried.....	4 360.0
Lime sandstone, dried approx. ½ year at 20°C ...	2941.0
Concrete block, dried for 3 days.....	8 148.0
Lime mortar blocks, a few days*.....	4 800.0
Cement mortar blocks, a few days old*.....	540.0
Cement mortar blocks, a month old*.....	140.0
Cement blocks, pure, a few days old*.....	1 550.0

\* 2.5 to 3.3% HCN by volume[139]. The vol.% data, according to authors, represent theoretical nominal values, which, in practice, however, are only reached up to 50% or less, through adsorption onto walls and fumigation materials.

In comparison to bricks, the formation of Iron Blue in mortar interstice and plaster is favored due to the extremely large inner surface of the material, its high porosity, and the relatively high moisture content, but disadvantaged due to the lower iron content. With increasing water content, the diffusion of hydrogen cyanide in deeper layers of the wall is inhibited, so that the binding of cyanide is then concentrated at outer layers; this is especially true for concrete.

Investigation about the diffusion of hydrogen cyanide through brick walls or plastered material of 5 cm thickness yielded result which where only accidentally reproducible, since especially in case of not-carbonatized or slightly humid material almost no hydrogen cyanide diffused through the wall, i.e., it was completely absorbed[140].

Table 6 (p. 52) shows the adsorption values of hydrogen cyanide in various building materials, quoted according to L. Schwarz et al.[141]. They confirm the assumption of considerably higher reactivity of cements compared to brick, as well as the greater tendency of fresh cement compared to older and generally more humid building materials toward accumulation in hydrogen cyanide. The adsorption of hydrogen cyanide by the concrete block is astonishingly high.

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**Graph 8:** concentration behavior of hydrogen cyanide in a delousing chamber with lime and chlorine caoutchouc painting[139].

**Graph 9:** Drop in the hydrogen cyanide concentration in old, dry, cement blocks, after 24-hour fumigation with 2.5 vol.% HCN[141] (see footnote in table 6, p. 52).

Therefore, cool, humid walls will accumulate 8 times more hydrogen cyanide than a wall which was permanently exposed to a temperature of 25 to 35°C.

The great importance of gas-tight paintings to prevent losses of hydrogen cyanide in gassed dwellings is generally referred to in the old literature. Graph 8 shows the importance of a protective painting, since without it, the hydrogen cyanide concentration rises only up to  $\frac{2}{3}$  of the rated value and drops very quickly due to adsorption and absorption in the wall. (A part of the decrease was caused by gas leaks. See [141])

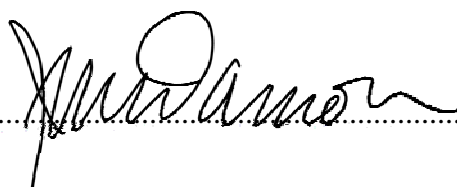
The durability of rather high concentrations of hydrogen cyanide over longer periods of time even in dry, carbonatized cement may be seen from the graph 9 (p. 53). The concentrations do not fall below  $\frac{1}{4}$  of the initial values even after 3 days. With daily fumigations lasting several hours, this resulted, in this example, in the concentration in the wall swinging approximately between 100 to 200 mg hydrogen cyanide per m<sup>2</sup> of masonry.

The measured values in graph 9 were approximated by a function consisting of two terms:

$$c(t) = 100 \cdot e^{-(t/0.3)} + 100 \cdot e^{-(t/4)} \quad (4)$$

c(t) = HCN concentration at time t  
t = time in days

The first term in the above can be interpreted as a disabsorption from the surface of the material, with a Materials  $\tau^{28}$  of 0.3 days. The second term describes the absorption of hydrogen cyanide and it reversion with a  $\tau$  of 4 days, caused by the slow diffusion processes in the pore water of the material. Larger errors relating to the drop in concentration described here will be made over longer



**Graph 10:** Simulation of the relative hydrogen cyanide concentration in relation to saturation (100%) in the masonry of a delousing chamber during alternating gassings and ventilations under ideal mathematical behavior. See text.

28  $\tau$  is the time after which the value has dropped to 1/e (0.368...) of the initial value.

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periods of time because the release of hydrogen cyanide is increasingly inhibited by physical and chemical effects (stable compounds) (see section 2.3.3.a., p. 42).

An analogous function is assumed by the absorption of hydrogen cyanide:

$$c(t) = 100 \cdot (2 - e^{-(t/0.3)} - e^{-(t/4)}). \quad (5)$$

**Graph 11:** Simulation of the relative hydrogen cyanide concentration compared to the saturation point (100%) in the masonry of a homicidal 'gas chamber' with alternating gassings and ventilation, under ideal mathematical behavior. See text..

This, then, is only a correct description of the process when the concentration of hydrogen cyanide in the air in the room remains constant. The function then reaches its maximum saturation after approximately 20 days. In arriving at this approximation, one must reduced the fumigation time involved in such a way as to equal real conditions with variable concentrations. Therefore, the gassing times will be reduced in the following.

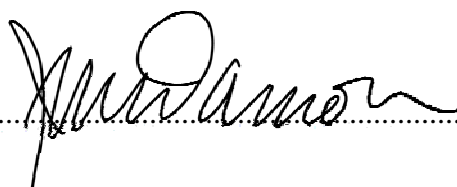
An alternating load of the masonry (n hours constant hydrogen cyanide concentration, n hours no hydrogen cyanide in the air) under these conditions will create a quasi-stationary condition approximating a constant hydrogen cyanide concentration in the masonry. When using the above function, the average hydrogen cyanide concentration increases roughly linearly with the average gassing time, as long as the gassing time does not exceed the ventilation time. If it does, only a small increase of the concentrations occurs. Graph 10 (left) shows the results of the two simulations for a delousing chamber with different gassing methods. The graph shows the relative hydrogen cyanide content of the masonry with relation to its saturation concentration, i.e., the maximum quantity of hydrogen cyanide which can be absorbed by the wall (100%). Case one shows the HCN concentration development in the wall of a delousing chamber with evenly alternating loading and release in longtime-permanent operation, i.e., alternating four hours gassing and ventilation, i.e., three gassings daily. The average concentration with this type of loading amounts to approximately 50% of the saturation concentration. Considering the gassing time commonly applied in these time – some 2 to in maximum 10 hours –, the assumption of four hours of constant concentration appears to be a bit too high under the given technical conditions. Compare for this section 3.3. Material Delousing Facilities (p. 59) and 4.4. Summary (p.

{55}

93). As will be shown in section 3.3., using the delousing chambers trice a day would have been impossible due to lack of Zyklon B. Therefore, the realistic case two shows the case of one gassing daily with a third of the average relative quasi-stationary concentration (some 15% compared to 46%).

Graph 11 (p. 54) shows, as cases three and four, the results of the simulation of the relative hydrogen cyanide concentration in relation to the saturation value of the masonry through a gassing lasting 12 and 24 minutes daily, of a homicidal 'gas chamber' with final 23 hour and 48, and 36 minutes ventilation, respectively with the same hydrogen cyanide concentration as used in case of the delousing. The average hydrogen cyanide contents appearing in the masonry lie around approximately 0.76% and 1.5% of the saturation concentration.

The cases of the delousing and homicidal 'gas chamber' are only correctly comparable when one con-



siders the absolute hydrogen cyanide concentrations in the masonry. If, for example, one considers that, in particular, the interior walls of the delousing chambers had warm, dry walls, while the alleged homicidal 'gas chambers' in Crematoria II and III were cool and very moist, then, with equal gassing concentrations, one must multiply the relative concentrations of the homicidal 'gas chamber' at least by the factor 8 of the 8-fold increased hydrogen cyanide absorption capability of cool, moist walls (see page 52). Therefore, the absolute average hydrogen cyanide content of the homicidal 'gas chamber' would lie around a value which would be comparable with the absolute content of a warm, dry wall in a delousing chamber, which has 6% of its saturation concentration (12 min. gassing) , or roughly 12% in case of the 24 minutes case. One can see that even with such short gassing times, the walls of a homicidal 'gas chamber' exhibit a hydrogen cyanide content which would lie lower than that of a delousing chamber exposed to a four hours lasting gassing with constant hydrogen cyanide concentration only by the factor 1.3 in case of 24 minutes, and 2.7 in case of 12 minutes gassings.

### 2.5.5. Destruction of the Pigment in Masonry

The dissolution of soluble and less soluble compounds of masonry depends heavily on environmental circumstances, mainly on the amount and type of the corroding water. Waters rich in carbon dioxide and mineral acids as well as chlorides and sulfates are considered to be particularly effective due to their carbonatizing and lime dissolving features[142,143]. For a direct dissolution of the pigment, the iron content of the ground water will be important.

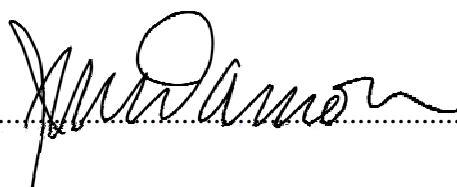
During to a ten years lasting study of the corrosive effects of waters rich in chlorides and sulfates onto a concrete facility of a pumping station in Egypt (Manzala Lake), it was determined that the amount of easily soluble alkali ions of the concrete was still in the range of the initial values, i.e., around 0.2%  $K_2O$  and 1 %  $Na_2O$ , even though the cement was apparently heavily wash out[144] (see also Table 5, p. 50).

This can be explain with the fact that the amount of lime has been reduced by more or less the same percentage as the alkali compounds (a few percents). However, the analysis methods for alkali compounds is working at its limits of exactness here, so that any changes will be covered by statistical fluctuations. Even though alkali compounds as more easily soluble than lime, the similar degree of dissolution is to be explained on hand by the fact that not all potentially soluble alkali ions can be reached by the water, but is protected by surrounding, less soluble compounds.

On the other hand, the adsorptive and adhesive forces in solid materials with high specific surfaces, like mortar, concrete, and cement, are so high that substances on their surfaces are difficult to remove[136]. Additionally, the diffusion paths in such materials are very long and the diffusion resistances very high. Non-carbonatized regions of masonry are not influenced by weathering. In them, a reduction of the content of  $CN^-$  or hexacyanoferrate(II) can hardly occur. In the carbonatized area, however, this is different. Since the dissociation equilibrium lies increasingly on the side of the volatile hydrogen cyanide, its concentration can be reduced by gassing out. Possibly not yet converted complex iron cyanide, especially the extremely stable hexacyanoferrate(II), however, is not subjected to this process of gassing out, since in this case the cyanide ion is firmly bound. In deeper

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regions of the masonry, it will be detectable for longer periods of time, and there it can slowly convert to Iron Blue. In wet masonry, soluble cyanide compounds are subjected to a slow migration<sup>29</sup> towards the surface of the masonry, parallel to the water transport (absorption from the ground soil, evaporation on the free masonry surface). There they are, besides erosion, subjected to an accelerated conversion to the pigment, supported by a higher water content, superficially activated iron, and possible catalytic effects of UV radiation. Hence, on the long run an accumulation of Iron Blue must be expected on the



outmost layer of the wall.

Iron Blue has a very good migration durability, i.e., it has a very low mobility[86]. Being much less soluble than the little soluble lime and the other iron contained in the wall, and additionally being resistant against acid, the only way to reduce the concentration of Iron Blue in the interior of a wall is by dissolving the lime on which it sticks or the entire cement as such. For instance, if 2 % of the cement dissolves, a similar amount of Iron Blue will be set free (not dissolved!). However, due to its low solubility, most of the pigment set free will remain the interior of the masonry.

Regarding the pigment's percentage of the entire sample mass, this means only a small reduction with time, if any at all, since the amount of pigment is always related to the entire amount which decreases, too.

In contrary to mortar, bricks normally consist of an almost indestructible material. Therefore, a possible decrease of the pigment can be neglected. Hence, it can take centuries before the pigment can no longer be detected, alongside with the decaying masonry itself.

These findings correspond to experiences with walls which have been tainted with a hardly soluble, coloring substance. Despite long-lasting attempts to clean them, such walls can be clean only to a very restricted degree.

Since during the long-term test (section 2.4.5., p. 48) Iron Blue turned out to have a comparable long-term stability as the likewise tested iron ocher ( $\text{Fe}_2\text{O}_3$ ), one can assume, in the case under consideration, a similar durability of the pigment as it is displayed by the  $\text{Fe}_2\text{O}_3$  in the masonry. Since both have to be considered as integral parts of the masonry, but no noticeable dissolution of iron oxide was ever observed, no noticeable reduction of the concentration of either substance can be expected over decades.

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<sup>29</sup> *Migration* (lat.: to wander, migrate) is the moving of particles driven by force fields (in most cases ions in electric fields), in contrary to the purely rein statistic *diffusion*. Since in our case the cyanide compounds do not move to the surface by themselves, but are carried away by the solvent water, hence are driven, this term is used here.

