IN THE COURT OF APPEAL 2000/2095

ON APPEAL FROM THE HIGH COURT OF JUSTICE

QUEEN'S BENCH DIVISION 1996-I-No. 1113

BETWEEN:

DAVID JOHN CAWDELL IRVING

Appellant

-and-

PENGUIN BOOKS LIMITED

First Respondent

-and-

DEBORAH E. LIPSTADT

Second Respondent

REPORT OF RICHARD J. GREEN, PHD.

Introduction

I have been asked to respond to several aspects of Rudolf's affidavit, specifically section D. The Ventilation System (pages 27-29), section J. The Leuchter Report Prof. Van Pelt and Prof. Roth (pages 175-190), and section K .The Research of the Forensic Institute of Cracow (pp. 191-250). I focus on the problems with Rudolf's reasoning in these sections. As I have responded to articles by Rudolf in the past, it is appropriate, however, first to note some facets of the manner in which he argues, and I do that in the section titled, “Rudolf’s Credibility.” Rudolf’s affidavit consists of claiming that the conventional history of the Final Solution cannot be correct owing to his attacks on specific aspects of that history. It is worth noting that he does not propose a coherent alternate explanation of the usage of the facilities whose

history he attacks. In examining Rudolf's attacks on that history, I discuss Rudolf's claims and whether or not they are correct. It is also important to examine the consequences of the possibility that he is correct with respect to whether it would present a significant challenge to conventional history. For the sake of consistency, I refer to Scheerer/Rudolf/Gauss etc. as Rudolf except when referring to titles that have used an alternate name. In the footnotes, I use the name used in the articles referenced.

Rudolf's Credibility

It should be noted that Rudolf has claimed in his own writing that he has intentionally attempted to deceive a court of law in Germany:[1]

> In spring and summer 1992 I was called by several defence lawyers as an expert witness in several trials imposed on Revisionists in Germany (see footnote 103 of the brochure mentioned). In these trials -- as in all trials against Revisionists -- the judges refused to accept any evidence presented by the defence, including all expert witnesses. I had to learn that a chemist (me) was being refused because he was neither a toxicologist nor a historian, an engineer (Leuchter) being refused because he was neither a chemist nor a historian, a historian (Prof. Haverbeck) being refused because he was neither a chemist nor an engineer. My conclusions were that one obviously had to be at the same time an engineer, a chemist, a toxicologist, a historian and a perhaps even an barrister to be accepted as an expert witness at a German court. The legal process being so perverted in Germany, we decided to mock it by inventing a person with all these features, but then we realized that this would be a bit unrealistic, so we split that person into many. That is the background.

In the above quote Rudolf admits to fabricating the existence of people with false credentials in order to influence a court to accept these "people" as expert witnesses. In passing it should be mentioned that Leuchter is not, in fact, an engineer.[2]

Rudolf appears to know more about chemistry than the average Holocaust denier and is therefore capable of making some arguments that require some work to deconstruct. That his arguments are made honestly requires further assessment. In an article on the Internet[3] he makes an argument that especially

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[1] Germar Rudolf, *Character Assasins [sic],* http://vho.org/GB/c/GR/CharacterAssassins.html

[2] Consent Agreement Between Fred A. Leuchter and the Board of Registration of Professional Engineers and Land Surveyors, http://www.holocaust-history.org/leuchter-consent-agreement/

[3] Germar Rudolf, *The 'Gas Chambers' of Auschwitz and Majdanek,* http://www.codoh.com/found/fndgcger.html

bears examination in shedding light on this question. In this article, he uses the word "exchange" in two different senses. Now, there is nothing wrong with using a word in two different senses, but when doing so in two subsequent paragraphs in such a way that it leaves a deceptive impression, one has an obligation to flag the change in meaning. The argument discusses the ventilation of gas chambers, an issue that I revisit below. Rudolf gives a probabilistic explanation of the same mathematical formula I use below to estimate dilution:

> Imagine, if you will, that someone is given a bucket containing 100 blue balls. Each time he reaches into the bucket, he puts in one red ball, briefly mixes the contents and, without looking, takes out one randomly selected ball. How often will he have to do this until only 50 blue balls are left in the bucket and all the others are red? *[...]* In the case described above, it takes an average of **70 exchanges** before half the blue balls have been replaced by red ones. [**emphasis** mine]

In Rudolf's example a single room exchange of air would be equivalent to 100 "exchanges" of balls. Rudolf's next sentence uses the very same word "exchange" in a way that misleads the reader:

> Calculations have shown that the ventilation facilities in the alleged gas chambers of Crematoria II and III in Birkenau - facilities designed only for ventilation of ordinary mortuaries - could have performed at most **6 to 8 air exchanges** per hour. [**emphasis** mine]

By using the same word "exchange" in two contexts he gives the impression that ventilation occurs very slowly. What he calls an "air exchange" in the second paragraph corresponds to 100 of his "exchanges" from the first, though he nowhere makes this clear. It seems the reader is expected to believe that it would take ten hours before the level of poison was cut in half; certainly Rudolf does nothing to dispel this notion. In a subsequent article on the Internet,[4] published on May 4, 1999, Jamie McCarthy and I pointed out this dual use of the word exchange. Rudolf's response was to claim that the fault was with our translation.[5] The article that we quoted, however, was an English language article available on the website of CODOH, which presumably appears with Rudolf's permission. I pointed out

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[4] Richard J. Green and Jamie McCarthy, "Chemistry is not the Science: Rudolf, Rhetoric and Reduction, " 1999 http://www.holocaust-history.org/auschwitz/chemistry/not-the-science

[5] Germar Rudolf, *Character Assasins [sic],* http://vho.org/GB/c/GR/CharacterAssassins.html

this "oversight" on July 28, 2000.[6] As of March 10, 2001, the online version still contained the deceptive wording.

D. Ventilation System

On pages 27-29 of his affidavit Rudolf has a brief treatment of the ventilation systems of Crematoria II and III. Later in the affidavit, he performs some more detailed calculations. Addressing the more detailed calculations is left for a later section. Here I discuss the brief section. Rudolf claims that the ventilation system in morgue 1 shows that it was "*never* intended" to be used as a homicidal gas chamber. I show that a) he fails to support this claim, and b) the ventilation capacity that he claims to have been present was in fact adequate.

Rudolf quotes Mr. Justice Gray's judgement**:**

> 7.62 The drawings further provide for the ventilation of the supposed gas chamber in crematorium 2. Van Pelt infers that the purpose of the system for extracting was to extract poisonous air and so speed up removal of the corpses to the incinerators.

Rudolf criticizes this statement as follows:

> The performance of the ventilation systems of the Crematoria II and III reveals that morgue 1, the alleged 'gas chamber', was *never* intended to be used as a homicidal 'gas chamber': [*emphasis* Rudolf's]

Rudolf attempts to support this startling claim with three arguments, all of which fail to support his assertion or undermine van Pelt's inference. I address each in turn.

> 1. All morgues in Birkenau had ventilation systems with some ten air exchanges per hour, which was to be expected, as it this [sic] was required by the German war-time law for underground morgues (5-10 air exchanges per hour). [Rudolf's footnote 22]

In support of this assertion, Rudolf cites sources identified by Holocaust denier Carlo Mattogno. Mattogno's research was published in 1994.[7] As Rudolf has not provided his sources, I cannot comment on the historical accuracy of the claim itself. I point out, however, that even if true, this assertion does

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[6] Richard J. Green, *Postscript to Chemistry is not the Science*, 2000, http://www.holocaust-history.org/auschwitz/chemistry/not-the-science/postscript.shtml

[7] Carlo Mattogno, *Auschwitz: The End of a Legend,* Granata, Palo Verdes, 1994, vho.org/GB/Books/anf/Mattogno.html, as referenced in Rudolf's affidavit, note 22.

not demonstrate that the gas chamber was "*never* intended to be used as a homicidal" gas chamber. The fact that there are non-sinister uses of ventilation systems does not demonstrate that this one was not intended for sinister purposes. There is nothing inherently sinister about a ventilation system on a morgue that can accomplish 5-10 air exchanges an hour. That may well be the case, but the fact that there are conceivable non-criminal uses of a ventilation system does not reveal lack of intent as Rudolf claims. Robert Jan van Pelt has pointed to other evidence such as the existence of a peephole, the use of the term "undressing room" etc. that when considered together do indeed reveal intent.

Rudolf continues:

> 2. A comparison between the performance of the alleged 'gas chamber' and that of the alleged victim's undressing room reveals that there is nothing sinister about the ventilation of morgue 1 ('gas chamber'), as its performance is even *lower* than that of the undressing room:
>
> morgue 1 ('gas chamber'): 9.94 exchanges per hour
>
> morgue 2 ('undressing cellar'): 10.35 exchanges per hour

Again, this claim does not reveal lack of intent to use morgue 1 as a gas chamber. It does, however, point to the possibility of other intents, for example using the rooms as morgues at times, or using morgue 2 as a gas chamber. Even according to Rudolf the two morgues had nearly equal ventilation capacities. It is not surprising that they should not be exactly equal as the rooms were different sizes. Morgue 1 was 30 m long by 7 m wide: 210 sq m. It was 2.4 m high, for a volume of 504 cu m.[8] According to Pressac those same chambers had a ventilation system with both intake and exhaust fans, capable of cycling 8000 cu m through the room each hour.[9] This is commonly referred to as

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[8]Piper, Franciszek, "Gas Chambers and Crematoria," in Gutman, Yisrael, and Michael Berenbaum, Eds., *Anatomy of the Auschwitz Death Camp*, 1994, p. 166.

[9]Pressac, Jean-Claude, with Robert-Jan Van Pelt, "The Machinery of Mass Murder at Auschwitz," in *ibid*, pp. 210, 232.

> In mid-March *[1942]*, Bischoff received new calculations from Schultz. After reviewing the original numbers, he had decided that it was better to increase the total capacity of the ventilation system of the new crematorium, now to be built at Birkenau, from 32,600 cu m of air an hour to 45,000 an hour. The room most affected by this was the B. Keller, which was to receive a system capable of aerating and deaerating 8,000 instead of 4,800 cu m an hour, that is, a 66-percent increase. Bischoff accepted Schultze's new proposal on April 2. He asked Topf to bring the designation on the firm's blueprints into line with the ones drawn

8000 ÷ 504 = 15.8 air exchanges per hour. Holocaust-denier Carlo Mattogno claims in his essay, "Auschwitz: The End of a Legend"[10] that the ventilation capacity is 4,800 ÷ 506 = 9.48 air exchanges per hour based upon what the SS planned to use originally. Pressac claims that although the SS planned for only 4,800 cu m/hour, they eventually installed ventilation capable of 8000 cu m/hour. John Zimmerman has recently researched, 502-1-327, a Topf bill dated May 27, 1943, which may refer to crematorium II (however, the first page in his copy is missing so he cannot yet be sure); it may indicate that the 4800 cu m/hour figure is correct.[11]

Rudolf's third point is also not new evidence. It is based upon the same 1994 work of Mattogno. Rudolf writes:

> 3. War-time literature recommended some seventy air exchanges per hour for professional delousing chambers, which is seven times more powerful than that attained by the systems of the crematorium morgues. This recommended standard must be expected for 'professional' homicidal 'gas chambers' as well. [Rudolf's note 23] Whereas the ventilation system of a morgue simply has to exchange bad smelling air, but non-hazardous gases, the ventilation system of a gas chamber, be it for homicidal or delousing purposes, needs to remove even minimal traces of highly lethal gases, which in the case of hydrogen cyanide, persistently adheres to moist surfaces. Although it is possible to temporarily operate a makeshift delousing chamber with a less powerful ventilation system, it should be obvious that a homicidal mass gassing facility working uninterruptedly for many months could not operate on a makeshift basis. The moisture involved, the densely packed bodies, as well as the necessity to quickly clear the chamber for the next batch would require enormously powerful fans.

Rudolf claims based upon the work of Holocaust denier Carlo Mattogno that war-time literature recommended some seventy air exchanges per hour for "professional" delousing chambers. In the above statement Rudolf makes several assertions of fact that are not correct, and I examine them below.

> up in the camp. [70] This meant that B. Keller became L. Keller 1 and L. Keller became L. Keller 2. The Topf design was modified accordingly and returned to Auschwitz on May 8. [71]
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> 70. Moscow *[Central State Special Archives of Russia]*, 502-1-312, letter Bauleitung April 2, 1942; Oswiecim, BW 11/1, 12.
> 71. Moscow, 502-1-312, letter Topf May 8, 1942.

[10]Mattogno, Carlo, *Auschwitz: The End of a Legend*, Newport Beach: IHR, 1994, pp. 60-62. Available in German translation as "Auschwitz: das Ende einer Legende" at http://www.codoh.com/inter/intnackt/intnackausch3.html.

[11] John C. Zimmerman, private communication. Professor Zimmerman is the author of *Holocaust Denial: Demographics, Testimonies and Ideologies*, University Press of America, Lanham, MD, 2000

Regarding the possible existence of such a recommendation for certain types of delousing chambers such existence would not demonstrate the inadequacy of the ventilation system present in the homicidal gas chamber. The implication that the a ventilation system that is as powerful as he claims, 9.94 air exchanges per hour, would not be adequate, however, is worth examining. If Rudolf is correct in his statement that gas chamber had this ventilation capacity, it is not inconsistent with the conventional history of the Final Solution.

Rudolf asserts but does not demonstrate that "This recommended standard must be expected for 'professional' homicidal' gas chambers' as well." Rudolf admits that it is possible to delouse without such a powerful ventilation system and then asserts that it is "obvious" that a gas chamber "working uninterruptedly for many months could not operate on such a makeshift basis." He has it almost backwards here as homicidal gassings occurred intermittently for short periods as compared to delousings which occurred much more frequently and for longer periods of time for each delousing. Rudolf goes on to claim that the ventilation system needs to remove even "minimal traces" of the HCN. This assertion is counter to fact. I assume that he knows better.

It should be noted emphatically, that small concentrations of HCN are entirely tolerable. According to Dupont[12] the following thresholds apply:

2-5 ppm Odor threshold
4-7 ppm OSHA exposure limit, 15 minute time weighted average
20-40 ppm Slight symptoms after several hours
45-54 ppm Tolerated for $^1/_2$ to 1 hour without significant immediate or delayed effects
100-200 ppm Fatal within $^1/_2$ to 1 hour
300 ppm Rapidly fatal (if no treatment)

The SS employed slave laborers and did not need to maintain OSHA standards. Residual concentrations in the gas chamber could have been as higher than 50 ppm or so without preventing the removal of bodies by slave laborers without gas masks, and in fact, the slave laborers had gas masks

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[12] Du Pont, *Hydrogen Cyanide: Properties, Uses, Storage, and Handling*, Wilmington: Du Pont, 195071/A (1991).

available. Even so, the ventilation capacity cited by Rudolf would have been adequate to make the chambers *comply with OSHA standards* within a reasonable time frame.[13] Rudolf claims:

> After a close inspection of the documented facts it is clear that Prof. Van Pelt's "powerful ventilation system" is nothing but a fiction.