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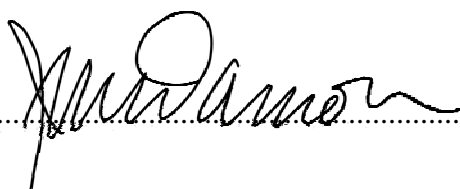
### 3. Procedures of HCN Gassings

#### 3.1. Toxicological Effect of HCN

The biochemical mechanism of hydrogen cyanide is the reversible attachment of cyanide to the  $\text{Fe}^{3+}$  in the respiration enzyme cytochrome oxidase in the body cells. This stops the oxygen delivery into the cell, resulting in the interruption of oxidation processes which are essential for the cell's survival. The human being suffocates due to the suffocation of the vital cell functions.

Lethal doses of cyanide can be ingested orally, inhaled, or absorbed through the skin. Whereas oral poisoning (for example, with potassium cyanide KCN) is very painful due to muscular convulsions (cramps) caused by cell suffocation, the victims of poisoning by inhalation of high concentrations of hydrogen cyanide become rapidly unconscious before muscular convulsions occur. This is the reason for the use of painless cyanide gas for execution in some states of the United States. A dose of 1 mg cyanide per kg body weight is generally considered to be lethal. Non-lethal doses of cyanide are quickly decomposed and excreted by the body by binding to sulfur (to rhodanide). The bright red coloration of the blood, and livid spots, caused by oxygen saturation of the blood, which can no longer give off oxygen to the cells, are generally considered, among other things, symptomatic of hydrogen cyanide poisoning in fatal cases[145-148]. Testimonies describing painful death cramps and a blue coloration of the victims of executions therefore cannot correspond to reality.

Absorption through the skin is especially likely when the skin has become moist, for example, as a re-





sult of sweating at work. It is generally advised to take care to avoid sweating during the handling of hydrogen cyanide. Concentrations from 6,000 ppm<sup>30</sup> (0.6 % by volume) constitute a health hazard, while 10,000 ppm (1% by volume) can cause death in just a few minutes[149]

Regarding the concentrations applied during execution in the USA, Leuchter reports about an order of magnitude of 3200 ppm, to which the victims are exposed immediately. Death is caused by this in 4 to 10 minutes, depending on the constitution of the victim[150]. Assuming a normal breathing volume of some 15 – 20 liters per minute, some 230-380 mg of HCN had been consumed in this time which is roughly three to five times the lethal dose.

The effects of various concentrations of hydrogen cyanide is described as followed in the literature.[79]

2 to 5 ppm:	Perceptible odor
10 ppm:	maximum permissible worksite concentration (MAK)
20 to 40 ppm:	Slight symptoms after a few hours
45 to 54 ppm:	Tolerable for ½ to 1 hour without significant or delayed effect
100 to 200 ppm:	Lethal within ½ to 1 hour
300 ppm:	Rapidly fatal

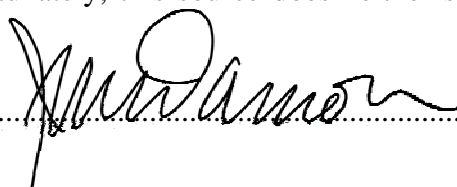
30 ppm means parts per million, here one ppm of HCN is 1 ml HCN per m<sup>3</sup> (1 000 000 ml) air.

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### 3.2. Evaporation Characteristics of Zyklon B

Liquid hydrogen cyanide has a short shelf life and is extremely dangerous with incorrect handling. Already at the end of the First World War, hydrogen cyanide was introduced onto the market in a more easily handled and safer form: porous materials soaked with hydrogen cyanide with the addition of a stabilizer and an irritant warning material, intended to warn people of the hydrogen cyanide, which has only a slight odor. The DEGESCH corporation, with registered office in Frankfurt, produced and licensed the *Zyklon B*<sup>®</sup> preparation, representing this easily handled form of hydrogen cyanide. Until the end of the Second World War, it played an extraordinarily important role in the struggle against insect pests and rodents [151-153], in foodstuffs warehouses, large-scale means of transport (trains, ships), public buildings, barracks, prisoner of war camps, concentration camps[154-156], and of course generally in hygiene and in the prevention of epidemics[139, 157-160] in many countries of the world. Of course, there were several other gaseous pest control agents in addition to Zyklon B[161,162] Zyklon B continued to play an important role even after the war, before it was largely replaced by DDT and its successors[163,164]. In these times, Zyklon B could be purchased in three different forms: cardboard disks made of porous fiber material, comparable to beer mats, with a hole in the middle, a grain-like carrier material made of gypsum (Erco) and diatomaceous earth in grainy form, grain diameter under 1 cm (Diagriß). Today, the Erco product is no longer available; the product name was changed to “Cyanosil<sup>®</sup>”. The Zyklon B version allegedly used for homicidal gassings was the Diagriß product, pellets of diatomaceous earth, 5 to 10 mm in size, where 60% of the product’s masse is caused by the carrier[165,166]. The toxic gas evaporates quite slowly from the carrier. This was intentionally so, since during gassings of dwellings, the personnel, equipped with gas masks, had to distribute the product in the rooms. Since a gas filter becomes unsafe at a certain concentration (see section 3.4.2.3., p. 73) and a poisoning can also occur through the skin, the slow release of the gas is a prerequisite for the safe retreat of the personnel after distributing the product.

The evaporation characteristic of hydrogen cyanide from the carrier material is given in two sources[166,167]. The information of the second, stemming from the US-Army Chemical Corps, can be seen in graph 12. Unfortunately, this source does neither say anything about the type of material



used for the carrier, nor about the way the product was distributed. At a room temperature of some 26°C, the boiling point of hydrogen cyanide, it takes up to 9 hours for 80 to 90% of the hydrogen cyanide to evaporate, following this source.

**Graph 12:** *Evaporation speed of hydrogen cyanide from carrier material, acc. to US-Army Chemical Corps[167]*

The other source originates from the Detia Freyberg GmbH, a successor company of the DEGESCH, who, until the end of the war, was the main supplier of hydrogen cyanide products[166]. Since the gas release depends on temperature and air movements, Detia Freyberg GmbH gives only a rule of thumb. According to this, the carrier releases 80 to 90% of the hydrogen cyanide during 120 min. at a temperature of over 20°C and even distribution, see graph 13.

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After 48 hours, no or only negligible amounts of hydrogen cyanide can be detected on the carrier. At lower temperatures this process is supposed to slow down according to the decreased vapor pressure of hydrogen cyanide. Hence, a release of some 50% of the hydrogen cyanide is to be expected after 40 to 45 minutes (120/3). G. Peters[152] gives half an hour for the release of 50% of the hydrogen cyanide with a product distribution in a layer 0.5 to 1 cm thick. This corresponds roughly with the time period given by Detia Freyberg GmbH. For later statement it is necessary to keep in mind that, at a temperature over 20°C, maximally 10% of the hydrogen cyanide have left the carrier material during the first five, probably even ten minutes after the product was distributed.

**Grafik 13:** *Evaporation speed of hydrogen cyanide from carrier material at more than 20°C and even distribution of the product, acc. to Detia Freyberg GmbH [166]*

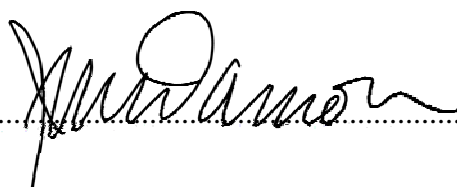
Reducing the temperature from the boiling point of hydrogen cyanide down to 0°C, the evaporation time would roughly triple (see Graph 1, p. 38). According to a war-time source, the evaporation of hydrogen cyanide from the carrier at minus temperatures slows down only marginally[168]. At lower temperatures, an increases slow-down is to be expected toward the end of the evaporation, since then adsorption forces of the carrier have a higher influence.

Thus, a factor 4 lies between the American and the German source. Since the German delousing procedures regularly last several few hours (see below), this latter source is more trustworthy, also because here the kind of distribution of the product is given. Additionally, Peters[152] mentions that the Americans almost exclusively use disks made of cardboard as carrier material, which releases the hydrogen cyanide more slowly than the Diagriß product.

In case the product is not distributed evenly, but in heaps, this leads to a retardation of the evaporation, of course. Two effects have to be considered here: While the volume of a heap of hydrogen cyanide to be released increases with the power of three of its size, the surface of the heap, through which the evaporation takes place, increases only with the power of two. Hence, an increase of the evaporation time proportionally to the size of the heap must be expected. Furthermore, the temperature inside and around the product will decrease stronger due to the increase energy loss, which will slow down the evaporation even more. A slightly over-proportional increase of time is thus given with a growing size of the product heap.

### 3.3. Material Delousing Facilities

A large quantity of publications are available regarding material delousing facilities, both from wartime and prewar periods, to which reference will be made[139,151-156,169-172]. There are also guidelines on



the fumigation of property and rooms, describing the procedures in detail, both before and afterwards[173,174]. These do not considerably differ from the regulations in application today[176]. The following is only intended to be a brief discussion of the technology and method of procedure employed.

Initially, for delousing of personal effects, ordinary rooms (10 to 30 m<sup>2</sup> surface area) were temporarily modified, by making the windows and doors as gas tight as possible, while providing for proper heating and

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ventilation of the rooms. Zyklon B was spread evenly on the floor of the room equipped with the property to disinfested, by workers wearing gas masks. This procedure is similar to what was then the ordinary fumigation of ordinary rooms for the destruction of vermin. Even today, in the main camp of Auschwitz I, such converted rooms can be seen. The operation of temporarily sealed rooms for fumigation is not without risk, however, in addition to which the sealing is only seldom perfect.

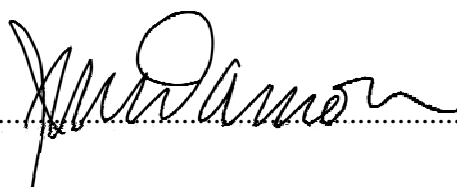
In order to explain the problem of leaking rooms gassed with hydrogen cyanide, a case from the literature may be quoted:

*“Example. J. M., 21 year-old woman carpet decorator. The woman was working in the cellar of a house the second floor of which was being fumigated for vermin with cyanide gas but with inadequate ventilation. Due to insufficient sealing during the fumigation, gas penetrated the corridor, and even reached the cellar through a shaft. Mrs. M. suddenly experienced a remarkable itching in her throat during her work and then suffered headache and dizziness. Two fellow workers also noticed the same symptoms and therefore left the cellar with her. After half an hour they returned to the cellar and suddenly lost consciousness. She was taken to hospital together with the exterminator, who was also unconscious. The patient only woke up in the hospital lift, felt quite well, and exhibited no more symptoms of poisoning during medical examination. The exterminator, by contrast, was dead on delivery.”[147]*

Later, special, window-less gas-tight installations were built, equipped with efficient heating and ventilation systems, and later with circulating air systems (the so-called “*DEGESCH-Kreislaufverfahren*”) for a more rapid circulation of the gas inside the room. Here, the Zyklon B cans were increasingly opened by means of a mechanism useable from the outside, so that the workers were no longer exposed to any danger. In so doing, when the bottom of the can was automatically cut open, the preparation fell into a basket, above which a stream of hot-air was led, comparable to hot air fan. These installations, with the so-called circulation installation, were relatively small in volume of a few m<sup>3</sup> to avoid dead space not needed for the property to be disinfested, that is, to save the very expensive vermin destruction product.

The applied concentrations could be very different according to the type of vermin and exterior conditions, and usually lay between 5 to 30 g hydrogen cyanide per m<sup>3</sup> of air. The exposure time varied just as strongly, from under 2 hours up to 10 hours and more. In the more modern installations with heating (larger than 25°C) and circulating air/ventilation installation, good results could be attained with concentrations of 20 g per m<sup>3</sup> even after 1 to 2 hours.

The longer exposure time of insects and their eggs, if compared to warm-blooded creatures, is due, for one thing, to their greater resistance against the toxic gas, and largely to the fact that lethal concentrations of the gas must penetrate in lethal concentrations into every narrow corner and every garment seam of the property to be fumigated, in order to kill, for example, every concealed louse. Warm-



blooded animals, by contrast, are very rapidly exposed to high concentrations of the gas, not only due to their size, but above all due to their breathing through the lungs.

As mentioned in section 1.4. (p. 32), no equipment can be found anymore in the rooms of building 5b in Birkenau camp, which are called 'gas chambers'(!) on the plans. The room has a surface area of approximately 130 m<sup>2</sup>, is open to the framework of the roof, and therefore has a volume of at least 400 m<sup>3</sup>, the total area of which above 2 m in height must be considered to have been unusable dead space. Use of the entire room as a delousing chamber requires a quantity of Zyklon B of at least 4 to 5 kg (10 g per m<sup>3</sup>) cyanide content<sup>31</sup>, regardless of whether the room contained only a few personal effects or whether the available area was filled. For example, with 100 fumigation cycles per year (one every 3 or 4 days) approximately 0.8 tons of Zyklon B would have been consumed by this installation alone and by building 5a, corresponding to 10% of the entire Zyklon B deliveries to Auschwitz in 1942, with a total delivery of 7.5 tons[176].

When one considers that there were other hydrogen cyanide delousing installations in Birkenau in addition to these[19], that the deliveries to Birkenau camp also supplied the

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31 The mass value refer always to the actual HCN net content of the product.

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related labor camps, more than 30 in number, as well as the fact that inmate barracks were also occasionally fumigated with this insecticide[21], (per barrack, some 40×12×3.5 m > 1500 m<sup>3</sup>, 15 kg Zyklon B, with 1000 barracks in Birkenau camp this amounts already to a demand of 1.4 tons) one recognizes that the quantities of Zyklon B delivered to Auschwitz camp can actually be explained by normal delousing activities.

According to a statement by the former inmate C.S. Brendel, the barracks were frequently disinfected with Lysoform (2 to 3% formaldehyde solution)[177]. Since Lysoform does not kill insects, this statement cannot be true. According to Pressac, this "prepared" testimony was supposed to serve as evidence that the Zyklon B supplies to the camp were mainly used for homicidal gassings. According to Pressac, this is untenable[178]. The annual delivery quantities were too low to perform a successful delousing of all personal effects and buildings in all camps in the Auschwitz complex, since typhus epidemics were never entirely suppressed. This leads also to the conclusion that the assumption of the upper limit case of the frequency of daily use regarding buildings 5a and 5b, as made on page 54, was much too high. The assumption of three gassing daily, as made there, would correspond to a daily demand of 24 to 30 kg Zyklon B for the buildings 5a and 5b alone, or ca. 9 to 11 tons annually, which is roughly the total amount delivered to the camp.

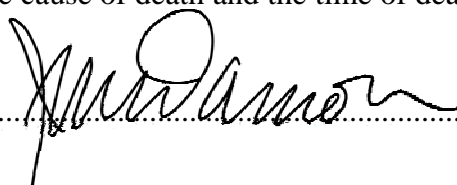
### 3.4. The Gassing of Human Beings

#### 3.4.1. Eyewitness testimonies

This section will examine a few related eyewitness testimonies for a determination of the chemical, physical, and technical basic conditions of the alleged homicidal gassings. A complete and detailed analysis of the many eyewitness testimonies in the individual trials and in the literature would be too voluminous to include here and ought to be reserved for later work. The following survey can therefore neither claim to be complete nor representative.

For a clarification of the problems, an extract from the judgment of the Frankfurt Auschwitz Trial should be quoted[179]:

"Since the court lacked almost all possibilities of discovery available in a normal murder trial to create a true picture of the actual event at the time of the murder. It lacked the bodies of the victims, autopsy records, expert reports on the cause of death and the time of death; it lacked any trace of the murderers,



murder weapons, etc. An examination of the eyewitness testimony was only possible in rare cases. Where the slightest doubt existed or the possibility of a confusion could not be excluded with certainty, the court did not evaluate the testimony of witnesses [...]

The general findings [...] are based on [...] the credible testimony of witnesses [...] Böck, in addition to the written notes of the first camp commandant Höss.”

Very many of the witness testimonies possessed insufficient credibility in the opinion of the court. But it nevertheless succeeded in obtaining sufficiently-credible sounding testimonies from a few “credible” witnesses. Two of these may be selected at this point for purposes of example: Rudolf Höß, former camp commandant at Auschwitz, and Richard Böck, a camp SS man of subordinate rank. Let us have a look at these two witnesses, in order to discuss two of the main problems involved in the testimonies of the prosecution witnesses.

According to reports by R. Butler, who arrested Höß at that time, Höß was tortured after his arrest.[180] In his autobiography, Höß also reports this, as well as similar procedures in his Polish imprisonment.[66] According to a report by a US Senator drawn up at that time, mistreatment of prisoners was a frequent occurrence at that time[181]. A few voices were raised at that time in the USA clearly stating that the Nuremberg Tribunal was a case of revenge, not justice.[182] A glance at the Londoner Agreement, which established the legal framework for the

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Nuremberg Trials, reveals two remarkable articles, which are incompatible with the procedures of a state of law. Article 19 states: “The Tribunal shall not be bound by technical rules of evidence” and in article 21: “The Tribunal shall not require proof of facts of common knowledge but shall take judicial notice thereof [...]”[183].

But what is the credibility of the eyewitness testimonies as to content? The following is a closer examination of the most frequently quoted eyewitnesses. The statements of Höß may be consulted in the Broszat edition, read as follows[66]:

p. 126: “Maintaining the fire at the ditches, pouring the collected fat,[...] They ate and smoked while dragging corpses [...]”

p. 157ff.: “The bodies were first doused first with oil residues, and later with methanol [...] He also attempted to destroy the bodies with explosives,[...]”

p. 166.: “Half an hour after the introduction of the gas, the door was opened and the ventilation installation was turned on. Removal of the bodies began immediately [...]”

and elsewhere:

“... ”

Q But was it not extremely dangerous for the inmates to enter these chambers and to work amongst all the bodies and the clouds of gas?

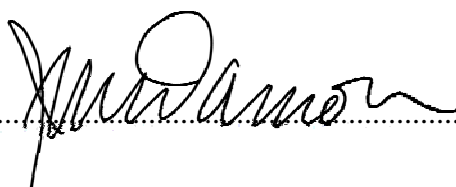
A No

Q Did the wear gas masks?

A They had them, but they did not use them, since nothing happened to them. [...]”[184]

The problem of incinerating corpses in ditches was already dealt with in section 1.5. (p. 35).

Entering the ‘gas chamber’ without a protective filter, eating and smoking in the gas chamber, as well as the commencement of the corpse dragging operation immediately after the opening of the doors, would only be conceivable if there were no longer any dangerous quantity of gas in the chamber. The



question of whether this was possible, will be the subject of the next section.

When corpses, which consist more than 60% of water, are burnt, this must take place with the expenditure of quite large quantities of fuel and great heat. It is therefore quite impossible to collect the easily-combustible fat during this process. After all, the bodies were burnt, and not grilled. The depiction of self-burning humans, as it was made in Hoffmann's fairy tale about the burning Paulinchen in "Struwwelpeter", is very remote from reality.

The testimony of H. Tauber may be discussed here briefly. H. Tauber was, according to his own testimony, a member of the inmate Sonderkommando of Crematorium II during the war. J.-C. Pressac writes that this eyewitness testimony is the best in relation to the crematoria, and is 95% historically reliable. This testimony contains the following[185]:

"During the incineration of such non-emaciated corpses, we used the coke only to light the fire of the furnace initially, for fatty corpses burned of their own accord thanks to the combustion of the body fat. On occasion, when coke was in short supply, we would put some straw and wood in the ash bins under the muffles, and once the fat of the corpse began to burn the other corpses would catch light themselves. [...]

Later on, as cremations succeeded one another, the furnaces burned thanks to the embers produced by the combustion of the corpses. So, during the incineration of fat bodies, the fires were generally extinguished. [...]

Another time, the SS chased a prisoner who was not working fast enough into a pit near the crematorium, that was full of boiling human fat. At that time [summer 1944], the corpses were incinerated in open air pits, from which the fat flowed in to a separate reservoir, dug in the ground. This fat was poured over the corpses to accelerate their combustion. [...]"

The combustion gases in a crematory oven flow from the ignition chamber through the combustion chamber containing the corpse, through the ash chamber into the flue, which conducts the exhaust gases from the combustion chamber to the chimney[187]. If a fire had been ignited in the ash chamber in order to burn the bodies located above, the flow of gas would be reversed: fresh air would be sucked out through the chimney, and the exhaust gases would flow into the combustion chamber, from which they would find their way out into the oven room. The combustion starting

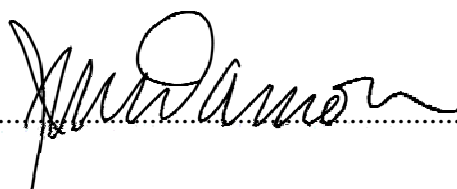
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in the ash chamber as described by Tauber would not work. Such testimonies are, to use Pressac's words, nothing by downright lies and pure invention[187].

But back to the testimony of R. Höß. Apart from wood, petrol and methanol was supposedly used for these open-air incinerations, the latter being totally unsuitable because it evaporates easily. Fluids fuels always burn at the side and on top of corpses, so that the heat gets lost. Apart from this, liquids seep away into the soil. Methanol evaporates very easily and has a very low flame temperature. In case of sufficient methanol supply, the vapor above the corpse burns. The flames reach the corpse only after the methanol has been almost completely consumed, so that the vapor layer is reduced and the slowly extinguishing flames settle on the corpse. The author got over an experiment with trying to burn his left arm without any serious wounds. The same can be observed with paper and fabrics: slight charcoaling only where the methanol runs out.

Experiences with open-air incinerations with petrol show that the corpses can be superficially charcoaled (dehydrated), but not entirely burnt[188,189].

The alleged attempt to destroy bodies by means of explosives requires no further comment, since such proceedings are obviously unsuitable.



It is interesting to note that Broszat deletes the last pages of Rudolf Höß's testimony from his edition, since they contain "completely erroneous data on the numerical strength of these Jews". In these pages, Höß speaks of 3 million Jews in Hungary, 4 million in Romania, 2½ million in Bulgaria. The actual figures were lower by a factor of approximately 10[190]. In addition, the same pages contain the following, which is also incredible[191]:

"Although well-cared for and plentifully provided with bonus payments, one often saw them [the Jewish special commands] dragging corpses with one hand, and holding and gnawing on something to eat with the other hand.

Even during the horrid work of digging up and burning the mass graves, they did not allow themselves to be disturbed while eating. Even the burning of their closest relatives could not shake them [...]"

But now to the testimony of the witness Richard Böck[68]:

"One day, it was during the winter of 1942/43, H. asked me, whether I wanted to drive with him to a gassing action [...]"

The transport train, which had already arrived, stood on the free stretch of track. [...]"

They were all loaded, and driven to a former farm house. [...]"

After the entire transport – there must have been approximately 1000 people – was in the building, the door was closed. Finally, an SS man came, I believe it was a Rottenführer, to our ambulance and got out a gas canister. He then went to a ladder with this gas canister [...] At the same time, I noticed that he had a gas mask on while climbing the ladder [...] he shook [...] the contents of the canister into the opening [...] When he had closed the little door again, an indescribable crying began in the chamber [...] That lasted approximately 8-10 minutes, and then all was still. A short time afterwards, the door was opened by inmates and one could see a bluish cloud floating over a gigantic pile of corpses. [...] At any rate, I was surprised that the inmate commando which was assigned to remove the bodies, entered the chamber without gas masks, although this blue vapor floated over the corpses, from which I assumed that it was a gas [...]"

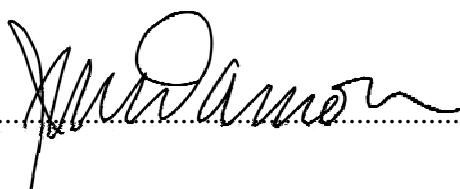
In view of our previous study of the subject, we can establish:

- In chapter 1.3.3. (p. 31), reference was made to the analysis of a US air photo, according to which there were, at the time when the pictures were taken (summer 1944) and at the decisive locations, no houses, no barracks, no cremation ditches or similar things.
- 1 000 people require an area of at least 200 m<sup>2</sup>. According to eyewitness testimonies, the farm houses had only half as much surface area at the most.[66]
- Section 2.1. (p. 37): Hydrogen cyanide is a colorless, invisible gas. Therefore, no "*blue vapor floating over the corpses*" could be seen. This passage is a sign of pure fantasy, obviously suggested by the German name "Blausäure" [blue acid], which only relates, however, to the formation of the pigment Iron Blue.

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- Section 3.2. (p. 58): Since the events described are alleged to have taken place in winter, the rapidity of the procedure is incredible, since Zyklon B only gives off gas slowly at frost. See p. 66ff. for this.
- The described entry into chambers with a high concentration of toxic gas without a protective filter is not possible, since such a manner of procedure would obviously be fatal in the long or short term.

The state prosecutor Dreßen had the following to say about Böck's testimony:[192]



“Dear Mr. XY,

I enclose a copy of the eyewitness testimonies of former members of the SS on the gassing of inmates at Auschwitz [...] for your information. They are only a selection – there are numerous other such testimonies. In contrast to yourself, I am of the opinion that these eyewitness testimonies relating to the fact of the occurrence of gassings of human beings, are entirely suitable, to refute the denial of this fact. Faithfully, (Dreßen) Prosecuting Attorney”

And yet again:

“Dear Mr. XY,

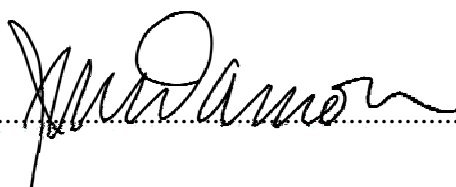
[...] Furthermore, the testimony of B ö c k is only one of numerous similar statements [...] Faithfully, (Dreßen) Prosecuting Attorney”

Böck’s testimony was one of the few, which the Frankfurt tribunal considered credible after careful examination, among which, that is, the inconsistencies would not be so easily recognized by the layman, in contrast to the many other testimonies. And yet it is entirely incredible.