On the contrary, even if we accept Rudolf's and Mattogno's claims about the gas chamber's ventilation system as accurate, it was adequately powerful. In an article available on the Internet since at least as early as 1997,[14] Rudolf made a similar argument. In that argument, he claimed that the gas chamber in Crematorium II had a capacity of only 6-8 air exchanges per hour. In the present affidavit, Rudolf claims 9.94 exchanges per hour.[15] In a response to his earlier claim, Jamie McCarthy and I demonstrated[16] that even were his claim of 6-8 air exchanges per hour correct, that a slave laborer could enter the gas chamber safely after 20-40 minutes of ventilation without a gas mask.

In the same article, we also did the calculation with a value we believed to be more accurate of 15.8 exchanges/hour. A faster rate increases the ventilation, however, even the number that Rudolf acknowledges as correct produces an adequate ventilation time. By using his number, the estimate is a conservative one that leaves room for error.

I make such an estimate by assuming several different scenarios of the highest HCN concentration achieved before the ventilation was turned on. It is impossible, of course, to get an *exact* figure for how long it actually took to clear the air in the gas chamber. We can obtain approximations through mathematical modeling. The equation used is a simple one: the concentration in the gas

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[13] OSHA is the Occupational Safety and Health Administration, which sets workplace standards in the United States.

[14] Germar Rudolf, *The 'Gas Chambers' of Auschwitz and Majdanek* http://www.codoh.com/found/fndgcger.html

[15] See his point 2 quoted above. He later arbitrarily reduces this number. I discuss that issue in the appropriate section below.

[16] Richard J. Green, and Jamie McCarthy, *Chemistry is not the Science: Rudolf, Rhetoric and Reduction*, 1999, http://www.holocaust-history.org/auschwitz/chemistry/not-the-science

chamber is cut to 1/e, or 0.368 for each room replacement of air. Where C(t) is the concentration of HCN at time t in hours, and C_0 is the initial concentration before the beginning of ventilation:

$$C(t) = C_0 e^{-9.94t}$$

The American Conference of Governmental Industrial Hygienists produces an Industrial Hygiene Calculator program for the Windows operating system.[17] When the size and ventilation rates of the gas chamber are converted to cubic feet and minutes, it returns identical results to the above equation.

This equation supposes that the fresh air mixes with the air in the chamber immediately and completely. In reality it does not do so. Ventilation systems are designed to have an air flow such that the expelled air has a higher concentration of poison, so this equation might seem conservative. In addition, the victims' corpses take up space, which has not been figured into any of the below calculations; this would reduce the volume and increase the replacement rate, again indicating that this figure is conservative. Blockages caused by the same corpses might work in the other direction. Additionally, Rudolf mentions the problem of HCN sticking to wet surfaces. Whereas Rudolf is technically correct that HCN is miscible with water, he is clouding the issue here. To the extent that outgassing is slowed by wet surfaces, it is simply not a problem, as outgassing at such a slow rate will not produce toxic concentrations in the relevant time frame. The following estimates show that even using extremely conservative numbers, the ventilation system was adequately powerful. On pages 233-238 of his affidavit, Rudolf starts with a functionally identical equation. The differences in his results owe to significant errors in his reasoning that are explained below in my treatment of that section. In each of the estimates below I provide a timescale in which 0 is the time at which the Zyklon was removed and the ventilation system was turned on. The tables differ in the assumption of what gas phase concentration of HCN was achieved prior to the ventilation being turned on. The second column shows the resulting concentrations after the given times of ventilation. The third column shows the average concentration that a slave laborer would experience over the next 15 minutes, if he entered at the given time. This value may be compared with the OSHA 15 minute standard given above.

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[17] American Conference of Governmental Industrial Hygienists website, at http://www.acgih.org previously had a free version of this calculator. Industrial Hygiene Calculator.

I begin by showing the results using reasonable concentrations of HCN, and continue showing the results using Rudolf's more unreasonable numbers. In all cases, the ventilation is adequate. First, I assume that the concentration used was 5g/m^3 and that it was allowed to outgas for 20 minutes before the remaining Zyklon was removed. Using Rudolf's function[18] for outgassing of Zyklon, the maximum HCN concentration reached would have been 1670 ppm. The following table shows the results:

Time (minutes)	HCN concentration (ppm)	15 Minute Mean Exposure
0	1670	616
10	319	118
20	61	22
30	12	4
40	2	1

According to this scenario within 20 to 30 minutes the air within the chamber was well below the lethal limit and indeed within the OSHA 15 minute standard. Assume instead that the amount of Zyklon used was 20 5g/m^3 and that it was allowed to outgas for 20 minutes before the remaining Zyklon was removed. Again using Rudolf's function for outgassing of Zyklon, the maximum HCN concentration reached would have been 6680 ppm. The results are shown in the following table:

Time (minutes)	HCN concentration (ppm)	15 Minute Mean Exposure
0	6680	2464
10	1274	470
20	243	90
30	46	17
40	9	3
50	2	1

Note according to this conservative calculation that within 30 minutes the air within the chamber was well below the lethal limit. Within 40 minutes, the concentrations would have been in compliance with the OSHA 15 minute exposure limit.

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[18] See Appendix II to this affidavit.

I anticipate the argument that the initial concentration assumed is too low. On p. 189 of his affidavit Rudolf provides an estimate that the initial concentration was 1%. 1% is 10,000 ppm, the difference is inconsequential as shown in the results of the calculation with C_0=10,000 ppm:

Time (minutes)	HCN concentration (ppm)	15 Minute Mean Exposure
0	10000	3689
10	1908	704
20	364	134
30	70	26
40	13	5
50	2	1

In an effort to show the unimportance of such an argument, I perform the same calculation setting C_0=20,000 ppm, a gross overestimate of the gaseous concentration that would have been present when the ventilation system was turned on. The following table shows the results of the calculation:

Time (minutes)	HCN concentration (ppm)	15 Minute Mean Exposure
0	20, 000	7378
10	3815	1407
20	728	269
30	139	51
40	26	10
50	5	2

Even with this gross overestimate, it would have been safe for a slave laborer to enter somewhere between 30 and 40 minutes. OSHA compliance would be met within 50 minutes. All of these calculations presume 1) that the slave laborers had no gas masks, and 2) that it was important to the SS not to endanger the lives of their slave laborers. The first assumption is not true and the second is true only to the extent that the SS wished to reduce attrition among slave laborers.

In fact, the slave laborers had gas masks available and wore them at least some of the time, as numerous witnesses have attested. In such cases, the duration of ventilation before the doors were

opened is only of interest to those slave laborers who wished to remove their gas masks after, say, fifteen minutes instead of twenty. The prisoner Dr. Nyiszli describes the scene: [19]

> An SS officer and a SDG (*Sanitätsdienstgefreiter*: Deputy Health Service Officer) stepped out of the car. The Deputy Health Officer held four green sheet-iron canisters. He advanced across the grass, where every thirty yards, short concrete pipes jutted up from the ground. Having donned his gas mask, he lifted the lid of the pipe, which was also made of concrete. He opened one of the cans and poured the contents - a mauve granulated material - into the opening. The granulated substance fell in a lump to the bottom. The gas it produced escaped through the perforations, and within a few seconds filled the room in which the deportees were stacked. Within five minutes everybody was dead. *[...]*
>
> In order to be certain of their business the two gas-butchers waited another five minutes. Then they lighted cigarettes and drove off in their car. *[...]*
>
> The ventilators, patented "Exhator" system, quickly evacuated the gas from the room, but in the crannies between the dead and the cracks of the doors small pockets of it always remained. Even two hours later it caused a suffocating cough. For that reason **the Sonderkommando group which first moved into the room was equipped with gas masks.** Once again the room was powerfully lighted, revealing a horrible spectacle. [**emphasis** mine]

(The cough was surely caused by the Zyklon warning indicator, a lachrymatory irritant. For safety reasons, the warning was designed to be noticeable even at low levels of cyanide. Eyewitnesses untrained in handling of Zyklon would probably not know this. Although there were some shipments of Zyklon without the warning agent, the use of such Zyklon was not universal.)

Gas masks are also referenced by Szlama Dragon at a gas chamber which lacked ventilation:[20]

> I myself and eleven others were detailed, as we learnt later, to remove the bodies from this cottage. We were given gas masks, and led to the cottage. When Moll had opened the door, we saw that the cottage was full of naked corpses of both sexes and of all ages.

Mueller also mentions the use of gas masks:[21]

> During the removal of corpses from the gas chambers bearers had to wear gas masks

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[19] Nyiszli, Miklos, *Auschwitz: A Doctor's Eyewitness Account*, Arcade Publishing, New York (1996), pp. 50-51.

[20] Dragon, Szlama, *The Höß Trial*, Vol. 1, pp. 102-121. As cited in Pressac, *Technique*, *op.cit.,* p. 171. Dragon also mentions donning a gas mask for work at the (also unventilated) crematorium V, in Kogon et al., *Nazi Mass Murder*, 1993, p. 167.

[21], Routledge, Paul Kegan , *Auschwitz Inferno* London and Henley, p.117-8:

There are many more testimonies that support the use of gas masks.[22] In addition, there are other pieces of evidence. Daniel Keren believes he has identified a gas mask in a photograph:[23]

> Look in http://www.holocaust-history.org/~dkeren/auschwitz/trip-2000/gas-mask.jpg, for a closeup I took of the enlargement of the well-known photo taken in the summer of 1944 (this enlargement is by Krema V). Note the leftmost SK member in the group on the right. I noticed that he's holding something, and then asked Harry and Mike Stein to say what they think it was. Independently, they confirmed my opinion: a gas mask. I don't think this was ever noted before - probably, because most reproductions of the photo are too small.

Other strong evidence for the use of gas masks is an order given by Rudolf Hoess that is cited by Jean-Claude Pressac and John Zimmerman.[24] In August of 1942, Höss issued a general directive requiring SS members handling Zyklon to wear gas masks.

It should be abundantly clear that Rudolf's longstanding claim that the "The performance of the ventilation systems... reveals that morgue 1, the alleged 'gas chamber', was never intended to be used as a homicidal 'gas chamber'..." is wrong.

J. The Leuchter Report, Prof. van Pelt, and Prof. Roth (pp.175-190)

I. Penetration of Building Materials by Hydrogen Cyanide

The defense put forward an argument that one of the reasons that Leuchter's samples from the gas chambers did not show significant levels of cyanides was that HCN penetrated only the surface of the building materials and that Leuchter's large samples therefore greatly diluted any cyanide present. Rudolf criticizes this claim by arguing that cyanide residues ought to penetrate deeply into the building materials

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[22] See for example the following testimonies cited in Eugen Kogon, Hermann Langbein, and Adalbert Rückerl, *Nazi Mass Murder: A Documentary History of the Use of Poison Gas,* Yale University Press, New Haven, 1993: Kremer, p.149, Wetzler p. 165.

[23] Daniel Keren, private communication. Daniel Keren is a member of the Holocaust History Project and one of the authors of the study locating the holes in the roof of morgue 1 of crematorium 2 that is included as an appendix to Robert Jan van Pelt's affidavit.

[24] Pressac, *Auschwitz*, p. 211 as cited in John C. Zimmerman, *Holocaust Denial: Demographics, Testimonies and Ideologies*, University Press of America, Lanham, MD, 2000, p.184.

exposed to HCN. I show that a) the principle behind the argument made by the defense valid b) Rudolf's comparison between Prussian blue staining in the delousing chambers with residues in the gas chamber is invalid, c) there is evidence that much of the Prussian blue staining is in fact superficial, d) that even if Rudolf were completely correct about his criticism, his argument fails to show that the gas chambers were not exposed to HCN. With respect to this last point, it should be noted that cyanides were in fact detected in the gas chambers by the Institute for Forensic Research (IFFR). Rudolf quotes the judgement of Mr. Justice Gray as follows:

> 7.115 The Defendants relied on the content of an interview of Dr. Roth, the scientist at the Massachusetts laboratory which carried out the tests on Leuchter's samples. According to Dr. Roth, cyanide produces a surface reaction which penetrates no further than one tenth of breadth of a human hair. The samples with which he was provided by Leuchter ranged in size between a human thumb and a fist, so they had to be broken down with a hammer before analysis. Roth asserts that the resulting dilution of any cyanide traces effectively invalidates the test results.

He also quotes Prof. van Pelt:

> Roth explained that cyanide will react on the surface of brick or plaster, penetrating the material not more than 10 microns, or 0.01 mm, or one tenth the thickness of a human hair (one micron equals 1/1,000,000 of a metre, or 0.000039 inch). In other words, if one wants to analyse the cyanide concentration in a brick sample, one should take a representative sample of the surface, 10 microns thick, and no more.

Rudolf states "This statement is unsupportable...." Without seeing Prof. Roth's evidence I am unwilling to call it unsupportable; however, I am not yet persuaded by Prof. Roth's full argument. Part of his argument is undoubtedly valid, but Rudolf focuses on criticizing the more problematic aspect. Before discussing this issue let me quote Professor Roth's words from the interview Errol Morris's documentary, *Mr. Death*:[25]

> I went up to Toronto on very short notice not knowing any of the background at all of what was going on. They wanted somebody from the laboratory to say yes we analyzed these samples, yes we produced this report on the analysis, and that's what I was there to do.
>
> I don't think the Leuchter results have any meaning. There's nothing in any of our data that says those surfaces were exposed or not. Even after I got off the stand I didn't know where the samples came from. I didn't know which samples were which. It was only at lunch that I found out really what the case involved. Hindsight being 20/20, the test was not the correct one to have been used for the analysis. He presented us with rock samples anywhere from the size of your thumb up to half the size of your fist. We broke them up

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[25] Errol Morris, *Mr. Death: the Rise and Fall of Fred A. Leuchter, Jr.*, Universal Studios, 1999. The transcription is mine and any errors in that transcription are mine alone.

> with a hammer so that we could get a sub-sample, place it in a flask, add concentrated sulfuric acid, and it undergoes a reaction that produces a red colored solution. It is the intensity of this red color that we can relate with cyanide concentration.
>
> You have to look at what happens to cyanide when it reacts with a wall. Where does it go? How far does it go? Cyanide is a surface reaction [sic]. It's probably not going to penetrate more than 10 microns. Human hair is 100 microns in diameter. Crush this sample up. I have just diluted that sample ten thousand, a hundred thousand times. If you're going to go looking for it, you're going to look at the surface only. There's no reason to go deep because it's not going to be there. Which was the exposed surface? I didn't even have any idea. That's like analyzing paint on the wall by analyzing the timber behind it. If they go in with blinders on, they will see what they want to see. What was he really trying to do? What was he trying to prove?

The only problematic sentence in the entire statement of Dr. Roth is, "It's probably not going to penetrate more than 10 microns." He even qualified his statement with the word "probably." His argument without that sentence is unquestionably valid. If a wall is exposed to cyanide, there will be more cyanide on the surface exposed to the cyanide. Crushing a large volume of the sample, rather than carefully sampling the surface will dilute the sample. Dr. Roth's argument should bring up another implication: the concentration of the contaminant is certainly not homogenous, and selection of different sample sizes that include inhomogeneous levels of contaminant within a given sample make comparison of concentrations between different samples suspect. Even ignoring the different chemical processes between the delousing chambers and the gas chambers, it would be necessary to measure equivalent samples to compare them. Because the concentrations are bound to be heterogeneous, even in a sample the size of one's thumb, one needs to use care in direct comparisons.

Dr. Roth's statement about the penetration of cyanide is somewhat problematic. I would like to see his reasoning before asserting that he is wrong; however, I understand the following to be the case at Auschwitz. Many of the delousing chambers have visual evidence of blue staining, whereas the remnants of gas chambers do not. Much of this staining penetrates to depths greater than 10 microns. The origin of this staining is not entirely clear. It is not at all surprising, however, that areas that exhibit such staining should show much higher concentrations of cyanides than areas that do not exhibit such staining. To be explicit, I would expect delousing chambers to show higher concentrations of cyanides than the homicidal gas chambers based on the visual presence of Prussian blue staining alone; so that even if one did a fair comparison, there ought to be much more cyanide where there is obvious blue staining.

Rudolf argues:

> Up to date I have not seen that Prof. Roth has supported his claim with scientific evidence. The fact is that the delousing chambers of Auschwitz, Birkenau, Stutthof and Majdanek are saturated with cyanide compounds not only at the surface, but in every depth, as I have proved by taking samples from different depths, see especially the samples no. 11, 13, 17, 19b, 23, in the following table. They prove that the cyanide easily reaches deeper layers of plaster and mortar. Even the other samples show that Prof. Roth's claim is false. It is logically impossible that only the upper 10 microns (0,010 mm) bear all the Iron Blue, as that would mean that between 10 and 75% of the entire Iron in these (furthest right column) is concentrated in this thin layer that makes less than 1% of the samples.

The comparison is illegitimate. To use a cliché, he is comparing apples and oranges. Exposure to HCN does not necessitate the formation of blue staining. Nothing that Rudolf says about the blue staining disproves the usage of the facilities as gas chambers. The chemical processes that took place in the delousing chamber were fundamentally different in some manner than those that took place in the gas chambers. The delousing chambers have obvious blue staining whereas the gas chambers do not. To argue on the basis of the delousing chambers what should have happened in the gas chambers is not as straightforward as it might seem. It is possible that a mechanism similar to Rudolf's proposed mechanism is responsible for the formation of Prussian blue in the delousing chambers. Some of the staining is quite odd, however: it stains certain areas and not others nearby. Harry W. Mazal among others has noted staining on outside walls.[26] Daniel Keren has a picture of such staining at: http://www.holocaust-history.org/~dkeren/auschwitz/trip-2000/prussian-blue-1.jpg. The reasons for such staining have not been entirely explained. Rudolf has proposed a chemical mechanism for the formation of Prussian blue in the gas chambers.[27] I have shown that even if Rudolf were entirely correct about the mechanism of Prussian blue formation in the delousing chambers, that one should not expect the same mechanism to apply under the conditions of homicidal gassing.[28] I retrace that argument in some detail below. An

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[26] Harry W. Mazal OBE, Private Communication. Mr. Mazal is the President of the Holocaust History Project and has conducted onsite forensic investigations of Auschwitz.

[27] See for example reference Germar Rudolf, *The 'Gas Chambers' of Auschwitz and Majdanek,* http://www.codoh.com/found/fndgcger.html

[28]Richard J. Green, Leuchter, *Rudolf and the Iron Blues,* 1998, http://www.holocaust-history.org/auschwitz/chemistry/blue

important point that should be made is that even if Rudolf is correct about the formation of Prussian blue, and even if Leuchter's samples were collected completely honestly and accurately, none of the evidence concerning Prussian blue is incompatible with homicidal gassing in the gas chambers. In fact, it should be noted that cyanide compounds have been detected by the Institute for Forensic Research in Cracow (IFFR) in gas chambers Kremas I-V and also in block 11 of Auschwitz.[29] I discuss these results in further detail below.

Rudolf writes:

> d. Finally, the patch blue discoloration of the *outer* walls of the delousing facilities in Birkenau, Majdanek, and Stuthof are an obvious and convincing proof for how easily HCN and its compounds can penetrate such walls.

In addition to the fact that Rudolf is again illegitimately assuming that what holds true for the delousing chambers must hold true for the gas chambers, there is nothing obvious about his conclusion. Rather the discoloration on the outside of walls, ought to make one consider what possible processes could have taken place outside of the delousing chambers. For example, is it possible that materials that had been soaked with aqueous solutions of HCN were leaned against the outside of the buildings? Not enough is known, but it is premature to conclude that the staining on the outside of buildings owes its origins to processes that took place within those buildings. Harry W. Mazal OBE has been studying the penetration of the brickwork by the stains. In a soon to be published essay he notes of photographs that he has taken:[30]

> As may be observed in the eight photographs above, penetration of Prussian Blue into either the wall material inside of the building, or the bricks on the exterior, is minimal, corroborating previous reports. It is possible that very porous materials such as plaster might permit a slightly greater penetration of the stain, but not to the degree claimed, without proof, by Holocaust deniers.

Furthermore, he notes of staining on the outside of B1b:

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[29] Markiewicz, Gubala, and Labedz, *Z Zagadnien Sqdowych*, z. XXX, 17-27, (1994) available at http://www.holocaust-history.org/auschwitz/chemistry/iffr/

[30] Harry W. Mazal OBE, *Technical Requirements for a Gas Chamber and Some Observations on Prussian Blue*, to be published.

> There is an as-yet unsolved mystery of how Prussian Blue made its way through apparently solid brick walls leaving it's tell-tale blue stains on the exterior of both bath and delousing chambers in BIa and BIb in Birkenau. An answer might be found by looking carefully at *Illus. 20.*
>
> [photo]
>
> This close-up picture shows strong Prussian Blue staining on both mortar and brickwork. Two other facts are revealed: (1) The stain scarcely penetrates the mortar. The broken section reveals pristine, unstained material proving that Prussian Blue does not penetrate solids to any great degree; and (2) the stains on the bricks appear like a semi-transparent wash, suggesting that the bricks are not subject (as was shown in the illustrations above) to any great penetration by the pigment.

If there is staining on an outside brick that does not penetrate deeply at all, it is very difficult to argue that this staining originates from fumigation by gas phase HCN. It is possible that the outer wall was somehow exposed to an aqueous solution of cyanide; note, however, that the coloring does not penetrate deeply. Daniel Keren provides further confirmation with a photograph in which it can be seen that the staining does not penetrate deeply at http://www.holocaust-history.org/~dkeren/auschwitz/trip-2000/prussian-blue-3.jpg.

Rudolf concludes this section by saying "On this question, Leuchter was right." What both Leuchter and Rudolf were wrong about is the assumption that the presence or absence of Prussian-blue staining is directly correlated to the presence or absence of exposure to HCN. This assumption is a fatal flaw in both of their arguments. Whereas the Prussian blue *may* indeed be a result of such exposure, it does not follow that exposure to HCN necessarily produces Prussian blue. HCN that did not form Prussian blue or similar compounds would have been washed away by water and weathering leaving far less of a trace than HCN that did form Prussian blue. Despite this fact the IFFR did indeed detect non-Prussian-blue cyanides in the remains of the gas chambers. Professor Roth was undoubtedly correct that crushing a sample in which one did not know which surface was exposed to HCN, would dilute the concentration that one would measure compared to carefully sampling the surface.

II. Concentration of Cyanide Required for Killing Purposes

Rudolf quotes a passage of Mr. Justice Gray's judgement in order to disagree with the claim that far more cyanide is required to kill lice than is needed to kill humans. Even if he were completely correct in his argument, Rudolf's claim would have few if any consequences regarding the veracity of the events

that happened at Auschwitz and Birkenau. The possible consequences are that ventilation of the chambers would have been too slow, that the victims would not have been silent as fast as reported, or that somehow the amount of exposure should increase the traces of cyanides found by forensic investigators. I show that Rudolf's numbers are almost certainly too large, and that even Rudolf's numbers do not produce such consequences. Rudolf writes:

> 13.79 The reason why Irving initially denied the existence of gas chambers at Auschwitz was, as has been seen, the Leuchter Report. I have summarized in some detail the findings made by Leuchter at paragraphs 7.82 to 7.89 above. I will not repeat myself. I have also set out at paragraphs 7.82 to 7.89 above the reasons why van Pelt on behalf of the Defendants dismissed the Leuchter Report as flawed and unreliable. Those reasons were put to Irving in cross-examination. It is a fair summary of his evidence to say that he accepted the validity of them. He agreed that the Leuchter Report was fundamentally flawed. In regard to the chemical analysis. Irving was unable to controvert the evidence of Dr. Roth (summarized in paragraph 7.106 above) that because the cyanide would have penetrated the brickwork and plaster to a depth no more than one tenth the breadth of a human hair, any cyanide present in the relatively large samples taken by Leuchter (which had to be pulverized before analysis) would have been so diluted that the results on which Leuchter relied had effectively no validity. What is more significant is that Leuchter assumed, wrongly as Irving agreed, that a greater concentration of cyanide would have been required to kill humans than was required to fumigate clothing. In fact the concentration required to kill humans is 22 times less than is required for fumigation purposes.

It is correct that far more cyanide is needed to kill insects than is needed to kill humans, Leuchter was apparently unaware of this fact. Rudolf, however, acknowledges this fact:

> It is true that mammals are far more sensitive to HCN than insects. The question is, however, what concentration of hydrogen cyanide is required to conduct a mass gassing as described by the alleged eye witnesses.

Many critics of Holocaust deniers have argued that because the lethal level of cyanide for a human being is less than that for lice far lower concentrations were in fact used in the murdering process. The fact that 300 ppm of HCN is rapidly lethal to human beings does not actually prove that such small concentrations were used in the homicidal gas chambers. The advantage of using a higher concentration is twofold: 1) the lethal effects can take place faster, and 2) the lethal concentration can be established much faster. The advantage of using a lower concentration, of course, is that it would save money. I have not seen evidence that the concentrations actually used for murder were significantly less (i.e., more than a factor of 2 or 3) than those used for delousing.

It should be pointed out that delousing took far more time than homicidal gassing. Because of this additional time, the Zyklon used for delousing would have had ample time to degas completely.

Therefore, for the same amount of Zyklon, the ultimate gas phase HCN concentration would be somewhat higher in the case of delousing. In his section on calculations, Rudolf finds a different result based upon his erroneous assumption that there were no Zyklon introduction vents. I discuss this issue below in my analysis of Rudolf's calculations. Proof for the existence of vents can be found in the presentation of Keren, McCarthy and Mazal.[31] Although the highest gas phase concentration in the gas chambers would have most likely been less than that in the delousing chambers, the concentrations would probably not have differed by as much as many denier critics have assumed.

These findings do not vindicate Leuchter or the *Leuchter Report.* The concentrations that were most likely used are consistent with testimony, consistent with the ability of slave laborers to clear out the bodies, and consistent with the differences in chemical traces between the gas chambers and the delousing chambers. Above in the section on ventilation I show that one can even double Rudolf's estimate of the gas phase concentration without endangering the slave laborers. Below I discuss the issue of chemical traces of cyanides. Here I discuss the issue of how much Zyklon B was used and what it's toxicity is.

1. Eyewitness Accounts of the amount of Zyklon B Applied

Rudolf claims:

> There are not too many eyewitness accounts regarding the amount of Zyklon B known, but according to a Polish source they generally refer to the application of 6 to 12 kg of hydrogen cyanide.

As Rudolf has not provided his source, it is impossible to judge the accuracy of his claim or to know to which gas chamber these amounts refer. Assuming, that the reference is to morgue 1 in crematorium 2, these concentrations would correspond to 12-24 g/ cubic meter. These concentrations are not out of line with the assumptions that Jamie McCarthy and I made in our article.[32] Our estimate

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[31] Daniel Keren, Ph.D, Jamie McCarthy, Harry W. Mazal OBE, " A Report on Some Findings Concerning the Gas Chamber of Krematorium II in Auschwitz-Birkenau", an appendix to Robert Jan van Pelt's expert report.

[32] Richard J. Green, and Jamie McCarthy, *Chemistry is not the Science: Rudolf, Rhetoric and Reduction*, 1999, http://www.holocaust-history.org/auschwitz/chemistry/not-the-science

was based upon the following considerations. Our low estimate of 4-5 g/cubic meter came from an estimate from our late colleague, Mark Van Alstine.[33] Our high estimate of 15-20 g/cubic meter came from Pressac.[34] Broad testified that two 1 kg tins were used,[35] which would work out to 4 g/m^3 consistent with our lower estimate. To be on the safe side, we used a range from 5-20 g/cubic meter. These values correspond to 4500 and 18,100 ppm respectively.[36] For the sake of comparison, the concentration

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[33] Mark Van Alstine, private communication. Van Alstine writes:

> Given that Zyklon B came in 200 g, 500 g, 1 kg, and 1.5 kg canisters, arguably "one of the smallest cans" would have been a 500 g can of Zyklon B. That would mean that in Krema II either 1.5 or 2.0 kg of Zyklon B (depending on whether or not one or both gas chambers of L.Keller 1 were used) would have been poured in. Since L.Keller 1 had a volume of about 500 cu m, that would mean a HCN concentration of about 3-4 g cu m. (Cf. Pressac, *Technique*, *op. cit.,* pp. 16-17, 21, 494)

[34] Jean-Claude Pressac, "The Deficiencies and Inconsistencies of 'The Leuchter Report'" in Shapiro, S. *Truth Prevails: Demolishing Holocaust Denial: The End of the Leuchter Report*, NY: The Beate Klarsfield Foundation (1990).

[35] Robert Jan van Pelt, second supplementary opinion, p.31.