Pressac himself judges very critically in quite a few passages relating to the reliability and credibility of eyewitness testimonies[193], upon which all descriptions of the killings in gas chambers are based. He lists the untruths, the impossibilities and exaggerations of the witnesses, and explains how they presumably materialized. Additionally, Pressac is compelled to correct the statements of witnesses in many cases in order to eliminate errors and, in his opinion, technical impossibilities. Thus the numbers of victims per gassing procedure, as estimated by Pressac, for example, lie considerably below those of the eyewitness statements, which often report several thousand victims per gassing operation per day for Crematoria II and III. One thousand people could only have been made to enter a cellar with a surface area of 210 m<sup>2</sup> under the maintenance of extraordinary discipline and a readiness to cooperate on the part of the victims. The numbers of people reported in places by witnesses on the other hand (2,000 and more[194]) could not have been lodged in Morgue 1. In order to arrive at the incorrect number of victims at Auschwitz-Birkenau peddled until the end of the 1980s – 4 million – one is in fact compelled to resort to technically impossible figures, as the witnesses do. In spring of 1990, after the Cracow Expert Report had been made[8], the memorial plaques in Auschwitz were removed which referred to 4 million victims. At the moment, the official estimates are from approximately 1 to 1½ million victims[195]. Pressac has corrected the witness statements. Mainly based on the work of D. Czech[196]. The following is a description of the homicidal gassing procedures for the individual installations as Pressac thinks he can reconstruct them after having corrected the witness accounts:

Crematorium I: Blocking of the closer crematory vicinity to third parties; undressing of most of 500 - 700 victims in the open air; entry into the ‘gas chamber’ (morgue) near the oven room; introduction of Zyklon B through pillars with the utilization of gas masks after closure of the doors; turning on of the ventilators after the death of the victims (approximately 5 min.); after 15 to 20 min. of ventilation opening the door to the furnace room, evacuation of the chambers without breathing filter, cremation of the victims[197]. According to Pressac only a few gassings, with a total of only 10,000 victims[25].

{65}Crematoria II/III: Entry for the 800 to 1 200 victims by means of the western exit steps into Crematorium 2; undressing therein; entry through the stairwell into Morgue 1 (‘gas chamber’); introduction of Zyklon B through pillars with the utilization of gas masks after doors are closed; turning on of ventilators after the death of the





victims (approximately 5 min.); opening of the doors after approximately 20 minutes; hosing down of the corpses, soiled with blood, vomit, and excrement; removal of the bodies without the utilization of gas masks; cutting of hair and removal of gold teeth while the bodies are still in the cellar; transport in the lift (payload 1.5 tons) to the ground floor; there, transport through water-filled channels to the ovens; cremation.[72] Approximately 400,000 victims for Crematorium II, 350,000 for Crematorium III according to Pressac[33], three times as many according to older data (for a total number of 4 million victims).

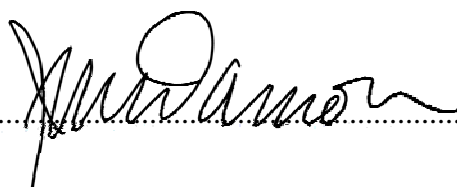
Crematorium IV/V: Undressing of a few hundred victims in the open air in good weather, otherwise in the morgue, partly next to the corpses of the last gassing victims awaiting cremation; entry into the 'gas chamber', past the coal room and doctor's office; introduction of Zyklon B through hatches from a ladder after closure of the door[s]; opening of the doors after 15 to 20 minutes; removal of the corpses to the morgue and/or to the exterior, to the cremation ditches behind Crematorium V by the Sonderkommando, some of them wearing gas masks, and some not. According to Pressac, the number of victims can only be estimated with difficulty, probably approximately 100,000 or, according to older descriptions, three times as many[198]. A similar scenario applies to farm houses I and II (see section 1.3.3., p. 31).

Regarding the gas concentration applied during the executions, Pressac assumes that 95 to 98% of the entire Zyklon B delivered to the camp were used for the original purpose, i.e., for delousing clothes and rooms[199], for which he relies on statements of the Nuremberg tribunal[200]. Pressac justifies this with the fact that, in relation to other concentration camps, where doubtlessly no extermination took place, the Auschwitz camp did not receive higher amounts of Zyklon B deliveries, when brought in relation to the number of inmates and to the material delousing facilities doubtlessly operated there. The supply figures of the Auschwitz camp can be found in the protocols of the International Military Tribunal. In total, they reached some 19000 kg during the years 1942 and '43[176]. The total supplied amount during the entire existence of the camp from 1940 to 1945 will hardly have exceeded 40 tons. According to Pressac, 800 to 2000 kg of this was used for extermination of humans. Between summer 1942 and fall 1944, in total some 1 million human beings were allegedly gassed in Birkenau, according to older figures (from here on in parentheses) some 4 million. Therefore, for each 1000 persons roughly 0.8 to 2 kg (0.2 to 0.5 kg) hydrogen cyanide was available. The 'gas chambers' (morgues I) of crematorium II and III could hold only little more than 1000 persons per execution. With a volume of roughly 430 m<sup>3</sup> (500 m<sup>3</sup> minus 1000 humans @ 70 liter), and after all hydrogen cyanide had evaporated from the carrier (after more than half an hour), 1000 (250) g of hydrogen cyanide would result in a theoretical end concentration of 2.3 g per m<sup>3</sup> (0.19 vol.%, at 4 Mio. 0.05 Vol.%). Hence, J. Bailer[6], W. Wegner [201] and G. Wellers[7] today assume an applied concentration of 1 g per m<sup>3</sup> (0.083 Vol.%) or less. In his book, Pressac frequently refers to 12 g per m<sup>3</sup> or 1 vol.%, which results to at least five times more Zyklon B than he concedes to have been used for killings from the total

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32 1 vol.% is 10000 ppm (roughly 12 g/m<sup>3</sup>)

deliveries to the camp[202]. He backs this up with many witness accounts, according to which four to six 1-kg cans of Zyklon B were allegedly poured into the 'gas chambers' (morgues) of crematorium II and III, which indeed corresponds to a concentration of 1 vol.%[72]. But then, the use of for the alleged homicidal gassings would have been 5000 kg or at least  $\frac{1}{8}$  (12.5%) of the total supplies. This is an ob-



vious inconsistency in Pressac's statements.

The alleged execution times are another indirect source to establish the hydrogen cyanide concentrations used, which are at the same the safest source. They all lie in the area of only a few minutes[203]. Even Prof. G. Jagschitz quotes in his 1992 Expertise a witness

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he assumes to be competent[204]. He quotes the camp physician Dr. Fischer, who himself claims to have regularly supervised 'gas chamber execution', and reports in congruency with the overwhelming majority of all witnesses about killings times of 2 to 3 minutes. Also, the former camp commander R. Höß speaks about 3 to, in exceptional cases, 15 minutes [Dokument 3868-PS, IMT-volume 33, pp. 275ff., zitiert nach L. Rosenthal, "Endlösung der Judenfrage", Massenmord oder "Gaskammerlüge"?, Verlag Darmstädter Blätter, Darmstadt 1979.]. Elsewhere he reports that the chamber doors were opened after half an hour to remove the corpses. According to this statement, the ventilation system had removed the toxic gas already during the previous 15 to 20 minutes.[66]

Assuming an execution time approximately corresponding to those in American gas chambers (4 to 10 min. at 3200 ppm HCN[150]), a concentration of at least 3000 ppm ( $3.6\text{g}/\text{m}^3$ ) would have had to penetrate even the remotest corner of the chamber at least at the end of the execution, i.e., after 10 min. With a surface area of  $430\text{ m}^3$  in Morgue 1 of Crematoria II and II this corresponds to a quantity of hydrogen cyanide of approximately 1.5 kg. Since the carrier material only releases 10% of its hydrogen cyanide content after 5 to 10 minutes (see p. 59), at least ten times that amount was required for a killing lasting only a few minutes, i.e., at least 15 kg. This of course only applies on the condition that the hydrogen cyanide released reached the victims immediately, which cannot be expected in overfilled, large cellars. It must be therefore be considered established that quantities of at least 20 kg of Zyklon B per gassing would probably have had to have been used for the gassing procedures described. Assuming some 1000 gassings, this would be some 50% of the entire Zyklon B deliveries to the camp.

### 3.4.2. Critique of the Eyewitness Descriptions

In order to assess how close to reality the officially registered witness accounts and other depictions about the alleged gassing events are, the following parameters need to be taken into consideration:

1. Speed of distribution of hydrogen cyanide in the room and time required for a successful killing
2. Time required for ventilation of a rooms filled with humans, depending on how densely the rooms are packed, on their layout and the ventilation system, as well as hydrogen cyanide remainders still evaporating from the carrier or desorbing from walls and corpses.
3. Effectiveness and capacity of protective filters and filter masks

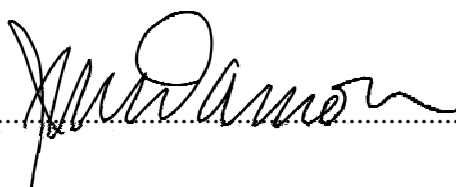
#### 3.4.2.1 Distribution of Hydrogen Cyanide in the Room

In their publications, Puntigam et al.[139] describe the hydrogen cyanide concentration behavior at different locations of a delousing chamber with and without air circulation ("*Kreislaufverfahren*"). Puntigam does neither give measures and loading of the chamber, nor the type of carrier material and its distribution, nor the temperature. Since the different measuring points show different concentrations peaks, this indicates a

**Graph 14:** Hydrogen cyanide concentration behavior in delousing chamber with and without circulating air systems, measuring points always in center of room (intern correspondence of DEGESCH, according [139].

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non-even distribution of the products in the chamber. For the sake of clarity, only the concentration



behavior in the center of the room is reproduced in Graph 14 (p. 67).

According to the already quoted publication by Schwarz et al.[141], their measurements were made in the range of room temperature. Although the interesting part of Graph 16 (p. 67) is only poorly resolved, it is nevertheless clear that under these circumstances the maximum concentration is reached as late as 4 to 5 hours after the start. In these years, circulating air systems did not yet exist, so that only the natural

air convection was responsible for distributing the gas. Remarkable is the strong concentration reduction due to adsorption on the load, here lifeless material to be deloused. Due to the slow increase towards the maximum concentration, it must be assumed that Puntigam's values without circulating air system (Graph 14, lower curve) were achieved at similar temperatures. The Detia Freyberg GmbH company reports a 80 to 90% evaporation *and* even distribution of the gas in the room at temperatures higher than 20°C in 120 min.

The relation between hydrogen cyanide adsorption on clothing and temperature in a delousing chamber can be seen in Graph 15. The higher adsorption at lower temperatures is caused by a higher moisture content in the gassed material[169].

In the case of hypothetical homicidal gassings, the sweat produced by the scared people might cause a similar, but due to the relative high skin temperature weaker effect.

**Graph 15:** *Hydrogen cyanide concentration behavior in delousing chamber with and without at room temperature[141].*

Upper curve: Ideal concentration behavior without Adsorption losses.

Center curve: Normal concentration behavior in a w a r m chamber.

Lower curve: Normal concentration behavior in a c o l d chamber.

**Graph 16:** *Relation of relation between hydrogen cyanide adsorption on clothing and temperature in a delousing chamber with circulating air system (schematic)[169].*

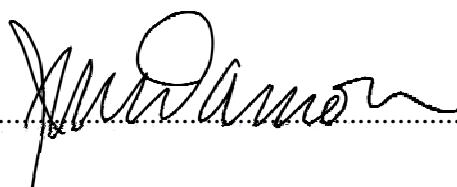
To this, the concentration reduction due to the respiration of the victims has to be added. Per capita, this is the higher, the higher the applied concentration is. The reason for this is that although the victims incorporate lethal amounts of hydrogen cyanide in short periods of time in case of high concentrations, their organism reacts delayed. During this delay, the victim incorporates more overdoses of hydrogen cyanide. In case of a high concentration applied (>1 vol.%), each person could incorporate not more than 1g HCN. At a hydrogen cyanide concentration of ca. 1 vol.% (12g per m<sup>3</sup>), this would correspond to 80 liters or 40 to 8 average breaths, hence an execution time of a few minutes (see experiences of F. Leuchter[150], p. 57). However, if death occurs only slowly due a low applied concentration, the victim would inhale much less

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**Graph 17:** *Schematic representation of the breathing volume behavior relative to time in case of suffocation/poisoning.*

hydrogen cyanide, and the delayed reaction leads to the fact that the organism receives only small overdoses. In case of high final concentrations during a hypothetical execution of ca. 1,000 people, in accordance to the witness statements, a maximum of 1 kg hydrogen cyanide would be incorporated by the victims per gassing, which is ca. 5% of the applied amount (20 kg).