[36] Concentrations of trace gases in air are conveniently described in terms of parts per million by volume (ppm) as follows: Concentration of species X in ppm = 10^6*(volume of species X alone)/(volume of air). See for example, John H. Seinfeld, Atmospheric Chemistry and Physics of Air Pollution, John Wiley & Sons, New York, 1986, p.6. Degesch defines in their publications that they mean ppm as parts per million by mass (a convention brought over from the liquid phase). Pressac has also followed this usage. Modern references to gas phase toxicity, however, are by volume. In the case of HCN, the point is moot. HCN has a molecular mass of 27 versus the atmosphere's roughly 28.8. Thus their densities are nearly equal at the same temperature and one may be loose about switching between the two conventions. In other words, the value in ppm by mass will be different by a factor of 27/28.8 or 0.94, an insignificant difference. To convert from g/m^3 to ppm by volume, one can use the following equation:

Conc. in ppm = ((Conc. in g/m3)/27.0)* (8.31441*298.15/101325)

Where 8.31441 is the ideal gas constant, 298.15 is the temperature in Kelvin (again note that a 30 degree temperature difference leads only to 10 % error), and 101,325 is atmospheric pressure in

suggested by Degesch for delousing is 8 g/cubic meter.[37] These are the ultimate concentrations once all of the HCN evaporates. During a delousing the full concentration would develop. During a homicidal gassing the remaining Zyklon was removed after apparent death and before ventilation; so the highest concentration actually reached would have, in fact, been less as the Zyklon did not fully degas within the chamber.

2. Eye witness accounts about the time required to kill all humans in the gas chamber

Rudolf writes:

> An indirect way to calculate the amount of Zyklon that would have been required to kill all humans in a 'gas chamber' is the time that was allegedly needed to kill them. According to nearly all 'eye witnesses' it took between only a few seconds and up to ten minutes to kill in the alleged gas chambers of Crematorium II and III. [Rudolf's note 448] This information can be used to make a rough calculation of the amount of Zyklon actually required to achieve such a killing time.

In order to make such a rough calculation, Rudolf compares this testimony to the times reported for death in US execution chambers employing HCN as a lethal gas. There are serious flaws in Rudolf's argument: 1) There is more variation between witnesses than Rudolf indicates. 2) For the victims of a gas chamber to appear dead to eyewitnesses, it would require only silence and immobility. 3) Rudolf's claims about US gas chambers are misleading.

Rudolf states "According to nearly all the 'eye witnesses' it took between only a few seconds and up to ten minutes to kill..." In footnote 448, he states that the "only exception" is the trial gassing in the Auschwitz inmate barracks (presumably block 11). One very important eyewitness (Rudolf Höss) must be another exception:[38]

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pascals. 1 g/m^3 is 906 ppm or 0.09%, so that dividing the concentration in g/m^3 by 10 roughly gives the concentration in percent.

[37] NI-9912, section IX, reprinted in Pressac, Jean-Claude, *Technique and Operation of the Auschwitz Gas Chambers*, The Beate Klarsfeld Foundation, New York, 1989, p.19. This document is online at the CODOH (denial) website, at http://www.codoh.com/incon/inconzyklon.html.

[38] Rudolf Höss, *Death Dealer: The Memoirs of the SS Kommandant at Auschwitz*, Steven Paskuly, Ed., 1996, p. 44.

> The door would be screwed shut and the waiting disinfection squads would immediately pour the gas [crystals] into the vents in the ceiling of the gas chamber down an air shaft which went to the floor. This ensured the rapid distribution of the gas. The process could be observed through the peep hole in the door. Those who were standing next to the air shaft were killed immediately. I can state that about one-third died immediately. The remainder staggered about and began to scream and struggle for air. The screaming, however, soon changed to gasping and in a few moments everyone lay still. After twenty minutes at the most no movement could be detected. The time required for the gas to take effect varied according to weather conditions and depended on whether it was damp or dry, cold or warm. It also depended on the quality of the gas, which was never exactly the same, and on the composition of the transports, which might contain a high proportion of healthy Jews, or the old and sick, or children. The victims became unconscious after a few minutes, according to the distance from the air shaft. Those who screamed and those who were old, sick, or weak, or the small children died quicker than those who were healthy or young.

It should not be surprising, if the quantities used were not always equally precise or equally effective. In fact, there is at least one report of someone who survived a gassing. I suppose that Dr. Nyiszli is another exception: [39]

> I grabbed my instrument case, which was always ready, and dashed to the gas chamber. Against the wall, near the entrance to the immense room, half covered with other bodies, I saw a girl in the throes of a death-rattle, her body seized with convulsions. The gas kommando men around me were in a state of panic. Nothing like this had ever happened in the course of their horrible career. *[...]*
>
> I calmly related *[to SS Sergeant Mussfeld]* the terrible case we found ourselves confronted with. I described for his benefit what pains the child must have suffered in the undressing room, and the horrible scenes that preceded death in the gas chamber. When the room had been plunged into darkness, she had breathed in a few lungfuls [sic] of cyclon gas. Only a few, though, for her fragile body had given way under the pushing and shoving of the mass as they fought against death. By chance she had fallen with her face against the wet concrete floor. That bit of humidity had kept her from being asphyxiated, for cyclon gas does not react under humid conditions. These were my arguments, and I asked him to do something for the child. *[...]*
>
> "There's no way of getting round it," he said, "the child will have to die."
>
> Half an hour later the young girl was led, or rather carried, into the furnace hallway, and there Mussfeld sent another in his place to do the job. A bullet in the back of the neck.

Nyiszli's explanation of the cause of the girl surviving may not be correct, but the episode points out that gassing was not necessarily a perfect science. It was not necessarily conducted ideally each time, in fact concentration profiles no doubt varied from gassing to gassing.

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[39] Miklos Nyiszli, *Auschwitz: A Doctor's Eyewitness Account*, New York: Arcade Publishing, 1993, pp. 114-120.

3. The time required to kill prisoners in U.S. Execution Chambers

What would be needed for the kind of rough estimate of the concentration used that Rudolf attempts is that the victims be shown to be exposed to enough cyanide that for the most part the majority of victims would appear to be dead in 10 minutes or so.

Rudolf's argument is that the concentrations used in the gas chambers must have been at least as great as in US gas chambers in order for death to occur within 10 minutes. He claims:

> But even under normal circumstances, executions in U.S. execution gas chambers take on average 10 to 14 minutes. The hydrogen cyanide concentration applied during these executions is usually similar to those applied during normal delousing procedures (0.3%-1%). [Rudolf's note 450] The victim immediately exposed to very high concentration of the poison gas as it develops underneath him, rising into his face.

The time reported for actual death in a US execution is not the same as an eyewitness at Auschwitz would have reported. In order for a US prisoner to be declared dead, at the very least, his or her heart must have stopped beating. In the gas chambers unconsciousness, silence and immobility would most likely have been reported as death. No one entered the gas chambers until they were ventilated. During the time of ventilation, exposure of the victims to HCN would have continued; so that any unconscious victims would continue to be exposed to lethal concentrations of HCN. So Rudolf's comparison is really invalid. In victims of cyanide poisoning, the heart may continue beating after most outward signs of life have disappeared:

> In many instances death is delayed, but after a very high dose of cyanide, death may occur in 1 to 2 min. In these cases, the individual collapses and breathing is labored and progresses to apnea. Convulsions and loss of consciousness follow quickly. With lesser doses, rapid respiration may be seen owing to stimulation of the carotid chemoreceptors by cyanide.... Unconsciousness and complete areflexia may occur and may continue for 15 to 60 min before death. Respiration ceases before cardiac arrest.[40]

In an appendix to this affidavit, I examine Rudolf's sources on the time of death in US execution chambers. Two facts are worth noting from that examination. The sources support the notion that unconsciousness and immobility precedes cardiac death. They also call into question the average of 10-

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[40] Joseph L. Borowitz, Anumantha G. Kanthasamy, and Gary E. Isom, "Toxicodynamics of Cyanide" in Satu M. Somani, *Chemical Warfare Agents,* Harcourt, Brace Jovanavich, San Diego, 1992, p. 213

14 minutes that Rudolf asserts for the time of death. These numbers are almost certainly too high given Rudolf's own sources.

Now I turn to the question of what concentration was used in the U.S. executions. Rudolf reports a concentration of 0.3-1%, but he cites only a single source. This source is listed in footnote 450 as "Cf. The News & Observer, Raleigh (NC), 11 June 1994, p. 14A." In the above mentioned appendix I cite a story that begins on p. A1 of this same issue.[41] This article does not give the concentration used. It has some information that might be used to extrapolate a concentration, but such an estimate would not be very accurate. On p. A14 there is an article about Phil Donahue appealing to the US Supreme Court for a stay of execution. It does not mention concentrations of cyanide used. I went to the *News & Observer* website http://newsobserver.com, and searched for articles occurring on June 11, 1994. A search on the word "cyanide" brought up the article by Bill Krueger on p. A1 and an unrelated article about tobacco ads. A search on "death penalty" brought up only the Krueger article. A search on "execution" brought up the Krueger article as well as the article concerning Phil Donahue. A search on the word "concentration" brought no result as did a search on "0.3." Without having access to a hard copy or microfiche of p. A14 I cannot absolutely exclude the possibility that Rudolf is being honest, but one should be suspicious of his value of 0.3 to 1% cyanide concentration in US executions. Even if he can provide a source for this claim, it is questionable what the uniformity of such usage is. It is certainly no manner in which to make an estimate of LC_{100} (the concentration required to kill 100% of those exposed in a given time period).

4. Subsequent Calculations

By comparison, at 5 g/m^3, the victims would have been exposed to 930 ppm within 10 minutes and at 20 g/m^3, the victims would have been exposed to 0.37 % within 10 minutes. This estimate is not so far different from Rudolf's low end. Given that the variation in the time of a gassing was greater than Rudolf claims, that the gas chambers were warmer than he claims, and that it takes longer to die a legal death than an apparent death, the estimates that Jamie McCarthy and I made are not unreasonable. It should be noted that Rudolf's estimate of 0.3-1% magically becomes 1% in his subsequent calculations.

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[41] Bill Krueger, "Execution Will Use Gas Chamber" in The News & Observer, Raleigh, NC, June 11, 1994, p. A1.

It is worth revisiting DuPont's thresholds:[42]

2-5 ppm	Odor threshold
4-7 ppm	OSHA exposure limit, 15 minute time weighted average
20-40 ppm	Slight symptoms after several hours
45-54 ppm	Tolerated for 1/2 to 1 hour without significant immediate or delayed effects
100-200 ppm	Fatal within 1/2 to 1 hour
300 ppm	Rapidly fatal (if no treatment)

One does not provide treatment to someone that one intends to kill, so for our purposes 300 ppm is "rapidly fatal." DuPont adds, however:

> These numbers should be considered reasonable estimates, not exact, since effects vary for different people, and data are not exact. Also, heavy breathing from physical work will increase cyanide intake and reduce the time for symptoms to show. The "rapidly fatal" exposure level of 300 ppm assumes no first aid or medical treatment. Either is very effective if used **quickly**.

(Emphasis Du Pont's.) How quickly is quickly?

> Seconds count, and treatment should be provided **within** about 200 seconds (3-4 minutes).

An article in *Human Toxicology* gives similar thresholds:[43]

Response	Concentration (ppm)
Immediately fatal	270
Fatal after 10 min	181
Fatal after 30 min	135
Fatal after 30-60 min or later, or dangerous to life	110-135
Tolerated to 30-60 min without immediate or late effects	45-54
Slight symptoms after several h	18-30

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[42] Du Pont, *Hydrogen Cyanide: Properties, Uses, Storage, and Handling*, Wilmington: Du Pont, 195071/A (1991).

[43] J.L. Bonsall, *Human Toxicol.* (1984), 3, 57-60.

This same article describes a case so remarkable that it was worth publishing an article about an industrial accident in which a worker survived a 6-minute exposure to 500 mg/m^3 (450 ppm). The article states:

> This case is unusual in that survival without sequelae occurred despite exposure to HCN in the order of 500 mg/m^3 for a 6 min exposure; especially as treatment was initiated until 1 h after exposure.
>
> Even if the initial exposure was lower than 500 mg/m^3, experiments carried out subsequently have indicated that the build up of HCN in the circumstances described is rapid.

In this case, the patient collapsed unconscious within 3 minutes. Upon removal from the tank in which he was exposed his breathing was imperceptible and he was comatose upon arrival at the hospital 40 minutes later.

Given the above, it is not unreasonable to assume that the claim that 300 ppm is "rapidly fatal" would apply to times of 10 minutes at most. One has to be concerned, however, with whether this value is LC_{100}. Without citing what he believes the lethal doses to be Rudolf writes (p.190):

> 1. the lethal dose 100%, LD_{100}, gives the concentration or quantity of poison required to kill *all* (100%) individuals of an observed species. This value is used to make sure that all individuals are successfully killed.
>
> 2. The lethal dose 1%, LD_1, gives the concentration or quantity of poison required to kill 1% of all individuals of an observed species. This value is used to mark a threshold beyond which exposure to that poison is definitively dangerous.
>
> Obviously, the two values differ enormously, *i.e.,* the LD_{100} value is much higher than the LD_1 value.

Here Rudolf seems to imply but does not state explicitly that the often quoted 300 ppm value for the toxicity of HCN is an LD_1 value and his 1% is an LD_{100} value, presumably for a ten minute exposure time. When citing lethal concentrations one usually refers to lethal concentration (LC) values rather than lethal dose (LD) values. A lethal concentration requires a time associated with it. One source gives the following values for LC_{50}:[44]

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[44]Timothy C. Marrs, Robert Maynard and Frederick R. Sidell, *Chemical Warfare Agents: Toxicology and Treatment,* John Wiley & Sons, Ltd. (Chichester, West Sussex, England), 1996 ISBN 0-471-95994. Chapter 9: Cyanides, pp. 203-219

> Precise figures for the acute toxicity of HCN to humans are unknown. The acute lethality is, by analogy with animals and on theoretical grounds, likely to be time dependent and some guideline figures are available in table 2.
>
> | Time | LC50 ($mg\ m^{-3}$) | LCt50 ($mg\ min\ m^{-3}$) |
> |---|---|---|
> | 15s | 2400 | 660 |
> | 1 min | 1000 | 1000 |
> | 10 min | 200 | 2000 |
> | 15 min | 133 | 4000 |
>
> However it should be stated that these figures are extremely uncertain, and a higher figure of 4400 mg m^{-3} was given by MacNamara based on an estimate of Moore and Gates....
>
> MacNamara's own estimates for the toxicity of inhaled HCN in humans is based on the similarity in responses to HCN of humans and goats, and he gives a 1-min LC_{50} of 3404 mg m^{-3}.

The value given for 10 minutes is equivalent to 181 ppm. Regardless of the absolute accuracy of these numbers, it would be ridiculous to suggest that 300 ppm is LC_1 for ten minutes. The LC_{50} estimate for 15 seconds corresponds to 0.21%, which is *smaller* than Rudolf's claim of LC_{100} for 10 minutes. McNamara's LC_{50} value for 1 minute is 3080 ppm, which is Rudolf's minimum LC_{100} value for 10 minutes. The value of 4400 mg m^{-3} is difficult to interpret without a timeframe. Perhaps it is an LCt value, but the units are wrong in that case. There is no ethical way to measure precisely LC_{100} for humans. Even making a proper estimate based upon US gas chamber times is problematic because the concentrations used were not necessarily consistent, nor is the sample size big enough. Rudolf's estimate is so problematic as to be worthless. Note, that (0.1%) 1000 ppm is more than 5 times the estimate of LC50 for 10 minutes. It is hard to imagine that 0.1% for ten minutes would not be well over LC_{100}. Rudolf writes:

> ... just as a louse bad shape [sic] can be killed by only 0.03% of hydrogen cyanide, so it is possible that a smart and healthy human can survive a 5 minute exposure to 1% of hydrogen cyanide.

Rudolf gives no evidence for this assertion.

Based upon the estimate given above that the amount of Zyklon used was between 5 and 20 g/cubic meter (4500-18,100 ppm), a conservative estimate is that the victims were exposed to 450-1810

ppm within 5 to 15 minutes, or between 2.5 and 10 times the LC_{50} estimate given above. This estimate depends on the chambers being only 15 °C. The gas chambers are likely to have been much warmer than the warmest temperature he studied. Human body temperature, for example, is 37°C, and the chambers were packed with people before the Zyklon was inserted. Under such conditions the Zyklon would outgas more quickly and the exposure would be greater.

Rudolf writes:

> It is obvious that the killing times reported by the alleged eyewitnesses of mass gassings with Zyklon B in Auschwitz and elsewhere, which are similar or shorter than those in US executions, would have required at least similar concentrations as applied in the U.S. executions (0.3%-1%). As a matter of fact Zyklon B releases its hydrogen cyanide only very slowly, about 10 % in the first 10 min.[Rudolf's note 451] Furthermore, since there was obviously no appliance to distribute the gas quickly over the entire room, more minutes would have passed before all victims would have been surrounded by high concentrations of hydrogen cyanide (even those standing in the corners of the room). We must therefore assume that the minimum amount of Zyklon B to be introduced in these rooms would have been in order of magnitude **ten times** the amount normally used for delousing procedures in order to reach a similar concentration already in the first 5 to 10 minutes of the execution even in the hindmost corner of the room.

Inspection of illustration 1 of the Irmscher paper[45] shows that about 10% of the Zyklon evaporates within a period of about 5 to 15 minutes even at the coldest temperatures he studied. Irmscher did his studies at temperatures ranging from -18°C and 15°C. In his calculations discussed below (see p. 235 of his affidavit), Rudolf fits Irmscher's data with the functional form 1-exp(-t/43.5), where t is in minutes. I plotted this fit against Irmscher's data, and I found that it is in reasonable agreement.[46] If one believes that one can extrapolate the data to early time, it yields the result that about 20% evaporates within 10 minutes. The gas chambers are likely to have been much warmer than the warmest temperature he studied. Human body temperature, for example, is 37°C, and the chambers were packed with people

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[45] Irmscher, R., *Nochmals: "Die Einsatzfähigkeit der Blausäure bei tiefen Temperaturen"* (Once More: "The Efficiency of Prussic Acid at Low Temperatures"), *Zeitschrift für Hygienische Zoologie und Schädlingsbekämpfung*, Feb/Mar 1942, pp. 35-37. Available on the web at http://www.holocaust-history.org/works/irmscher-1942/. See also appendix II to this affidavit.

[46] See appendix II of this affidavit.

before the Zyklon was inserted. There is, in fact, some evidence that the gas chambers were heated. John Zimmerman writes:[47]

> The discovery of the Auschwitz Archives in Moscow suggests that the technical problems of heating the "gassing cellar" were overcome. A bill from the oven builders to the Auschwitz authorities requests payment for a "warm air induction system" [warmluftzufuhrung] for Crematorium II installed in June 1943.

Additionally, there were in fact devices to distribute the gas over the room.[48] So Rudolf's minimum estimate is a worst case scenario; it makes several assumptions:

1) that his 10-13 minute average for death in US gas chambers is accurate. As shown above, some deaths did indeed take this long, but it is hard to justify as an average time.

2) that eyewitnesses to the gassings in Auschwitz would report full legal death rather than unconsciousness and cessation of movement.

3) that 10 minutes is the upper length of time reported at Auschwitz with only one exception.

4) that there were no introduction devices,

5) that cold temperature were present. (He uses data for Zyklon B at 15 °C).

6) that 0.3-1% is an accurate claim of the concentrations used in gas chambers in the US.

7) that one should use 1% rather than 0.3%

8)that only 10% evaporates within ten minutes in contrast to the functional form he later gives to fit Irmscher's data, which gives a value of 20%.

1% corresponds to 11 g/ cubic meter. If one assumes under the worst conditions that one needs to use 10 times as much to achieve such a concentration in only 10 minutes at 15°C, then one needs 110 g /cu meter. For the sake of comparison, the concentrations suggested by Degesch for delousing range

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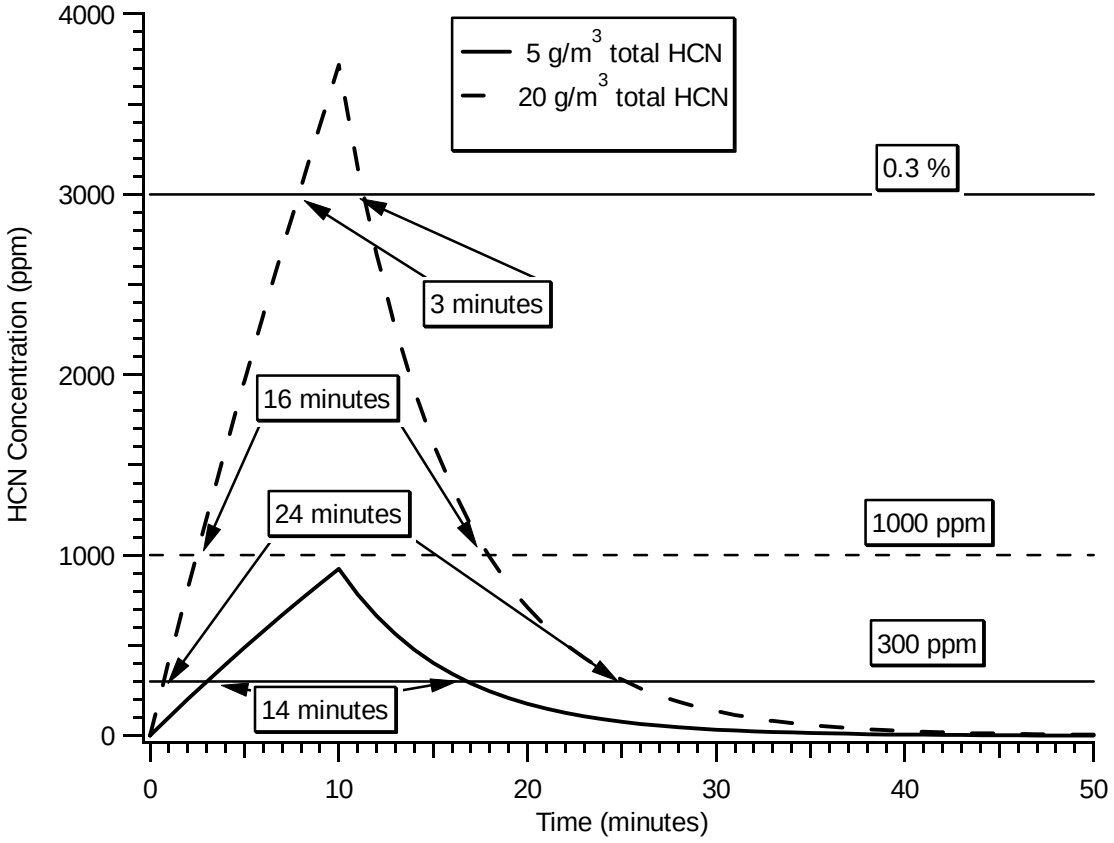
[47] John C. Zimmerman, Holocaust Denial: Demographics, Testimonies and Ideologies, University Press of America, 2000, p. 193. His reference reads: "Bill from Topf and Sons dated August 20, 1943 in AA File 502-1-327, Reel 42, p. 2 of the memo.

[48] Jamie McCarthy and Mark Van Alstine, *Zyklon Introduction Columns,* http://www.holocaust-history.org/auschwitz/intro-columns/

from 8 g/cubic meter.[49] If on the other hand one looks at the numbers that Jamie McCarthy and I made based on the available evidence that 5-20 g/m^3 concentration was used, a reasonable picture emerges. In the following plot I assume that Rudolf's functional form for the outgassing of Zyklon B is valid, that the Zyklon was removed after only 10 minutes and that the ventilation rate is that given by Rudolf of 9.94 room exchanges per hour.



It is important to note that the victims would continue to be exposed to HCN during ventilation. An unconscious victim who was not yet dead, would in all likelihood be dead by the time that the bodies were removed. Note that the minimum estimate shows that the victims would be exposed to

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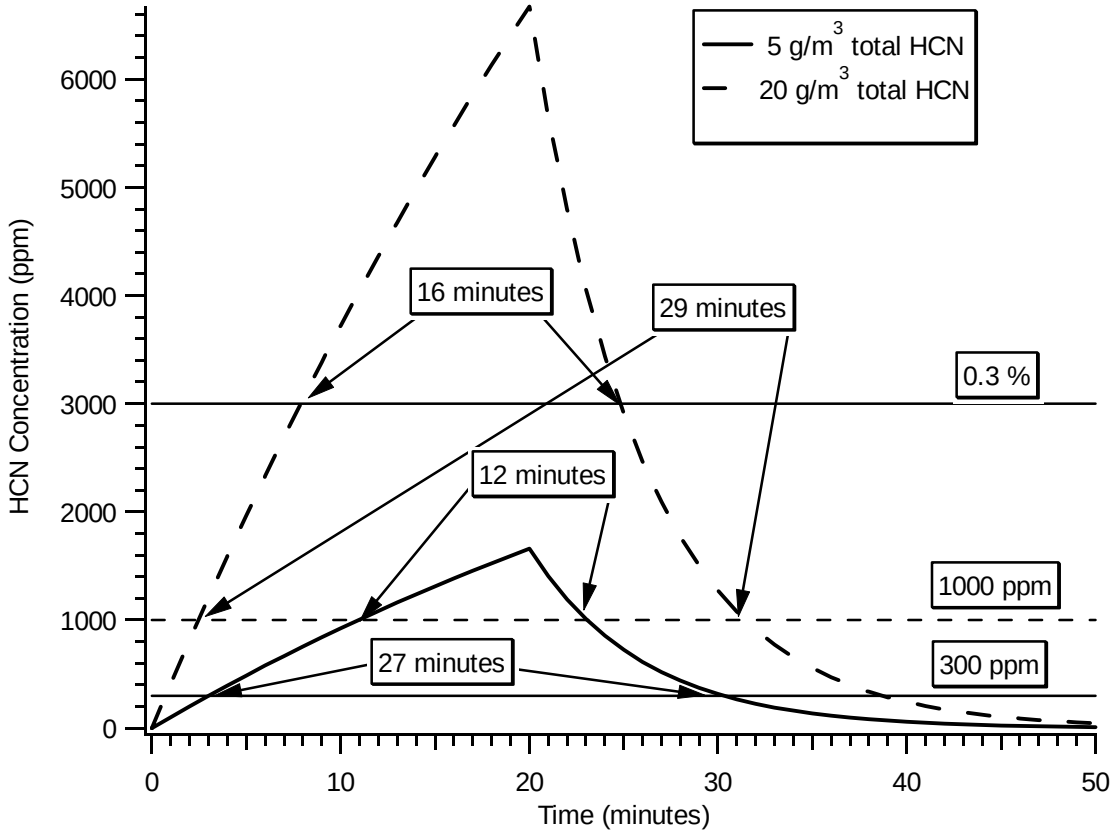
[49] NI-9912, section IX, reprinted in Pressac, Jean-Claude, *Technique and Operation of the Auschwitz Gas Chambers*, The Beate Klarsfeld Foundation, New York, 1989, p.19. This document is online at the CODOH (denial) website, at http://www.codoh.com/incon/inconzyklon.html.

concentrations above 300 ppm for 14 minutes. Recall that LC_{50} for ten minutes is about 181 ppm. Under these conditions the victims would be exposed to concentration in excess of 181 ppm for 18 minutes. It might be argued (in fact, no doubt Rudolf and Irving will argue) that a victim might possibly survive such treatment. Our maximum estimate should put such questions to rest. That estimate shows that the victims would be exposed to concentrations above 300 ppm for 24 minutes, and concentrations above 181 ppm for 27 minutes. Note also that the victims would be exposed to concentrations above 1000 ppm for 16 minutes. This value corresponds to LC_{50} for 1 minute. The concentration would be in excess of 3000 ppm (0.3%) for 3 minutes. This concentration corresponds to LC_{50} for 15 seconds. There is little question that Rudolf's estimate is an overestimate.

Now I plot the results for the case in which the Zyklon was not removed for 20 minutes:



The smaller estimate shows that the victims would be exposed to concentration above 300 ppm for 27 minutes. Again, LC_{50} for ten minutes is about 181 ppm. Under these conditions the victims would be exposed to concentration in excess of 181 ppm for 31 minutes. It is difficult to believe that even

Rudolf would claim that a victim might possibly survive such treatment. Our maximum estimate here is almost certainly too large. That estimate shows that the victims would be exposed to concentrations above 0.1 % ppm for 29 minutes, and concentrations above 0.3% ppm for 16 minutes. This concentration corresponds to LC_{50} for 15 seconds.

Without accepting Rudolf's evidence, it is worth saying that the differences in our estimates are practically inconsequential. Even if Rudolf turned out to be exactly correct that it is necessary to develop a concentration of 1% within 10 minutes, there is nothing incompatible between this value and the known facts of homicidal gassing. As shown above, a 1 % concentration would easily be ventilated in a reasonable amount of time. It is shown above that even doubling that concentration that the ventilation system would have been adequate. As shown below a 1% concentration does not guarantee the formation of Prussian blue. In fact given the considerations taken into account below, it is extremely unlikely that significant amounts of Prussian blue would have formed in the gas chambers. It is shown below that such concentrations are not incompatible with the difference in chemical traces between the gas chambers and the delousing chambers. The importance of the effect on Prussian blue formation is discussed below, but suffice it to say here that nothing about these concentrations is inconsistent with the historical evidence. Rudolf's estimate that homicidal gassing would have required a concentration 10 times that of delousing, on the other hand is too large. Even Rudolf's estimate, however, is consistent with the safety of the slave laborers as well as with the residual cyanides detected in the gas chambers by the IFFR.