One has to reckon with high adsorption rates of hydrogen cyanide especially at the cool and wet walls of the cellars of crematorium II and III, in contrary to Weller's hypothesis, according to which this is not supposed to happen[7]. According to his opinion, the little amounts of hydrogen cyanide applied were supposedly inhaled entirely. This does not only contradict the witness accounts of the quick gas chamber death[203] which required large amounts of hydrogen cyanide, but also all logic, since hydro-



gen cyanide would certainly have been quite unimpressed by possible orders of the SS to react only with the respiration organs of the victims. Even in case of low application amounts, one has to expect a quite intensive reaction of hydrogen cyanide with the masonry close to the source. Thus, one can safely dismiss Weller's hypothesis.

Compared to delousing chambers, one can expect an accelerated distribution of hydrogen cyanide close to the source during hypothetical executions in a room filled with humans, due to breathing, moving and body heat. On the other hand, the distribution of the gas can be delayed due to the enormous filling of the room.

Extreme absorption effects of hydrogen cyanide on the wet walls and wet skin and by inhalation of those close to the source must be expected, leading to initially delayed distribution of hydrogen cyanide. Even under ideal conditions, which cannot be realized, i.e., with an immediate release of excessive concentrations, it must be expected that *all* victims would not be dead before 10 to 15 minutes (see experiences of F.A. Leuchter with executions, section 3.1., p. 57). Assuming these unrealistic circumstances, those standing far away from the sources would not have incorporated lethal amount prior to 15 minutes.

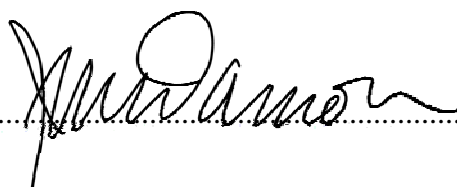
With a sufficiently high hydrogen cyanide amount (more than 0.5 vol.% of average end concentration or 6 g per m<sup>3</sup>), a successful killing in the medium sized, heated alleged 'gas chambers' of crematorium IV and V, where the Zyklon B was allegedly poured on the floor between the victims, seems possible within 30 to 45 min. Due to inhalation and absorption effects of hydrogen cyanide on the wet skin and possible excreta of victims close to the source, the application of small amounts would heavily delay the killing success of those victims standing far away from the source. Additional delays would occur in the farm houses I and II with their cold floors during winter time, since the floor would have been warmed up only marginally by the body warmth of the humans (the victims get nothing but cold feet). The 'gas chambers' of crematorium II and III are similar, since these humid underground rooms could not be heated and hence were cold all year long. Judging the introduction holes existing today, here, too, the Zyklon B could have been introduced only irreversibly by pouring it onto the floor between the victims. It was not possible to install any devices to remove the product from the cellars after the execution.

Theoretical end concentrations as little as 1 g per m<sup>3</sup> (0.083 vol.%), as assumed by Bailer, Wellers and Wegner contrary to the witness accounts[6,7,201], would never have been reached due to absorption in walls and humans especially close to the source. It is doubtful whether lethal concentrations would have been reached under such circumstances also in the remotest corners even after long periods of time (hours) (more than 0.2 g per m<sup>3</sup>, 0.017 vol.%). But even under such circumstances, death will occur due to lack of oxygen in these allegedly gas-tight 'gas chambers', filled with humans. This would correspond to the slow, possibly hours lasting death due to a combined effect of suffocation and poisoning, as described by Bailer, but this contradicts the witness statements of a fast death by poisoning. At least due to the lack of a heating in the morgues I ('gas chambers') of crematorium II and III, Pressac's statement[58] that it took longer to kill in the 'gas chambers' of crematorium IV and V than in those of crematorium II and III, is wrong and ought to be reversed.

A killing of all victims in only a few minutes, even those far away from the source, as it corresponds with the witness accounts, would have required the application of much larger amounts of hydrogen cyanide as

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was allegedly was applied according to the witness accounts, and as could have been applied when considering the restricted Zyklon B supplies. By increasing the amount, the security problems would have aggravated dramatically, especially regarding explosiveness close to the source.



### 3.4.2.2. Speed of ventilation of the 'gas chambers'

An imaginary experiment may help clarify a somewhat complicated mathematical relationship: two buckets filled with 100 blue balls stands in front of a candidate. Each time he puts one red ball into the bucket, mixes the content briefly, and blindly picks an arbitrary ball to take out. How often does he have to do this until only 10 blue balls are left over? A small help: provided that he has already replaced half of all blue balls by red ones. What is the probability that he coincidentally picks out a red instead of a ball, i.e., he has acted in vain?

In mathematics, the equation related to this problem is called a linear, homogenous differential equation.

In general, the following time behavior applies for the concentration change of a substance  $i$  with time,  $dc_i/dt$ , in case of air exchange provided that the newly added gas (free of  $i$ ) is ideally mixed with the old gas:

$$dc_i / dt = -a \cdot c_i(t) \quad (6)$$

i.e., that the concentration change of substance  $i$  is proportional to the concentration at time  $t$   $c_i(t)$ .

The modification of the equation yields:

$$\int (1/c_i(t)) dc_i = \int -a \cdot dt \quad (7)$$

After integration over  $dc$  and  $dt$ , resp., this yields:

$$\ln(c_i(t)) = a' - a \cdot t \quad (8)$$

or

$$c_i(t) = a'' \cdot e^{-at}. \quad (9)$$

For  $t = 0$ ,  $e^{-at} = 1$  and thus

$$a'' = c_i(t = 0) = c_0 \quad (10)$$

with  $c_0$  as initial concentration (when the ventilation is started). This leads to:

$$c_i(t) = c_0 \cdot e^{-at}. \quad (11)$$

From equation (6) results the initial concentration change  $dc_i(t=0)/dt$ :

$$dc_i(t=0) / dt = -a \cdot c_0 \quad (12)$$

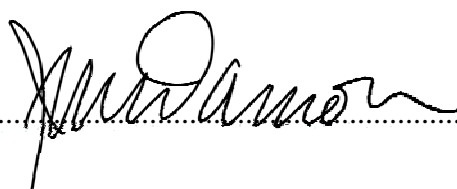
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Hence, we get for the constant  $a$ :

$$-a = dc_i(t=0) / (dt \cdot c_0) \quad (13)$$

In case of a sufficiently low exchange volume  $dv$  per time interval  $dt$ , the ratio of total volume  $V$  to the exchange volume  $dv$  can be introduced as initial concentration change (in case of infinitesimal transition ( $dt \rightarrow 0$ ) this is mathematically correct).

For example, if the air exchange is  $1/1000$  of the total, the concentration change per time is  $1/1000$  per time



unit, too.

This turns (13) into

$$-a = dv / (dt \cdot dV) \quad (14)$$

After the time  $t = V \cdot dt / dv$ , the complete volume is exchange one time. Therefore,  $a$  is the reciprocal of the air exchange time:

$$a = 1/\text{exchange time.}$$

After a single air exchange, the concentration is:

$$c_i(t) = c_o \cdot e^{-1} = 0.37 \cdot c_o. \quad (15)$$

For the  $1/x$ -value times (time in which the value drops to the value  $1/x$ ) the following applies accordingly:

$$t_{1/x}^1 = \ln(1/x) / -a. \quad (16)$$

Example: If it is required to lower the value down to 1% of the initial value (2 g per  $m^3$ , 0.17 Vol.%, down to 20 mg hydrogen cyanide per  $m^3$ , 0.0017 Vol.%), i.e., down to  $1/100$  of the initial value, this results to:

$$t_{1/100}^1 = \ln(1/100) / -a = 4,6 \times \text{air exchange time.} \quad (17)$$

The half time value is:

$$t_{1/2} = 0.693 / a. \quad (18)$$

Therefore, the concentration has dropped down to half after roughly  $2/3$  of a complete air exchange.

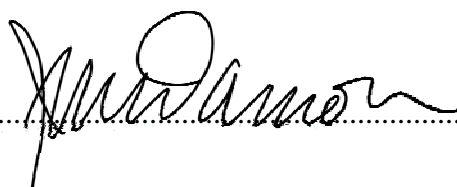
### Other Ventilation Scenarios

1. Exchange of old gas only (linear, laminar flow along the entire cross section of the room): air exchange time roughly identical with ventilation time: Technically absolutely not given in the facilities under consideration.
2. Exchange of mainly fresh gas (exhaust close to intake), areas of old gas partly not involved: ventilation time is a multiple of what is described above. In our case, this is certainly given for the areas between the corpses, since here almost no mixing of the gases takes place. Additionally, the unfavorable location of the air intakes to the exhausts leads to a partial exchange of fresh gas (air short circuit). This increases the ventilation time by the factor 2 to 4 or more.

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Additionally to this the problem would arise that there would be a steady supply of hydrogen cyanide evaporating constantly from the carrier for several more hours, so that the ventilation could have been successful two hours after the introduction of the product at the earliest anyway. But even after that, hydrogen cyanide absorbed on walls and corpses would steadily be released. Therefore, the ventilation had to have run permanently on full power even during the removal of the corpses. Since there are no technical data available for the 'gas chamber' (mortuary) of crematorium I, no statement can be made about this. As shown in section 1.2., one has to assume that this mortuary had no ventilation system going through the roof. Hence, it could not have served the attributed function.

**Table 7: Reduction of hydrogen cyanide concentration**



with ideal and actual (hindered) air exchange			
Number of air exchanges	time	Hydrogen cyanide remainder	
		ideal	actual (Factor 4)
1	15 min	36.8%	77.9%
2	30 min	13.5%	60.7%
3	45 min	5.0%	47.2%
4	1 hrs	1.8%	36.8%
5	1 hrs 15 min	0.7%	28.7%
7	1 hrs 45 min	0.1%	17.4%
10	2 hrs 30 min	0.0%	8.2%
15	3 hrs 45 min	0.0%	2.4%
20	5 hrs	0.0%	0.7%

With the facts about the facilities to ventilate the morgues I ('gas chamber') of crematorium II and III, as described in section 1.3.1., a single air exchange is supposed to have lasted 15 min. (see also 3.4.1., p. 61, and [40,205]). When taken the witness accounts into consideration, a concentration of 2 g hydrogen cyanide per m<sup>3</sup> can be assumed (0.17 vol.%, theoretical end concentration 10 g hydrogen cyanide per m<sup>3</sup>, 0.83 vol.%, the rest absorbed). In an ideal scenario (no product present) this yields a ventilation time of at least one hour, and at least two hours when considering the non-ideal air exchange between the corpses. Table 7 shows a calculation example. According to this, a safe entry into the chamber is not possible before 4 to 5 hours, provided that one could remove the product, which was not the case. Without this possibility, the entire product had to be gassed out totally, before any ventilation could be successful and before one could

enter the chamber. In case of the use of huge Zyklon B excesses, as attested to, this means that the ventilation process would have been prolonged for several more hours.

The rooms in Crematoria IV and VI designated as 'gas chambers', like farm houses I and II, allegedly had no ventilation installation and only slight ventilation possibilities by means of a few doors. Since there is supposed to have been no possibility to remove the Zyklon B granules lying underneath the corpses, which would have gasses out for hours, one has to expect a ventilation time of up to a day, in case of a calm or cold weather up to several days, in congruence with the value for room gassing, as given in guidelines and product information of manufacturers[2,139,151,152,155,157,161,163,164,172-175].

Activities in all other rooms of this building (physician's office, cremation) would have been no longer possible under these circumstances.

### 3.4.2.5. Capacity of Protective Filters

Filter devices to protect against hazardous and/or lethal gases and vapors are divided a) into types according to the kind of gas to be filtered and b) into classes according to their capacity. Filters of class 3 with a large capacity are stored externally, usually in a container to be carried at one's side, since they are too heavy to be carried at the mask. They are connected to the mask with of a hose. Filters of class 2 are screwed into the mask and form the majority of all used filter types. Filters of class 1 are plug-in filters.

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The service life of gas filters depends on:

- Type and concentration of the harmful compound;
- Air demand of the carrier, as a function of the intensity of work performed and the personal constitution;
- Humidity and temperature of the air.

Needless to say that the German Institute for Standardization hat determined the minimum values of break-through times of filters under Standard testing conditions. These conditions are:

- 20°C
- 70 % relative humidity of air
- 30 l flow-through of air per minute

<b>Table 8:</b> Maximally admissible concentration of harmful compound for protection filters[206]		
Gas filter class	Maximally admissible concentration of harmful compound	
1	0.1 Vol.%;	1000 ml m <sup>-3</sup> (ppm)
2	0.5 Vol.%;	5000 ml m <sup>-3</sup> (ppm)
3	1.0 Vol.%;	10000 ml m <sup>-3</sup> (ppm)
Short-term excess up to twice of the table value is permissible		

In Table 9 the values of different filter types are given with their respective harmful gas.

Hydrogen cyanide filters used by the allies during that time belonged to class 3 with filters to be carried externally. The service life of such filters at hard physical labor and 0.05 vol.% of hydrogen cyanide is given with 3 to 5 hours. At a concentration of over 1 vol.%, the gas quickly breaks even through these devices[208].