K. Research of the Forensic Institute in Cracow (191-250)

Rudolf takes issue with the results of the Institute for Forensic Research in Cracow that show unequivocally the presence of cyanide in the homicidal gas chambers. He argues that they did an incorrect analysis by excluding Prussian blue compounds and also that their results are too low to be meaningful. He is incorrect on both counts. To understand why Rudolf is wrong requires examining the chemistry of Prussian blue formation. Rudolf quotes Mr. Justice Gray's judgment:

> 7.73 The Leuchter report, which I have mentioned earlier and to which I will return in greater detail when I come to summarize the evidence relied on by Irving in connection with Auschwitz, claimed that forensic analysis revealed no trace of in [sic] the surviving ruins of the gas chambers at Auschwitz. Prompted by the publicity given to the Leuchter report, the

> director of the Auschwitz museum enlisted the expert assistance of Professor Markiewicz, Director of the Forensic Institute of Cracow, who arranged in February 1990 for further samples to be taken from Auschwitz for analysis.
>
> 7.74 Markiewicz decided that the so-called Prussian blue test was unreliable because its formation depended on the acidity of the environment which was particularly low in the alleged gas chambers. Markiewicz and his team therefore adopted microdiffusion techniques to test for cyanide samples from the crematoria, from the delousing chambers and a control sample taken from elsewhere within Auschwitz. The latter was because claims had been made that the cyanide traces in the gas chambers were explained by the fact that a single fumigation of the whole camp had taken place during the typhus epidemic. The control sample tested negative, refuting those claims. As to the tests in the crematoria and the delousing chambers, the conclusion arrived at by Markiewicz was that cyanide compounds are still to be found in all the facilities (that is, in both the delousing chambers and in various supposed gas chambers) that, according to the source data, were in contact with cyanide. The concentration of cyanide compounds in the various samples varies greatly, even in the case of different samples taken from the same chamber or building. This indicated that the conditions producing the cyanide compounds varied locally. According to van Pelt, the Markiewicz report demonstrated positively that Zyklon-B had been introduced into the supposed gas chambers, albeit that the test results varied greatly.

It is worth noting the conclusion of the paper of Markiewicz et al. of the Institute for Forensic Research in Cracow (IFFR):

> The results of analyses are presented in Tables I-IV. They unequivocally show that the cyanide compounds occur in all the facilities that, according to the source data, were in contact with them. On the other hand, they do not occur in dwelling accommodations, which was shown by means of control samples. [50]

They were successful at detecting significant traces of cyanide in the gas chambers of Auschwitz and Birkenau. This result is in contrast to the claims of Leuchter and Rudolf that the gas chambers do not have significant cyanide residues. Even if one assumes that Leuchter and Rudolf are reporting their own results accurately, there are significant problems with their studies that make them more-or-less meaningless. To wit: it is visually apparent that the delousing chambers have blue staining, whereas the homicidal chambers do not have obvious staining. If the staining is indeed Prussian blue (or another one of the class of compounds known as the iron blues), then the chemical results of Leuchter and Rudolf yields no more significant information than what is apparent to the eye: some of the delousing chambers have apparent iron blue staining and the gas chambers do not.

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[50] Jan Markiewicz, Wojciech Gubala, Jerzy Labedz, *Z Zagadnien Sqdowych*, z. XXX, 17-27, (1994) available at http://www.holocaust-history.org/auschwitz/chemistry/iffr/

The origin of the staining is not at all obvious. The staining is far from homogeneous. It is splotchy, concentrated in some areas and not others, and in fact there are instances of staining on the outside of buildings and in places that were not used for delousing. Not all possibilities for the origin of the staining have been exhausted. For example, it may be that camp materials were soaked with aqueous solutions of HCN and those materials were subsequently leaned up against the walls. It may be that some other process entirely is responsible for the blue staining. Rudolf has proposed a mechanism for the formation of the iron blue staining as a result of delousing with Zyklon B. I think that his mechanism may be a plausible explanation for the presence of blue staining in the delousing chambers. Below, I show that, if Rudolf is right about this mechanism, it is highly improbable that the same mechanism would have been active in the homicidal gas chambers. The important point is that not all facilities exposed to gas phase HCN necessarily form iron blue staining. Some do and some do not. The conditions from facility to facility are different.

Rudolf writes:

> Mr. Justice Gray was mislead [sic] regarding the motivation of the Cracow institute in using a method of analysis different to those usually applied to detect Prussian blue (more correctly: Iron Blue.) To show the fundamental bias of the research conducted by the Polish Institute, I shall have to go into more detail:

To examine Rudolf's accusation of bias by the IFFR I too, have to go into more detail. As for whether Mr. Justice Gray was misled, it is a matter of examining the IFFR Report itself:[51]

> The undertaking of chemical analysis had to be preceded by careful consideration. The revisionists focussed their attention almost exclusively on Prussian blue, which is of intense dark-blue colour and characterized by exceptional fastness. This dye occurs, especially in the form of stains, on the outer bricks of the walls of the former bath/delousing house in the area of the Birkenau camp. It is hard to imagine the chemical reactions and physicochemical processes that could have led to the formation of Prussian blue in that place. Brick, unlike other building materials, very feebly absorbs hydrogen cyanide, it sometimes does not even absorb it at all. Besides, iron occurring in it is at the third oxidation state, whereas bivalent iron ions are indispensable for the formation of the $[Fe(CN)_6]^{-4}$ ion, which is the precursor of Prussian blue. This ion is, besides, sensitive to the sunlight.

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[51] Jan Markiewicz, Wojciech Gubala, Jerzy Labedz, *Z Zagadnien Sqdowych*, z. XXX, 17-27, (1994) available at http://www.holocaust-history.org/auschwitz/chemistry/iffr/ Their footnote (1) reads: Amoklauf gegen die Wirklichkeit. Praca zbiorowa (B. Gallanda, J. Bailer, F. Freund, T. Geisler, W. Lasek, N. Neugebauer, G. Spenn, W. Wegner). Bundesministerium fuer Unterricht und Kultur Wien 1991.

> J. Bailer (1) writes in the collective work "Amoklauf gegen die Wirklichkeit" that the formation of Prussian blue in bricks is simply improbable; however, he takes into consideration the possibility that the walls of the delousing room were coated with this dye as a paint. It should be added that this blue coloration does not appear on the walls of all the delousing rooms.
>
> We decided therefore to determine the cyanide ions using a method that does not induce the breakdown of the composed ferrum cyanide complex (this is the blue under discussion) and which fact we had tested before on an appropriate standard sample.

Their approach makes sense. The issue is whether or not the walls were exposed to HCN. The issue is not whether that HCN subsequently formed iron blue. By admitting ignorance to the origins of the iron blue staining, they did the correct test. Rudolf on p. 209 of his affidavit makes an attempt to obfuscate the reasons for discrimination against Prussian blue when testing for cyanides:

> ... That is the way in which the Poles argue. But why did they do it?
>
> The answer is very simple: they wanted to exclude the Iron Blue and similar iron cyanide compounds from their analysis. This can only be justified when assuming that Prussian Blue in the walls of the delousing chambers *must* have a different origin, e.g., stemming from paint....[emphasis Rudolf's]

Rudolf is simply incorrect. If one admits that sometimes iron blue forms when a wall is exposed to HCN and sometimes it does not, then one acknowledges that the presence or absence of Prussian blue is not a reliable marker for exposure to cyanides. If one wishes to test for exposure to cyanide in a reliable manner, one *must* discriminate against the iron blues regardless of their origins. Markiewicz *et al.* did an extremely intelligent analysis that differs from the supposed results of Leuchter and Rudolf in several ways:

1) They tested for a true marker for exposure to HCN, i.e., the presence of cyanides not complexed to iron.

2) They used a method with high sensitivity (3 $\mu g/m^3$).

3) They calibrated their method against standards of known concentration during the detection process.

4) They measured a true control: living quarters that were probably fumigated with HCN, but only once.

It should be noted that the samples collected by the IFFR were obtained legally allowing them the luxury of scraping samples from locations that were somewhat sheltered from the weather, thus

enhancing the probability of detecting traces of water-soluble cyanides. It is also important that sample collection and measurement were done by separate teams.

I. The First Modern Forensic Research By The Cracow Institutes

Rudolf writes:

> By early autumn of 1990, the Cracow Institute had already prepared a preliminary report which was not intended for publication, but which nonetheless seeped through and was subsequently published by revisionist [sic] journals.[Rudolf's note 454]

Regarding the preliminary study done by Markiewicz *et al.*, it should be noted explicitly that it was not published with the permission of the researchers, but rather was disseminated by Holocaust deniers without permission. The fact that a preliminary unpublished report may contain errors should not be used to undermine the credibility of the later published report.

1. Influence of Carbon Dioxide on Cyanide Salts

Rudolf writes:

> Soluble cyanides are indeed subject to hydrolysis (dissolution) in neutral and acid aqueous solutions. This leads to a slow evaporation of HCN in those cases where cyanide is set free. For this process, no CO2 is required, since water itself is a stronger acid than HCN. This process does, however, not apply to iron cyanides, and particularly not to Iron Blue, since their hydrolysis in water does not set any cyanide free, as will be demonstrated in the following chapter.

Qualitatively speaking, Rudolf is correct. Quantitatively speaking CO_2 has an important influence as it lowers the pH of (acidifies) the water. At lower pH hydrolysis of cyanide salts occurs more completely. As for the comments of the IFFR regarding iron blue pigments, again I point out that this study was a preliminary unpublished study. Honest people make mistakes; careful people correct them before publishing as the IFFR researchers did. It should be noted that Rudolf acknowledges two important facts here: 1) iron blues are not very susceptible to weathering, and 2) soluble cyanide salts are. One would therefore expect it to be very difficult to detect soluble cyanide salts in facilities that have been exposed to weather. If iron blue forms, it should be easy to detect and most of the cyanide that remains should be in this form. So there is no surprise that facilities that formed iron blue contain more total cyanides than those that did not form it efficiently. As mentioned above, exposure to HCN is no guarantee that iron blue will actually form. Despite these facts, the IFFR did manage to detect water soluble cyanides in the gas chambers at levels above their sensitivity.

2. Long term stability of the iron blues.

Rudolf spends a few pages demonstrating that iron blues are not very susceptible to weathering. I do not substantially disagree with Rudolf's conclusions regarding the weathering of Prussian blue. It is in part because Prussian blue in contrast to compounds of simple cyanide ions is resistant to weather that the results of Leuchter and Rudolf are not meaningful. I would like to set the record straight regarding the issue of iron blue "solubility." Rudolf states on p.198 of his affidavit, "The literature flatly refers to the Iron Blue as 'insoluble.'" He is not exactly right. The literature refers to two types of iron blues, "soluble" and "insoluble." A distinction is important here: "soluble" iron blues are not very soluble in the sense of forming true solutions; rather they form a type of mixture known as a colloidal dispersion.[52]

In practice, I do not disagree with Rudolf's conclusion that iron blues, once formed, should survive weathering. This fact goes a long way in explaining what is wrong with the conclusions of Leuchter and Rudolf and what is correct about the work of Markiewicz *et al.* Where Prussian blue has formed, it is no mystery that the cyanide concentration is higher than where it has not formed. Recall that exposure to cyanide is not a guarantee that Prussian blue will form. That there are more cyanides present today in some of the delousing chambers than in the homicidal gas chambers demonstrates nothing concerning the exposure of the latter to HCN. If Rudolf could prove rigorously that iron blues *absolutely must* form with high efficiency in the gas chambers his argument might be better. Below, I show that if Rudolf is correct about how iron blues formed in the delousing chambers that it is highly improbable that they would form with reasonable efficiency in the homicidal gas chambers. The results of Leuchter and Rudolf on differences in cyanide concentrations even if correct do not in anyway establish that the gas chambers were not exposed to HCN. The work of Markiewicz *et al.*, on the other hand shows unambiguously that that the gas chambers were exposed to more cyanide than were the living barracks.

II The Second Modern Forensic Research by the Cracow Institute

Rudolf writes:

> There is no shame in not having understood something. Actually that is the very beginning of science: realizing that one does not understand. Whereas in pre-scientific ages, humans

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[52] Robin and Day, *Advances in Inorganic Chemistry and Radiochemistry*, **10**, p.296, 1967.

> tend to find mystical or religious answers to unsolved questions, in our modern time scientist [sic] take problems they do not understand or can hardly imagine as a challenge to investigate in order to understand. This quest for knowledge is the most important driving force behind modern humanity. So, after such a statement, one would expect that the Poles would now try to find out, whether the blue stains are indeed Iron Blue and how it could have formed.

One would think from Rudolf's pontification that the IFFR had concluded that because they did not understand the origin of the blue staining that there were in fact no blue stains. Rather, they kept in mind their purpose: to examine whether there were traces of exposure to HCN in the homicidal gas chambers. Their methodology makes sense. If the iron blues in fact originated from HCN exposure, a test that includes iron blues is in essence a test for two processes: 1) exposure to HCN 2) efficiency of iron blue formation. Both 1 and 2 must occur for the results to be comparable. The point of their study was to test for exposure to HCN. Unless it can be proved without a shadow of a doubt that Prussian blue *must* have been formed with equal efficiency in all facilities, then it is incorrect not to exclude iron blue. Not having understood something is the beginning of science. Unfortunately Rudolf, only goes half the distance. Having proposed a mechanism for formation of iron blue in the delousing chambers that is not entirely implausible, he does not take the next step and ask why did iron blue not form efficiently in the homicidal gas chambers. Rather, he assumes that he knows why. He assumes that worldwide historians and eyewitnesses are all liars. A scientist would admit ignorance and ask whether there could be other explanations.

1. Paint as a source of blue discoloration

Rudolf spends some time criticizing the hypothesis of J. Bailer that the blue staining is actually the result of paint. Without adequate time to check all of Rudolf's sources (and the apparent inability of Rudolf to provide those sources), I cannot adequately examine this issue in a way that is fair to Bailer. Having witnessed Rudolf's methodology, I am reluctant to accept his arguments on faith. Even if Rudolf is correct to rule out paint as a source for the blue discoloration, it does not prove that exposure to Zyklon is the only possible explanation. Even if Rudolf is correct that the blue discoloration occurs because of Zyklon, it does not show that all facilities exposed to Zyklon *must* exhibit such staining.

2. Zyklon B as a Source of Discoloration

It is important to understand that although exposure to HCN *may* be the explanation for the presence of Prussian blue in the delousing chambers that exposure to HCN does not necessarily produce Prussian blue. On page 216 of his affidavit Rudolf explicitly agrees with this point:

> In the many hundreds of thousands of fumigations with Zyklon B which have been carried out since 1920, there cannot, as a rule, have been any complications, otherwise the procedure would have been very rapidly abandoned. The case discussed was, therefore, an exception. But what exactly was it that made this case an exception?