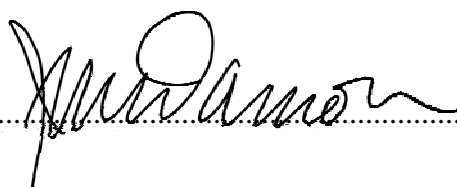
<b>Table 9:</b> Minimum break through times for filters According to DIN 3181 part 1 in minutes[207].					
Type	Test gas	Break Through criterion (ppm)	Class 1 Test concentration	Class 2 Test Concentration	class 3 Test concentration
A	CCl <sub>4</sub>	10	80	40	60
B	Cl <sub>2</sub>	1	20	20	30
	H <sub>2</sub> S	10	40	40	60
	HCN	10*	25	25	35
E	SO <sub>2</sub>	5	20	20	30
K	NH <sub>3</sub>	25	50	40	60
* relating to HCN + (CN) <sub>2</sub>					

R. Queisner wrote a report about his experiences with German filter devices used during the Second World War for

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delousing procedures with hydrogen cyanide[209]. The filter inserts »J« and »G« used at that were especially developed for being applied in air containing hydrogen cyanide and had a service life of 30 min. with a peak load of 1 vol.%. Since the mask carrier is only exposed to small amounts of hydrogen cyanide during delousing activities (during distribution of the product and at the end of the gassing, the hydrogen cyanide concentration is very low), experience showed that it is possible to use the mask several hours.

According to Schmidt[210], relaxed humans inhale some 14 liters of air per minute. This can increase





up to 50 to 60 liters per minute in case of heavy physical work, in extreme cases even up to 100 - 120 liters.

If, according to Pressac and in congruency with the witness accounts, a theoretical end concentration of 1 vol.% was used during the gassings, the inmates of the special commands (“Sonderkommandos”), who carried away the corpses out of the ‘gas chambers’ of the crematorium IV and V as well as out of the farm houses I/II, which did not have a ventilation system, had to wear gas masks. Equipped with gas filters of class 2 and doing heavy physical work, they would have been exposed to a high concentration of toxic gas. Since hydrogen cyanide is particularly well absorbed through sweat-wet skin, this would certainly have led to signs of poisoning.

The minimum break-trough times of corresponding modern gas filters of class 2, type B (for hydrogen cyanide) lies at 25 min. for 0.5 vol.%

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at an air flow-through of 30 liters per min. In case of a sufficiently hard physical labor, this time will be quickly cut to half or a quarter. Therefore, a modern filter of class 2 can offer only several minutes of safety under the circumstances under consideration. Breathing would have been seriously hindered by these filters (max. 5,6 mbar pressure difference at 95 l per min. according to the current DIN), hence the working speed would have been slow and the demand for resting times and forced pauses due to gas poisonings would have been huge. Since they were especially designed for hydrogen cyanide, the filters of that time had a higher capacity, and consequently their durability might have been correspondingly higher, which, in turn, increased their service time.

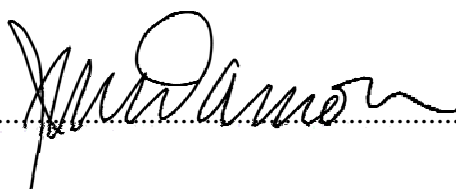
Pressac writes[205] that a hydrogen cyanide concentration of 1 vol.% is not tolerable even with filter mask, and that an exposure time of up to one minute is granted only in emergency cases, and this without any heavy physical work!

Finally, a poisoning through the sweat-wet skin would have been avoidable under these circumstances only, if the workers would have worked with protective garment in the ‘gas chamber’, which was not reported by any witness and which would have reduced the working performance even more. The accounts of some witnesses regarding the applied concentrations and the quick clearing of the chamber after the execution without protective garment and mask, on which even Pressac relies, exclude each other and thus can certainly not be correct.

It should not be forgotten here that hydrogen cyanide is a contact poison. Transporting corpses, on whose skin huge, possible lethal amounts of hydrogen cyanide are absorbed, had required that the special commands dealing with these corpses had to wear protective clothes. Finally, when considering the applied concentrations attested to, the guards, like the special commands, would have exposed risked their health. This is true for all ‘gas chambers’.

### 3.4.3. Evaluation of eyewitnesses

It was possible to provide a satisfying answer to the problem of the Zyklon B introduction holes in the roofs of Morgue 1 (the ‘gas chambers’) of Crematoria II and III by means of interpretation of the air photos and structural considerations. One must first assume, that the holes visible today were only pierced after the destruction of the building during the winter of 1944/45. The toxic gas could not, therefore, have been introduced into the alleged ‘gas chambers’. If one assume, against all circumstantial evidence, that these introduction holes existed prior to that and were used as such, the measures given by the witness Michal Kula have to be amended in order not to contradict the actual size of the holes to be found at the site today. Introduction holes of the size as found today, however, had to be visible on air photos, but they are not. Supposing in accordance with witness testimonies that high concentrations of hydrogen cyanide were applied in order to achieve a rapid killing success, which also



corresponds to witness accounts, this contradicts the actual amounts of Zyklon B supplies to the camp, since 95% of them are supposed to have been used for delousing purposes. On the other hand, if one assumes that only small amounts could have been used according to the admitted portion used for homicidal gassings, than all the witness testimonies regarding amount and time required for the process are incorrect, since the short execution time attested to require enormous amounts of Zyklon B. Finally, when applying minimal amounts of Zyklon B, the toxic gas loses its sense, because being densely packed into an air-tight space, the victims would be suffocated to death within hours anyway. 5% of the Zyklon B supplies, however, would have never sufficed to accomplish the mass killings in the testified short time.

On the other hand, the rapidity of the executions as described by the eyewitnesses (a few minutes) can under no circumstances be attained with Zyklon B under the given technical preconditions, especially in their extreme values (“a few moments”, “a few minutes”, “two minutes”, etc.).

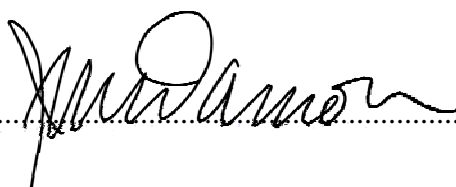
Entering the ‘gas chambers’ without protective measures, the heavy physical work in the chambers, sometimes with a naked torso while simultaneously eating and smoking, and simultaneous testimony relating to large quantities of toxic gas, reveals the perjury of these eyewitnesses.

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Just as false are the statements relating to the duration of ventilation of Morgue 1 (the ‘gas chamber’) of Crematoria II and III, since it is erroneously assumed that a single air exchange would remove of toxic gas. Due to an exponential reduction of the hydrogen cyanide content, however, one has to deal with a ventilation time that is, in an ideal cases, 5 times higher than those reported by witnesses, but in reality with one more than 20 times as long (inhibition of circulation due to corpses, air short circuit). This would be different if Pressac, due to his lack of technical understanding, had erroneously thought that the ventilation time reported by witnesses is equal to an air exchange time. This means of course, that the ventilation system of morgue 1 (‘gas chamber’) of crematorium II and III would have completed one air exchange every 3 minutes, which is technically inconceivable for a morgue. But already the problem of the Zyklon B remainders which were releasing gas and therefore would have made it impossible to enter the chamber for at least two hours even *with* ventilation, prove that the witnesses made false statements here, too.

The illogical and ridiculous – in Pressac’s words – gassing scenarios in the ‘gas chambers’ of Crematoria IV and V, which would have been extremely dangerous for the Sonderkommandos[58], as corresponding to the farmhouses I and II, which nevertheless must have been planned and built as instruments of mass murder[61], if the mass gassings, already underway during the construction period, compel people accustomed to thinking in terms of technology and the natural sciences to conclude that the Germans must have decided to use absolutely the most expensive, laborious, most dangerous and difficult way possible in which to kill people en masse. The nearby carbon refinement plants BUNA of the I.G-Farbindustrie AG could have delivered cheaply and in abundance both process gas rich in carbon monoxide to asphyxiate, or nitrogen for suffocation in pressurized bottles. But just in Auschwitz the expensive and rare Zyklon B, which was difficult to handle, was supposedly used, which was urgently needed to fight epidemics. In all other alleged extermination camps far away from the BUNA plants, carbon monoxide was allegedly used to kill humans, presumable generated with Diesel engines of captured Russian tanks, whose exhaust gases contain only non-lethal amounts of carbon monoxide[211].

One has to realize that in Auschwitz, close to the alleged ‘homicidal gas chambers’, excellently working delousing facilities existed, with sluices, heating, large ventilators asf., which were all built prior to the alleged ‘homicidal gas chambers’. Furthermore, at the construction time of the alleged ‘homicidal gas chambers’, the technology to quickly gas material was well advanced, and the production of these



facilities was in full swing (see section 3.3., p. 59). From the daily delousing procedures, one would have known the difference of required time and amount of Zyklon B between gassings with and without circulating air system. It must therefore be expected that at least similar technical standards would have been applied for the alleged facilities for homicidal gassings, but this was demonstrably not even remotely the case.

It would have been logical, for propaganda purposes, to have represented installations such as the delousing chambers intended for personal effects located in buildings 5a and 5b as 'homicidal gas chambers. But this was neither attempted, nor are there any eyewitness testimonies as to such a use of these premises. Furthermore, the doors drawn in the plans of the delousing chambers of buildings 5b as well as the doors located there today, open inwards, which would have rendered it impossible to removal the bodies lying in front of the doors after the mass gassings. These rooms were, therefore, certainly never used as homicidal 'gas chambers'. It is nevertheless possible that an attempt was made to represent the delousing chamber in building 5b as a (fake) homicidal 'gas chamber'. The water pipes visible there hang freely in the room without any connection; only a few of them are equipped with shower heads, and terminate in the ventilation openings in the exterior wall, i.e., they were installed after the expansion of the delousing devices (ovens, ventilators, and so on), very probably after the withdrawal of the Germans (see Illustration 21, p. 34). Remarkably, all pipes and fittings have been removed from the real shower room in the wing (see Illustration 18, p. 32), but not, however, those in the delousing wing. If this is not an attempt at falsification, it is still possible that this wing was

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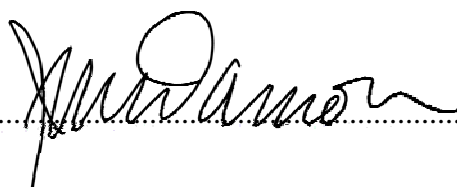
clumsily modified into a shower room after the end of the war, when Birkenau was used a prisoner camp for Germans.

Brief mention should be made at this point of the widespread notion that the toxic gas streamed into the alleged homicidal 'gas chamber' through shower heads, especially as there are even a few such eyewitness statements. Zyklon B consists of the active ingredient, hydrogen cyanide, absorbed in a solid carrier material diatomaceous earth and only released gradually. Since it was neither a liquid nor a gas under pressure, the hydrogen cyanide from this product could never have traveled through narrow water pipes and shower heads. Possible showers or fake shower heads could therefore only have been used to deceive the victims; they could never have been used for the introduction of the gas. There is general unanimity as to this point, no matter what else might be in dispute.

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**Table 10:** Evaluation of Witnesses Testimonies

Witness testimony	Evaluation
Death of all victims after 0 (instantaneously) to 15 minutes.	In the use of high concentrations of hydrogen cyanide, as in American execution chambers, death occurs in period of 4 to 10 minutes. During the process, the victim is immediately exposed to the full concentration of hydrogen cyanide. Technically this is not possible with Zyklon B, since the Zyklon carrier base only releases the gas slowly (50% in 30 to 90 minutes, according to the temperature). The distribution of the gas throughout the chamber from a few sources of hydrogen cyanide only, and the absorption of the gas by the moist walls and the nearby victims would further delay the process. Killing all the victims in 2 to 15 minutes would be impossible even when using of very large quantities of Zyklon B (much more than 10 g per m <sup>3</sup> ).



Use of very large amounts of Zyklon B (much more than 10 g per m <sup>3</sup> ).	This contradicts the witness testimonies, but would still not explain reported execution times of a few minutes. Under these condition, however, a large portion of the Zyklon B supplies to the camp would have been used for this purpose, which has not been the case, according to the IMT.
Opening of the doors to the gas chamber after the execution and immediate commencement of transport of the bodies without gas masks and protective clothing.	Assuming that the victims died quickly from the high concentrations of toxic gas, then the workers in the Sonderkommando would also have been killed by the gas. Working without gas masks equipped with a filter is totally inconceivable; at high concentrations of poison gas, even these are very unsafe. Heavy respiratory devices must be worn at concentrations of over 0.5 vol.%, which would render the removal of the bodies much more difficult. Contamination through the skin must be expected during heavy work, involving perspiration, and due to the high concentrations of hydrogen cyanide on the skin of the victims. At the same time, such concentrations are sufficient to put a stop to the workers' ability to work (dizziness, nausea, etc.). Protective clothing is therefore required.
Blue vapor over the victims.	Hydrogen cyanide is a colorless liquid and/or an invisible gas. The [German] name "Blausäure" ("blue acid") is due to the reaction of hydrogen cyanide with iron, forming the iron-blue pigment. There cannot, therefore, have been any "blue vapor".
Bluish coloration of the skin of the victims.	Hydrogen cyanide blocks the oxygen supply to the cells. The blood can no longer give off oxygen to the cells. Saturation of the blood with oxygen therefore occurs; the skin of the victim therefore has a reddish, not bluish, appearance, especially on the mucous membranes and during postmortem lividity. On the other hand, if the victims had slowly suffocated, this could explain the [bluish] coloration of the skin.
Attempted destruction of the bodies by means of explosives.	Totally unsuited.
Cremation of bodies in crematory ovens without fuel.	This testimony is quite absurd. Bodies never burn due to their own fat content alone. Additional ignition is always required. {77}
Table 10 Continued	
Commencement of body transport from the chamber of Crematoria II and III 20 minutes after commencement of ventilation, without gas masks.	The unheated morgues 1 of crematoria II and III, filled with bodies, would have been incompletely ventilated in 15 to 20 minutes using the allegedly built-in ventilation installation. After-gassing for hours from the Zyklon B distributed among the bodies, the release of hydrogen cyanide absorbed by the skin and walls and the absence of air exchanges between the bodies would have led to ventilation times amounting to several hours, before the cellar could have been entered without gas masks equipped with filters.

The victims writhe during their throes of death due to cramps, corpses lie cramped and tangled with each other.	Oral incorporated cyanide (potassium cyanide) is resorbed by the stomach and, if applied in high doses, paralyzes the closest muscle functions first. This is followed by cries of the victims due to painful suffocation cramps of the muscles. High hydrogen cyanide concentrations incorporated be inhalation knock out the consciousness of the victim, before noticeable failures in muscular regions occur. No loud throe of death takes place. This is proved by animal experiments and experiences with American execution gas chambers.
Incineration of the bodies with methanol and/or old oil.	The complete incineration of bodies requires a high temperature. Liquid fuels always burn only near and on the corpse, so that the heat is lost upwards; in addition, they trickle down into the subsoil in the open air. Methanol evaporates very easily and has a very low flame temperature. Experiments with open air incinerations show that corpses can be carbonized on the outside, but not however entirely cremated with these fuels.
Incineration of corpses in ditches up to several meters deep.	Open incinerations of corpses can be performed on pyres only, since the temperatures necessary can be reached due to sufficient oxygen supply from all sides. Additionally, deep ditches would fill up with ground water in Birkenau, which would extinguish every fire.
Pouring escaping human fat over the bodies.	This is an entirely absurd testimony. If anything burns in the flesh at all, then it is the fat. Since the bodies would have lain in the fire, the fat cannot possibly have been collected outside the fire by means of channels.
Flames shooting out of the crematory chimneys.	Coke fires are very short-flamed. Even carbonized, burning corpses do not generate any flame. That these flames could penetrate through a 10 meter-long flue and a 15-foot high chimney to the outside, is technically impossible. Even the reflection of the fire disappears in the flue.

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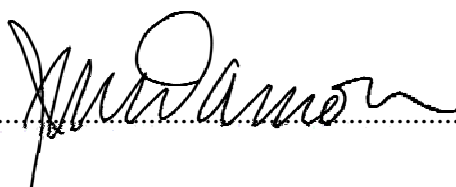
## 4. Evaluation of chemical analyses

### 4.1. Test sample taking and description

Test samples from installations at Auschwitz have been taken analysis by three persons or groups so far – as far as has been made known.<sup>33</sup>

1. Fred A. Leuchter, Consulting Engineers, Boston, MA, on behalf of the defence of E. Zündel, Toronto.
2. Prof. Dr. Jan Markiewicz, Jan-Sehn-Institute for Forensic Medicine, Forensic Toxicology Department, Cracow, on behalf of the Auschwitz State Museum.
3. Dipl.-Chem. Germar Rudolf, Stuttgart, certified chemical engineer, on behalf of the defence of Major General O. E. Remer (retired).

1.: F.A. Leuchter noted his sample taking locations the diagram, reproduced here, contained in his re-



port. Leuchter's sample takings from Morgue 1 ('gas chamber') of Crematorium II only are reproduced in the sketch below (Illustration 23, p. 81). There is also a video establishing Leuchter's sample taking locations, which can be purchased.[213] J.-C. Pressac has subjected the sample taking to criticism.[3] Leuchter failed to indicate a more exact specification of the sample material; the designation is "brick" in all cases. The sample taking was done without regard for depth. From the traces left by Leuchter in the corresponding places in the masonry, one must calculate sample taking depths of up to 3 cm and more.

2. J. Markiewicz provides more exact data on the sample taking location, the type of material, and sample taking depth in a sample taking record. The control samples were taken from a disinfestation chamber in the Auschwitz main camp, the interior walls of which, according to the report, were painted during the war, so that a pale blue tint is only visible in places. This is not, therefore, unaltered masonry material; rather, overly-low cyanide values must be expected as a result of the painting, according to the sample taking depth in comparison to the untreated wall.

3.: The samples were taken in the presence of witnesses by hammer and chisel and immediately sealed in a plastic bag. The subsequent numbering of the bags was recorded by hand, including the measured sample taking location and type of sample. Table 13 (p. 84) shows buildings, sample taking locations and depths, as well as a brief description of the wall material. The exact locations are shown in the sketch of the corresponding buildings in Section 1. of this book.

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33 C. Mattogno (Rome) has also taken samples from several facilities in Birkenau ('gas chambers' and delousing chambers) and he had them analyzed, the results being comparable to those of F.A. Leuchter and G. Rudolf. C. Mattogno, letter to the author, Rome May, 26, 1992.

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## 4.2. Analytical methods

The analyses were performed in each case respectively by:

At 1. Prof. Dr. J. Roth, Alpha Analytic Laboratories, Ashland, Massachusetts

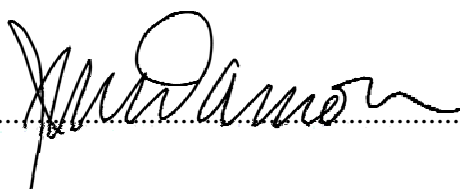
At 2. Jan Sehn Institute for Forensic Medicine, Forensic Toxicology Department, Cracow, Poland

At 3. Fresenius Institute, Taunusstein, Hessen, with no knowledge of the origins of the samples.

**With regards to 1.:** For analyzing the iron content of three of the samples (not included here), the Americans used an ICP spectrometer.<sup>34</sup> The results were in the range of 6,000 to 7,500 mg per kg. For the cyanide analysis, the American used a procedure carried out analogously to the German standard (see 3.). Control analyses were prepared for some test samples near the detectability threshold of 1 mg cyanide per kg test material. The results fluctuated up to 40%.

**With regards to 2.:** The Poles used the microdiffusion chamber method, which is neither commonly used nor especially suited for the detection of cyanides. This method exposes the sample 24 hours long to half-concentrated sulfuric acid. The evading gases are caught in a KOH solution by diffusion. It should be alarming to use sulfuric acid to expel hydrogen cyanide, since sulfuric acid has an oxidizing effect on hydrogen cyanide. No detection threshold was given, no iron content determined.

**With regards to 3.:** The iron content was determined with an ICP spectrometer as well, the cyanide content according to DIN 38 405, Section D 13. Short description for experts: expelling hydrogen cyanide from the sample by boiling it in aqueous HCl in slightly reductive medium (SnCl<sub>2</sub>) in a continuous air flow, catching it in an aqueous KOH. Finally, detection photo- or titrimetric, according to concentra-



**Illustration 23:** Sketch of Morgue 1 ('gas chamber') of Crematorium II in Birkenau with sample taking locations by F.A. Leuchter, acc. to [2].

- Samples 1,2,3,5 from Masonary;
- Sample 4 from the ceiling;
- Sample 6 from the pillars;
- Sample 7 from the debris on the ground.

tion. The detection threshold lies in the range from 0.5 to 0.1 mg per kg. All values below 0.5 mg per kg are uncertain, and are commonly marked as "not proven". Control analyses were performed by the Institute for Environmental Analytcs (Institut für Umweltanalytik Stuttgart) (IUS) (Table 14, p. 86). It was considered to make elementary analyses and pore size distribution measures of some samples. For the reason of high costs and especially because elementary analyses have only a restricted validity, I refrained from this.<sup>35</sup>

### 4.3. Evaluation of the analytical results

#### 4.3.1. F.A. Leuchter/Alpha Analytic Laboratories

All of Leuchter's positive findings from the alleged homicidal 'gas chamber' lie in the vicinity of the detection threshold (1 mg per kg), and must be expected to exhibit very high fluctuation values. Control sample no. 32 is from the delousing wing of Building 5a (delousing chamber 1). The foundations of Crematoria IV and V are alleged to have been reconstructed from the rubble of other buildings[8,64]. Thus the analyses of the samples originating from these walls are nevertheless interesting due to their positive findings in some places. These detectable cyanides either stem

<sup>34</sup> Induced Coupled Plasma, photo-emission spectroscopy in Argon plasma, induced by means of inductions.

<sup>35</sup> Although X-ray fluorescence- and -emission spectrograms for the determination of element percentages in sample materials can be very accurate, they cannot distinguish between, e.g., silicium stemming from the added sand and from the quartz portion of cement, which is of the highest interest to determine the kind of material. Without any clue about the original composition, it is therefore almost impossible to determine this afterwards. Although Pressac (see supplement to [3]) gives the composition of the building material of crematorium II and II, he does not give any source for this.

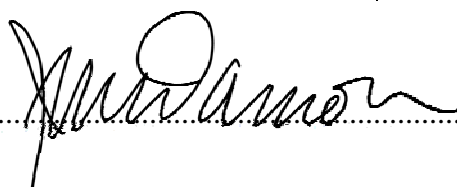
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from gassed buildings, or they indicated an ubiquitous<sup>36</sup> of small traces of cyanides.

That the analytical values of the samples from areas protected by the weather are just as low and/or just as undemonstrably low as the results from exposed installations, led Leuchter to the conclusion that the environmental influences could not have considerably reduced the cyanide content of the exposed buildings[214] which would be in accordance with the findings in Section 2. According to Leuchter, the low cyanide traces may have resulted from isolated fumigations of the morgues for pest control, since such interior room delousings were carried out in many camp buildings at that time. The positive result (1.3 mg per kg) of sample 28, which Leuchter took from the partition of the former washroom to the dissection room of Crematorium I, a wall which never formed part of the alleged 'gas chamber' and moreover was probably newly erected during the conversion to an air raid shelter, is remarkable. This result, approximately as high as the rest of the samples is proof for the fact that the cyanide values of all samples do not originate in the use of this building as a 'gas chamber', but that they originate in room gassings for pest control or that such amounts are ubiquitous.

**Table 11:** Cyanide concentrations in the masonry of 'gas chambers'/Disinfestation chambers

According to F.A. Leuchter/Alpha Analytic Laboratories, Ashland, Massachusetts, USA



Test sample no.	Sample taking location	CN <sup>-</sup> [mg per kg]
1-7	Crematorium II, Morgue 1	0.0
8	Crematorium III, Morgue 1	1.9
9	Crematorium III, Morgue 1	6.7
10.11	Crematorium III, Morgue 1	0.0
12	Door sealing	0.0
13.14	Crematorium IV	0.0
15	Crematorium IV	2.3
16	Crematorium IV	1.4
17-19	Crematorium IV	0.0
20	Crematorium IV	1.4
21	Crematorium V	4.4
22	Crematorium V	1.7
23.24	Crematorium V	0.0
25	Crematorium I, Mortuary	3.8
26	Crematorium I, Mortuary	1.3
27	Crematorium I, Mortuary	1.4
28	Crematorium I, Wash room	1.3
29	Crematorium I, Mortuary	7.9
30	Crematorium I, Mortuary	1.1
31	Crematorium I, Mortuary	0.0
32	Delousing chamber 1	1 050.0

The Morgue of Crematorium I and Morgue 1 of Crematorium II are alleged to have been homicidal 'gas chambers'.

According to Bailer, the high cyanide content of the control samples taken by Leuchter

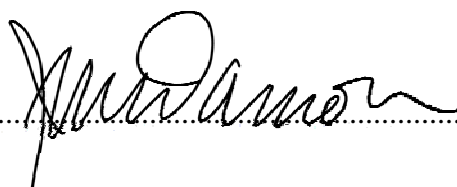
36 Ubiquitous (lat.: everywhere) traces are those which can be found everywhere in nature in statistical distribution.

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in the disinfestation wing is to be attributed either to an artefact, an error in the sample taking or an analytical error. He understands an artefact to mean that the wall of the disinfestation wing was painted with blue paint, precisely, an iron blue paint, at an earlier time. Bailer further expresses the opinion that no iron blue could form in the masonry material due to the alkali environment. In addition, the high cyanide content of 1050 mg per kg is said to mean that the walls consist 0.1% of pigment, which could not possibly be true[6].

As was shown in Section 2. (from p. 37 onward) the environment is only alkaline in the non-carbonated masonry. It was also established that the alkaline environment even supports the enriching of cyanide and certain other steps in the reaction towards the formation of iron blue. If one assumes, in the limit case, an entire conversion of the iron contained in the masonry into pigment, (1 to 2% iron content), the the values found by Leuchter are even, on the contrary, rather low. Whether the walls of the disinfestation wing were painted blue, i.e., whether a high cyanide content would only found on the superficially painted wall, will be discussed in section 4.3.3.3. (p. 87).