Most of these fumigations did not lead to staining. There was, however, a Bavarian Church that when fumigated exhibited staining. Rudolf argues that the delousing chambers and gas chambers are more similar to the exception than the rule, but ignores or downplays significant differences about the conditions of gassing in the homicidal chambers.

I do not claim to know why some facilities have Prussian blue staining and why others do not. In particular, the staining *outside* of the delousing chambers and in parts not used for delousing should make one pause. The hypothesis of the deniers that the gas chambers were not exposed to cyanides has been disproved by the results of the IFFR in that they demonstrated that the gas chambers, in fact, have traces of cyanides above background levels. It is worthwhile, however, to show why Rudolf's claims about Prussian blue formation do not work. To expose these claims requires addressing the chemistry in more depth. Before going into such depth, let me note his conclusion to this section:

> It is therefore proved that Iron Blue does indeed form in building materials, and that such formation did occur in all buildings without properly seal walls [sic] where the use of Zyklon B is not disputed by anybody, *i.e*., the delousing facilities of Auschwitz, Birkenau, Majdanek, and Stutthof.

Rudolf has shown that sometimes buildings exposed to HCN form blue staining and that the delousing facilities have blue staining. Of course this fact is suggestive that exposure to HCN produced this blue staining. It is not conclusive. Other possibilities such as the exposure of the buildings to aqueous solutions of HCN have not been adequately ruled out. Nevertheless, the issue is as follows: if it is the case that Prussian blue formed in the delousing chambers because of exposure to Zyklon B, would that mean that the homicidal gas chambers must also form this pigment efficiently? Rudolf claims that several facilities that everyone agrees were exposed to cyanide exhibit blue staining. This is not controversial, but it is inconsequential.

To begin with, let me discuss what iron blues are. The history of the study of these compounds was somewhat controversial in its own right.[53] The compounds have iron in two different oxidation states, Fe(II) and Fe(III), where the roman numeral indicates the oxidation state of iron. The oxidation number is a formal bookkeeping method of assigning charge to atoms in compounds. Robin and Day[54] describe them as follows:

> The mixed valence iron cyanides have been the object of constant study for over 250 years, a large part of their allure springing no doubt from their deep blue colors. Although it was long held that that Prussian blue, made by adding Fe(III) to $[Fe(II)(CN)_6]^{4-}$, and Turnbull's blue, made by adding Fe(II) to $[Fe(III)CN_6]^{3-}$, were distinct compounds, an overwhelming amount of evidence has since accumulated demonstrating that they are identical materials. We shall call this material Prussian blue. There are two kinds of Prussian blue, the first of which, soluble Prussian blue, is generally taken to be $M(I)Fe_2(CN)_6$, whereas insoluble Prussian blue is $Fe_4[Fe(CN)_6]_3$. The early history of these "iron blues" has been reviewed by Holtzman.

Rudolf reveals his proposal for how Prussian Blue forms:

> Dr. Bailer was the first to claim that Iron Blue cannot develop in walls as a result of exposure to hydrogen cyanide (Zyklon B).[Rudolf's note 480] His argument is that Iron Blue requires the presence of both bivalent and trivalent iron compounds, but that only trivalent compounds can be found in building material. Even though this is true for building material not exposed to hydrogen cyanide, this changes as soon as HCN gets involved, since HCN itself is a [sic] agent capable of reducing trivalent iron to bivalent iron especially in alkaline, *i.e.*, fresh mortar and plaster.

Although, I do not consider it the only possible model, I do think that his mechanism is plausible. If he is correct about his mechanism, however, it is highly improbable that Prussian blue would have formed with reasonable efficiency in the gas chambers. The rest of this section demonstrates this claim in some detail.

Rudolf treats his comparison between the delousing chambers, the gas chambers, and the Bavarian church as if what mattered was the gas phase concentration of HCN used. This treatment is incorrect. What is important for Rudolf's mechanism to work is the concentration of cyanide ions in the *condensed phase*. Rudolf no doubt understands this fact as he has spent a little time considering transfer

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[53] H. Holtzman, *Ind. Eng. Chem*., **37**, 855 (1945).

[54] Robin and Day, *Advances in Inorganic Chemistry and Radiochemistry*, **10**, p.294-295, 1967. M is a placeholder, somewhat like x in algebra. M(I) could for example be the potassium K^+ ion.

of HCN from the gas phase to the condensed phase. His treatment, however, glosses over inconvenient details. The key differences in the conditions of homicidal gassing versus delousing are:

1) The gas chambers were washed with water after gassing.[55]

2) The residence times of HCN in the delousing chambers were much longer than in the gas chambers.

3) Delousing occurred regularly. Mass murder on the other hand was conducted more infrequently. Robert Jan van Pelt estimates that 350,000 people were killed in morgue 1. At 2000 people per gassing, that leads to 175 gassings, or approximately 117 hours of exposure (not all of which are at the maximum exposure because of the decrease owing to ventilation). In contrast, delousing chamber

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[55] Mark Van Alstine has helpfully found the following references regarding the hosing-down of the gas chambers:

According to Sonderkommando Henryk Tauber, re Krema II (Pressac, *Technique*, p. 484):

> The water tap was in the corridor and a rubber hose was run from it to wash the floor of the gas chamber...

According to Sonderkommando Filip Müller, re Krema V (Müller, *Eyewitness Auschwitz*, pp. 82-83):

> Normally the concrete floors in the gas chamber as well as in the changing room were damp: today they were carefully dried....

According to Nyszili, re Krema II (Nyszili, *Auschwitz*, p. 52):

> The Sonderkommando squad, outfitted with large rubber boots, lined up around the hill of bodies and flooded it with powerful jets of water. This was necessary because the final act of those who die by drowning or by gas is an involuntary defecation....

According to Daniel Bennahmias, re Krema II or III (*The Holocaust Odyssey of Daniel Bennahmias, Sonderkommando*, p. 46):

> Once the gas chamber had been cleared, it must be hosed free of all traces of blood and excrement - but mainly blood - and then it must be whitewashed with a quickdrying paint. This step is crucial, and it is done each time the gas chamber is emptied, for the dying have scratched and gouged the walls in their death throes. The walls are embedded with blood and bits of flesh, and none on the next transport must suspect that he is walking into anything other than a shower. This takes two or three hours.

BW5a had a minimum of 450 gassings of approximately 16 hours each for a total of 7200 hours most of which was at the full concentration.

These three factors are certainly significant. An additional factor that may be significant is the fact that 4) carbon dioxide levels within the gas chamber would have been much higher than ambient air owing to the exhalation of the victims.

The first factor is important because whatever the cyanide ion concentration was immediately after a gassing, it would have been greatly reduced by the washing of the chambers with water. It is not possible to come up with a precise number for the dilution, but a dilution of 3-4 orders of magnitude certainly would not have been unreasonable.

The second and third factors are important because of the kinetics of the transfer of HCN from the gas phase to the condensed phase. It is not too difficult to estimate a thermodynamic value for how much HCN can be transferred from the gas phase to the aqueous phase given the gas phase concentration of HCN. This value, however, must be considered the upper limit to how much HCN could transfer. In other words, if one waited an infinite amount of time with a given gas phase concentration, one can estimate the cyanide ion concentration in the aqueous phase. The shorter the exposure time to HCN, the further the actual amount of HCN transferred will be from the thermodynamic value. It is a question of how fast the transfer can take place, i.e., it is a question of chemical kinetics. The simple picture is that the shorter the time of exposure, the less HCN that will be absorbed. This effect will greatly favor the formation of Prussian blue in the delousing chambers when compared to the gas chambers as delousing exposures were longer and more frequent. It is beyond the scope of the present work to try to develop an accurate kinetic model. In absence of such a model, it is sufficient to say that the answer given by thermodynamics will be a gross upper limit to the aqueous cyanide ion concentration, and that the kinetics favor the likelihood of iron blue formation in the delousing chambers over the gas chambers.

The fourth factor may be important because carbon dioxide is an acid anhydride. When carbon dioxide dissolves in water, it creates a more acidic environment. The more carbon dioxide that is in the air, the more acidic the water will be. In his discussion of the IFFR results, Rudolf discounts the importance of carbon dioxide arguing that because water is a stronger acid than HCN it is unimportant. It is, however, important because it affects the pH value of the solution and also affects the concentration of

cyanide ions in solution. The importance is difficult to model, however, because other factors could affect the pH of the solution as well and it is very difficult to account for all of them. In footnote 61 below, I discuss this issue in more detail.

In order for Prussian blue to form from exposure to HCN, several events must happen:

1) HCN from the gas phase must enter the aqueous phase, and yield CN^- ions in solution.

2) Iron in its third oxidation state (Fe(III)) from the construction materials must combine with the cyanide ions to form the complex hexacyanoferrate(III) ion ($[Fe(CN)_6]^{3-}$, sometimes called the ferricyanide ion.

3) There must be a source of iron in its second oxidation state. The most likely source is the reduction of iron (III) to iron (II). Rudolf's invokes a mechanism by which the CN^- ion itself can act as the reducing agent to convert iron (III) to iron (II) to form the $Fe(CN)_6^{4-}$ ion. If iron(III) is still present, Prussian blue can then form.

The first step is where the important differences between the gas chambers and the delousing chambers come into play. As indicated above, given a gas phase HCN concentration, it is possible to estimate a thermodynamic value for the HCN in solution. It is an upper limit to how much HCN could enter solution because of the issue of kinetics explained above. The concentration of cyanide ions in solution will depend upon a) the HCN that enters solution, and b) the pH of the solution

The second step will be inhibited in a basic environment. So although a basic environment theoretically aids Rudolf's case in the first step; it hurts his case in the second step. Additionally, to the extent that this step takes place, the cyanide ion concentration in solution will be reduced.

The next step in Rudolf's proposed mechanism depends critically on two factors:1) The pH must be between 9-10, and 2) the cyanide ion concentration must be in excess by 3.3×10^{-4} moles/liter.[56] If the cyanide ion concentration is too low Prussian blue will not form. Thus, if the cyanide ion concentration in the delousing chambers was high enough, but if it was too low in the homicidal gas chambers it is possible that this difference explains the presence and absence of obvious staining in the respective facilities.

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[56] M.A. Alich, D.T. Howarth, M.F. Johnson, *J. Inorg. Nucl.Chem*. 1967, **29**, pp. 1637-1642.

I will therefore estimate the cyanide ion concentration that was present in the delousing chambers and the gas chambers. Again, the estimate is a thermodynamic estimate and not a kinetic one. The effect of kinetics is to enhance the differences in cyanide ion concentrations between the delousing chambers and the homicidal gas chambers.

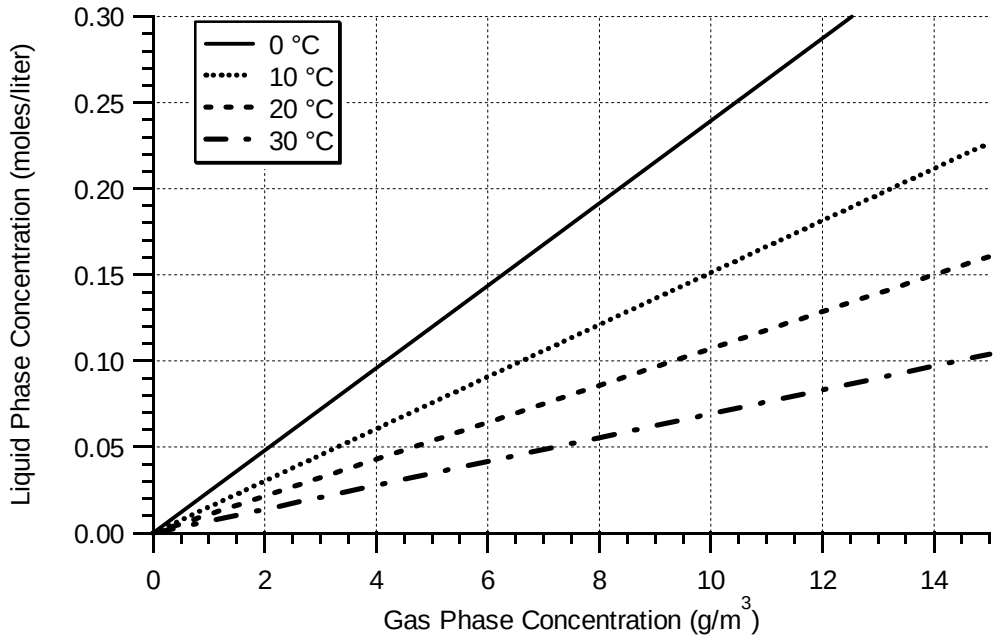
Relationship Between Aqueous Concentration and Gas Phase Concentration at Thermodynamic Equilibrium

If water is exposed to a given concentration of HCN at a given temperature, it is possible to calculate the aqueous concentration of HCN that will result if one waits long enough. This calculation gives the thermodynamic value of the aqueous concentration of HCN exposed to a given gas phase concentration. The actual aqueous phase concentration will depend on the kinetics. The thermodynamic value puts an upper limit on how high the concentration can be.

Page 32 of DuPont's *Hydrogen Cyanide: Properties, Uses, Storage and Handling*[57] contains a plot of the partial pressure of HCN above aqueous solutions of HCN at various concentrations and temperature. These values are equilibrium values. That means that at these concentrations the rate of HCN in the gas phase becoming absorbed into the solution is exactly balanced by the rate of HCN leaving solution into the gas phase. Because the plot shows equilibrium values, it contains implicitly the value of equilibrium constants, *i.e.*, it is possible to obtain the equilibrium concentration of HCN in solution in water exposed to HCN in the gas phase at a given concentration and temperature. In DuPont's plot liquid phase concentration is expressed in weight percent and gas phase concentration in millimeters of mercury (also known as Torr). By reading the values for a given temperature from the plot, one can construct a plot of the weight percent HCN in water as a function of gas phase concentration in Torr (760 Torr = 1 atm, 1 Torr of HCN = 1316 ppm). The relationship is linear in the region of interest; This linear relationship is known as Henry's Law and the slope can be identified with the Henry's Law constant. Further details of determining the Henry's law coefficients as a function of temperature can be found in an

[57] DuPont, *Hydrogen Cyanide: Properties, Uses, Storage and Handling*, 195071A (1991).

appendix to my article, *Leuchter, Rudolf, and the Iron Blues*.[58] A simplifying assumption was made in the treatment here: in converting from mass percent to molarity the mass of the solution can be treated as equal to the mass of water. As this approximation is quite good, the results here are the same as in the earlier article. At colder temperatures, the thermodynamic value of amount of HCN that enters solution will be larger. On the other hand, colder temperatures slow down the kinetics and make it less likely that the equilibrium value would be reached within the time frame of a gassing. The gas chambers were warmer than Rudolf would like to believe, 25 °C or higher would not be unreasonable. However, I shall treat a range of temperatures from 0-30 °C. (In converting the gas phase concentration to a partial pressure of HCN, I assumed a temperature of 273.15 K (0 °C). Note that a 30 degree temperature difference only creates an error of 10%, which is insignificant.). The following plot shows the liquid phase concentration of HCN that would be present at a given temperature and given gas phase concentration of HCN, *if there were sufficient time* for equilibrium to be established:



[58] Richard J. Green, *Leuchter, Rudolf and the Iron Blues*, Appendix 1 datehttp://www.holocaust-history.org/auschwitz/chemistry/blue/appendix-01.shtml, revised October 1998.