Pressac[3,29] is of the opinion that these low cyanide taces in the masonry are the final proof of the existence of the 'gas chambers', since since they are still detectable today after what was, in his opinion, a short working time and the slight reactivity of the hydrocyanic acid on the cool masonry and despite corrosion and erosion. He furthermore expresses the opinion that warm walls would be necessary for the formation of the pigment[3,75]. Just how unrealistic this opinion really is, has already been shown: First, the pigment of the pigment formed is durable (section 2.4., p. 45), second, cool, moist, walls materials have a higher reactivity to pigment formation (section 2.3., p. 45), third, Leuchter's sample 28 proves that the cyanide traces are not caused by homicidal gassings.





### 4.3.2. Institut for Forensic Medicine, Cracow

<b>Table 12:</b> Cyanide concentrations in the masonry of 'gas chambers'/ Disinfestation chambers				
According to the Institute for Forensic Medicine, Forensic Toxicology, Cracow, Poland, data in mg per kg				
Nr	Building	Sample taking location and – depth	Material	CN <sup>-</sup>
1	Disinfestation Block 3	Room 4, around the ventilator opening, 2 mm	Plaster	0.068
2	Disinfestation Block 3	Room 4, next to doors to Room 3, 2 mm	Plaster	0.036
7	Disinfestation Block 3	Room 3, below window, opposite, 2 mm	Plaster	0.076
8	Disinfestation Block 3	Door opening between Room 2 and 1, 2 mm upper left	Plaster	0.140
9	Disinfestation Block 3	Like Nr. 8, lower left	Plaster	0.404
10	Disinfestation Block 3	Room 1, Ventilator opening, 2 mm	Plaster	0.528
11	Disinfestation Block 3	Like 10, light blue	Plaster	0.588
15	Crematorium II, Morgue 1	Concrete support columns	Plaster (?)	0.024

4 additional samples from Crematorium II, 1 from Crematorium I, 1 from Crematorium V, in each case an alleged 'gas chamber', and 2 control samples contained demonstrable traces of CN<sup>-</sup>.

Cracow gives the cyanide concentrations found in µg (KCN) per 100 g, an unusual unit. The values shown in Table 12 were converted to mg CN<sup>-</sup> per kg. One recognizes immediately that the analysis results are untenable, since all results are underneath the detection threshold of the Americans, even in samples which clearly showed a bluish discoloration and for which, therefore, a result in the order of some thousand mg per kg would have been expected. On one hand, an error of magnitudes can be found here, but on the other hand also an error within the testing method[215]. All that can be concluded is that the Poles found no or only small amounts of cyanides in 'homicidal gas chambers'. The only positive sample originating from a 'gas chamber' (no. 15) has the lowest cyanide content of all samples and was allegedly taken from the plaster of one of the concrete pillars in morgue 1 ('gas chamber') of crematorium II, which is impossible, because these concrete pillars were not plastered. Perhaps concrete is meant.

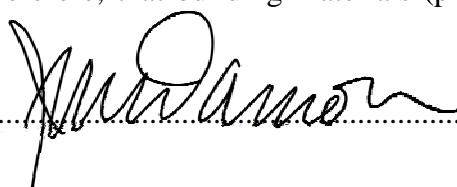
Despite the fact that the walls of the alleged 'gas chamber' of the main camp

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(morgue) was entirely protected from, and those of the 'gas chamber' (morgue 1) of crematorium II were partly protected from, the weathering, the Cracow institute makes the following statement (quote):

“Hydrogen cyanide is a weak acid, which has the result that its salts decompose slightly in the presence of stronger acids. One of these stronger acids is carbonic acid, which arises from the reaction between carbon dioxide and water. [Even] stronger acids, such as, for example, sulphuric acid, decompose cyanide even more easily. Complex compounds with cyanide ions with heavy metals are more durable. Among such compounds is the already mentioned 'Prussian Blue', but even this decomposes slowly in an acid environment.

One could hardly expect, therefore, that building materials (plaster, brick) exposed to environmental



influences (precipitation, acid oxides, and especially nitrogen monoxide) would contain derivative compounds of cyanides after a period of 45 years.”

As demonstrated in section 2.4. (p. 45), these statements are untenable: Iron blue is long-term stable. If this Institute would have taken its sample from the delousing building 5a and 5b, which are located closely to the alleged ‘gas chambers’, it would have noticed the blue walls and thus had avoided this misjudgment. In a later letter, this Institute confirmed that it neither had applied an appropriate analysis method, nor that it had sufficient knowledge about the chemistry that is taking place here[215]:

“...IV. With the method applied by us, we were not able to detect all cyanide compounds. For instance, only a small portion of cyanide ions can be splitt off the Iron Blue. For this, we had to use IR spectroscopy, but only for qualitative results...”

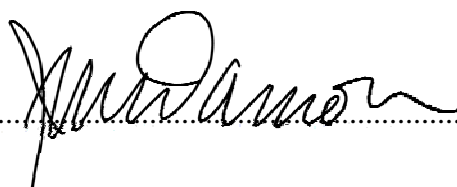
“...VIII. Water activates many chemical processes. The chambers were certainly moist. What kind of influence this exerts upon the binding of HCN by cement (wall plaster), is unknown to us ...”

“...IX. The blue stains on the exterior walls of Building 5a are not easily explained. Above all, we must examine whether or not it is actual Berlin Blue ...”

#### 4.3.3. G. Rudolf/Fresenius Institute

Only a few samples were taken from the alleged homicidal ‘gas chambers’, care was taken to ensure that samples were only taken from material not exposed to weathering. Only a few places in Morgue 1 (the ‘gas chamber’) in Crematorium II at Birkenau, where a pillar supports the roof even today and has therefore visibly protected both the underside of the roof and parts of the wall from all influence of weathering, exemplified by the deposition of spider webs many years old and the absence of any trace of lime precipitation on the concrete or mortar, i.e., water runoff.

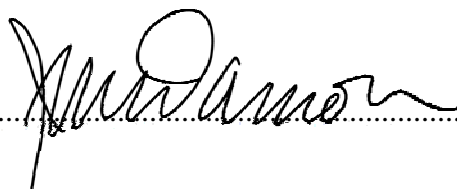
Many samples have already been taken from the alleged ‘gas chambers’ by Cracow and Leuchter, all with at least nearly negative results. Since it was above a matter of clarifying [the question of] which circumstances favour the formation of pigment and [since] clearly positive findings were not to be expected according to the analyses performed in the alleged ‘gas chambers’ thus far, the sample takings took place chiefly in the disinfection chambers of Buildings 5a and 5b in camp section building segment Ia and/or Ib. It is known that their walls not only contain large quantities of pigment, but that their age also corresponds approximately to that of the crematoria on the same location, which cannot be said of the buildings in the main camp. The age can, but need not, have an influence on the chemistry of the wall materials. Furthermore, these buildings are not so much in the footlights of the museum activity as those in the main camp, and therefore rather permit hope of an absence of subsequent building alterations.



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**Table 13:** Cyanide concentrations in masonry of gas chambers / Delousing chambers  
According to G. Rudolf/Institut Fresenius, Tausnusstein, Hesse, Germany

Concentration values in mg per kg; %Fe: Portion of total iron content converted to Iron Blue.						
No.	Building	Sampling location and depth	Material	c[CN]	c[Fe]	%Fe
1	Crema II	Morgue 1, ceiling, between 2. and 3. supporting pillar from the south, removal of material from a broad area, concrete drips incl. a small piece of deeper material, 0-3mm.	Concrete	7.2	13000	-
2	Crema II	as 1, 1-5 mm.	Concrete	0.6	20000	-
3	Crema II	Inner side of western wall of morgue 1, 0-1,5 cm, see illustration 12 (page 25).	Plaster	6.7	10000	-
4	Crema II	Inner side of the norther wall of the chimney wing, garbage incineration, 0-1 cm.	Plaster	0.1	11000	-
5	B1b Barrack 20	Wall separating berth, underneath the crossing beam of one bed in the large room, 2 <sup>nd</sup> row of berths from the entrance, first berth to the right (separating wall), ca. 5 · 5 · 5 cm <sup>3</sup> big.	Plaster	0.6	9400	-
6	B1b Barrack 20	Separate room in the west, interior wall, mortar between bricks, 0-1 cm.	Mortar	<0.1	4400	-
7	B1b Barrack 20	as 6, at the entrance directly to the right, 0-1 cm.	Plaster	0.3	19000	-
8	B1b Barrack 13	as 5, behind beam rest.	Plaster	2.7	11000	-
9	B1a BW 5a	Inside of external wall (West), 120 cm from northern wall, 155 cm from the floor, 0-2 mm.	Plaster	11000.0	12000	75
10	B1a BW 5a	Internal wall (south), 240 cm from western wall, 170 cm from the floor, 0-2 mm.	Plaster	3.6	10000	-
11	B1a BW 5a	as 9, 1-10 mm.	Plaster	2640.0	6000	36
12	B1a BW 5a	Eastern wall (inside), 170 cm from northern wall, 170 cm from floor, (eastern hot air chamber), 0-2 mm.	Plaster	2900.0	8500	28
13	B1a BW 5a	as 12, 2-10 mm.	Plaster	3000.0	9000	27
14	B1a BW 5a	Outside western wall, 40 cm from southern wall, 160 cm from the ground, 0-5 mm.	Brick	1035.0	25000	3.5

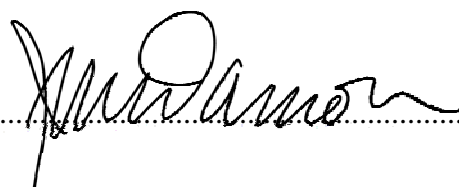


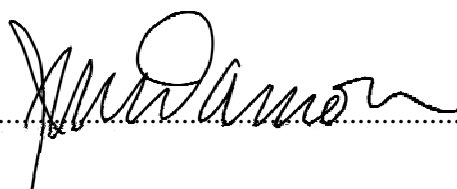
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**Table 13 continued: Analysis results Rudolf/Fresenius**

No.	Building	Sampling location and death	Material	c[CN]	c[Fe]	%Fe
15a	B1a BW 5a	Outside southern wall, 40 cm from western wall, 210 cm from the ground, 0-3 mm.	Mortar	1560.0	10000	13
15b	B1a BW 5a	as a, > 0-5 mm, with pigment layer removed.	Brick	56.0	n.d.	-
15c	B1a BW 5a	as b, removed pigment layer, < 1 mm.	Brick	2400.0	n.d.	-
16	B1b BW 5b	Outside southern wall, 2 m from entrance door, 1 m from the ground, 0-7 mm.	Brick	10000.0	47000	17
17	B1b BW 5b	Inside southern wall, 130 cm from eastern wall, 130 cm from the floor, 4-10 mm.	Plaster	13500.0	15000	74
18	B1a BW 5a	Floor area of door post of hot air delousing chamber, eastern chamber, pointing to the main wing, 0-5 mm.	Holz	7150.0	n.d.	-
19a	B1b BW 5b	Inside northern wall, 230 cm from eastern wall, 90 cm from the floor, 0-4 mm.	Plaster	1860.0	4300	35
19b	B1b BW 5b	as 19a, 4-8 mm.	Plaster	3880.0	9500	33
20	B1a BW 5a	Inside exterior wall (west), 40 cm from southern wall, 210 cm from the floor, 0-3 mm.	Plaster	7850.0	11000	59
21	B1a BW 5a	Interior wall (east) from western wall, 30 cm from door, 190 cm from the floor, 10-50 mm.	Mortar	0.3	18000	-
22	B1a BW 5a	Inside of exterior wall (south), 40 cm from western wall 155 cm from the floor, 3-10 mm.	Plaster	4530.0	11000	34
23	B1a Barrack 3	Special room northwest, inside exterior wall (north), 0-5 mm.	Plaster	0.3	8100	-
24	B1a Barrack 3	Main room inside exterior wall, (north), 0-5 mm.	Mortar	0.1	13000	-
25	Experiment	Untreated brick, 0-5 mm.	Brick	9.6	*35000	-
26	Experiment	16 h in 0.3 vol.% HCN, 0-5 mm, see text.	Brick	0.1	*35000	-
27	Experiment	24 ¾ h in 2 vol.% HCN, +1 g H <sub>2</sub> O, 20 mm, 100 g.	Cement Mortar	**109	*8800	1.0
28	Experiment	as 27, without added H <sub>2</sub> O, 108 g.	Cement Mortar	**94	*8800	0.9
29	Experiment	as 28, 94 g.	Lime Mortar	**53	*4500	1.0
30	Experiment	as 28, + 2g H <sub>2</sub> O, 96 g.	Lime Mortar	**58	*4500	1.1

Cyanide Values between 0.1 and 0.5 mg per kg are considered uncertain (NN); n.d.=not determined; \*own analyses; \*\*= Institute for Environmental Analytic, Stuttgart (IUS).



A handwritten signature in black ink, appearing to read "J. M. Damon", written over a horizontal dotted line.