At a concentration of 10 g/m^3 and a temperature of 20 °C the equilibrium value of the liquid phase HCN concentration would have been 0.1 mole/liter. At colder temperatures and higher gas phase concentrations the liquid phase concentration would be slightly higher; conversely with lower concentrations and higher temperatures the result is somewhat lower. 10 g/m^3 is an overestimate of the maximum concentration reached that corresponds with Rudolf's assumptions. Note that a dilution of 3 orders of magnitude from the washing of the chamber walls with water would already bring this concentration below 3.3 x 10^{-4} moles/liter. In a more realistic scenario in which 5 g/m^3 was used and outgassing took place for 20 minutes the highest gas phase concentration achieved would be less than 2 g/m^3. At 20 °C, the corresponding equilibrium liquid phase concentration is about 0.02 moles/liter. In this case a dilution of merely two orders of magnitude would bring the concentration below 3.3 x 10^{-4} moles/liter. As has been discussed above these concentrations are upper limits. Because of kinetics the liquid phase HCN concentration in the gas chambers with their short exposure times would have been even less than these values. Note also that I have not yet discussed the relationship between the concentration of aqueous HCN to that of cyanide ions in solution. This relationship depends on the pH of the solution and is discussed below. Additionally the formation of the hexacyanoferrate (III) ion, a necessary precursor to the formation of Prussian blue, would reduce the cyanide ion concentration. Suffice it to say here that although the cyanide ion concentration in solution may have exceeded 10^{-4} moles/liter in the delousing chambers, that such concentrations were extremely unlikely to exist in the gas chambers.

Alich *et al.* found that reduction of the hexacyanoferrate (III) ion does not occur at such low concentrations.[59]

The Effect of Acidity

The mechanism that Rudolf asserts for Prussian blue formation requires an alkaline pH of 9-10. In an acidic environment, this reaction is not expected to occur efficiently.

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[59] M.A. Alich, D.T. Howarth, M.F. Johnson, *J. Inorg. Nucl.Chem*. 1967, **29**, pp. 1637-1642

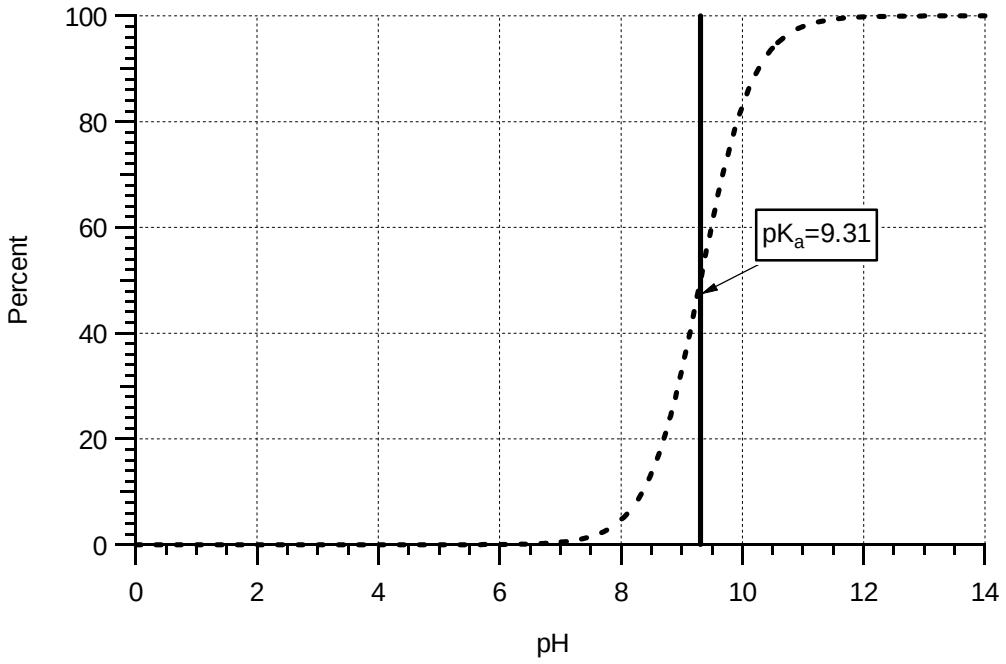
Additionally, HCN is a weak acid, which means that in aqueous solutions it dissociates somewhat but not completely. In other words the concentration of cyanide ions in solution is even less than the concentration of HCN. The strength of an acid is measured by a quantity known as the pK_a. The lower the pK_a the stronger the acid. The pK_a is defined as $-\log(K_a)$ where:

$$K_a=[H^+][CN^-]/[HCN]$$

In this equation the square brackets represent the molar concentration (M, or moles/liter) of the given species in aqueous solution. $[H^+]$ is related to the pH by the simple expression $[H^+] = 10^{-pH}$. The pK_a of HCN is 9.31.[60] At neutral pH the cyanide ion concentration is only 1 percent of the HCN concentration. To calculate this value at other pH's I define the initial concentration of HCN as $[HCN]_0$, and using the identity $[HCN]=[HCN]_0-[CN^-]$ rewrite the equation as:

$$[CN^-]/[HCN]_0 = (K_a/[H^+])/(1 + K_a)$$

The following figure expresses the percent dissociation of HCN as a function of pH.



[60] P.W. Atkins, *Physical Chemistry*, p. 826, table 12.3, Third Edition, New York: W.H. Freeman and Company (1986).

Rudolf would like to claim a pH of around 10. Note that at such a pH, the concentration of cyanide ions would be about 80% of the initial HCN concentration. If the pH is 6-7 as measured by Markiewicz *et al.*, it is about 1% of the initial hydrogen cyanide concentration. Above, I show that assuming Rudolf's overestimate of the gas phase concentration the concentration of aqueous HCN *before washing with the walls with water* is on the order of 0.1 M: 1% of this concentration is on the order of 10^{-3} M. With reasonable concentrations these number become 0.02, and 10^{-4}, respectively. Again that is the thermodynamic value, taking into account kinetics would yield a lower concentration. For the overestimate, a mere tenfold dilution of this thermodynamic value by the washing of walls with water would make the formation of Prussian blue by Rudolf's mechanism improbable. For the more reasonable estimate,1 % would lead to a concentration that would already be too low before dilution. If Rudolf were correct about the pH, the concentration of cyanide ions would still be reduced by 20% as compared to the aqueous HCN concentration, and the reasoning regarding the dilution and the kinetics still holds.

On the other hand, even if Rudolf were correct that the gas chambers had a pH of 10, this fact also inhibits the formation of the hexacyanoferrate (III) ion, which is a necessary precursor to Prussian blue as the base makes its formation compete with the formation of $Fe(OH)_3$. Rudolf acknowledges this fact, but hides it in footnote 481:

> An overly alkaline environment would, however, disturb the complexing of the Fe^{3+} -ion by cyanide, which is then displaced by OH- ($Fe(OH)_3$ then occurs as a by-product) and/or the latter can hardly be displaced from the iron.

The Differences between Delousing chambers and Gas chambers

For the reasons discussed above it is extremely unlikely that aqueous phase concentrations of cyanide in the gas chambers would have been great enough to produce iron blue through Rudolf's mechanism. The walls were washed with water, which would have greatly reduced the cyanide ion concentration. Additionally, the fact that gassings were short and infrequent compared to delousings means that the equilibrium value of the concentration of cyanide ions in solution was never established. In the delousings by contrast the concentrations no doubt were much closer to the equilibrium values. If Rudolf is correct about the mechanism of iron blue formation, it is no surprise that there is a difference in blue staining between the gas chambers and the delousing chambers despite the fact that both have been shown to have been exposed to HCN.

III The Method of Analysis and the Analysis Results

Rudolf criticizes the results of the IFFR by comparing them to the results that he and Leuchter obtained. On p. 220 of his affidavit he picks a few specific samples and shows that he and Leuchter detected a large difference between the delousing chambers and the gas chambers, whereas Markiewicz *et al.* detected a difference but not a large one. Presumably because Rudolf does not like the result he concludes that their method is flawed and that they are guilty of fraud. I propose an alternate model:

1) Both the delousing chambers and the homicidal gas chambers were exposed to HCN.

2) Prussian blue formed in the delousing chambers, but no measurable amount of Prussian blue has been found in the homicidal gas chambers of Auschwitz-Birkenau.

3) The gas chambers, were exposed to weathering for 50 years unlike the delousing chambers.

4) The difference in total cyanides (Prussian blue + non-Prussian blue) owes to the fact that Prussian blue formed efficiently in the case of the delousing chambers but not in the homicidal gas chambers, and Prussian blue once formed is likely to remain.

The discrepancy in cyanides between the delousing chambers and the homicidal gas chambers cannot prove that no homicidal gassing took place. Thus another one of Rudolf's criticisms is invalid. His claim that that values of cyanided concentrations under 10 mg /kg are not reliable is without merit when applied to the results of the IFFR. Even if he is correct regarding values of total cyanides, he is not correct regarding concentrations of non-Prussian blue cyanides. Again, he is comparing apples to oranges. How do we know the IFFR measurements are significant? They used a method with a known sensitivity limit of about 3 μg/kg. They checked their measurements against standards of known concentration, and in their control sample they did not detect any non-Prussian blue cyanides within their sensitivity limits. On the other hand, they measured considerably more non-Prussian blue cyanides in all of the gas chambers studied. On p. 220 of his affidavit, Rudolf makes the following claim:

> What is interesting in this context is the fact that the unpublished results of samples analysed in 1991 were not even mentioned in the more recent Polish publication.

This claim is simply untrue. Markiewicz *et al.* make explicit reference to the earlier results:

> At the beginning of 1990 two workers of the Institute of Forensic Research arrived on the premises of the Auschwitz-Birkenau Camp and took samples for screening analysis: 10 samples of plaster from the delousing chamber (Block No 3 at Auschwitz), 10 samples from gas chamber ruins and, in addition, 2 control samples from the buildings which, as living

> quarters, had not been in contact with hydrogen cyanide. Out of the 10 samples from the delousing chamber, seven contained cyanogen compounds at concentrations from 9 to 147 µg in conversion to potassium cyanide (which was used to construct the calibration curve) and 100 g of material. As far as the ruins are concerned, the presence of cyanide was demonstrated only in the sample from the ruins of Crematorium Chamber No II at Birkenau. Neither of the control samples contained cyanides.

Rudolf's language in this regard is quite extreme:

> Hence, in their paper published in 1994, the Poles suppressed any information about their first results. Normally, scientists are expelled from the scientific community if they are caught out in such unethical acts.

Rudolf writes further:

> I will not discuss the Polish results further, since the results of analysis obtained in a methodically incorrect method cannot be corrected even by correct interpretation. Any attempt at interpretation is therefore a waste of time.[Rudolf's footnote 487][61]

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[61] A word on Rudolf's footnote 487, Rudolf writes:

> A word on the HCN-CO2 mixture used by the Poles for their fumigation experiments. In their view, CO2 has a negative influence on the absorption of HCN in masonry. Their own test results are, however, in contradiction to this view...

Perhaps, Rudolf did not read their argument closely enough. He is correct that initially they measure more cyanide in the sample fumigated with HCN-CO_2, however Markiewicz *et. al.* (Op. Cit.) point out that the decrease of HCN content over time in such samples is much faster than the decrease of HCN content in samples not exposed to CO_2:

> After an interval of a month the mean decrease of hydrogen cyanide content in this material was 3% and so it was markedly greater than in the run with hydrogen cyanide only. In as many as four samples that loss ranged from 97% to 100% and then airing was nearly complete. This statement is significant in as much as in their reasoning the revisionists did not take into consideration certain circumstances, namely, the simultaneous action of cyanides and carbon dioxide on the chamber walls. In the air exhaled by man carbon dioxide constitutes 3.5% by volume. Breathing for 1 minute, he takes in and next exhales 15-20 dm^3 of air, comprising on the average 950 cm^3 CO_2; consequently, 1000 people breathe out about 950 dm^3 of carbon dioxide. And so it can be estimated that, if the victims stayed in the chamber for 5 minutes before they died, they exhaled 4.75 m^3 of carbon dioxide during that period. This is at least about 1% of the capacity, e.g. of the gas chamber of Crematorium II at Birkenau, the capacity of which was about 500 m^3, whereas the concentration of hydrogen cyanide virtually did not exceed 0.1% by volume (death occurs soon at as low HCN concentrations as 0.03% by volume). Therefore, the conditions for the preservation of HCN in the gas chambers were not better than in the delousing chambers, despite what the revisionists claim. Besides, as has already been mentioned, the chamber ruins have been thoroughly washed by rainfall.

In the sample not exposed to CO_2 they found "the concentration of hydrogen cyanide and its combinations in the materials examined decreased on the average by 56% (from 28% to 86%)." Note

that their estimate of CO_2 exposure is conservative. They underestimate the number of people by a factor of two, and they assume a short time to death (5 minutes). Rudolf states furthermore that:

> ... they are also incorrect in assuming that CO_2 could have a negative influence on the absorption of HCN; the influence is probably based on the fact that the carbonic acid (H_2CO_3, pK_A=6,37) displaces the cyanide ion (CN^-) from the equilibrium: 1. $CO_2 + H_2O <=> H_2CO_3$; 2. $CN^- + H_2CO_3 <=> HCN + HCO_3^-$

The process can be broken down into two parts. The effect of CO_2 on the pH of the solution, i.e., the concentration of hydronium ions (H^+), and the equilibrium:

$$H^+ + CN^- <=> HCN$$

Rudolf argues qualitatively that CO_2 has a low solubility and that the equilibrium in equation 1 lies to the left. These two claims are more or less equivalent. The equilibrium is more complicated than Rudolf acknowleges. At low concentrations of CO_2, the equilibrium in his equation 1 is determined by the Henry's Law constant of CO_2. However, because H_2CO_3 partially dissociates to H^+ and HCO_3^-, and HCO_3^-, subsequently partially dissociates to H^+ and CO_3^{2-}, at equilibrium one has to treat all of those reactions and derive an effective Henry's Law constant. The net effect is to acidify the water. It is a well known fact that ideal pure rain water has a pH of 5.6 because the atmosphere has a concentration of CO_2 of 360 ppm. During World War II, atmospheric concentrations of CO_2 were closer to 330 ppm, but that is not an important difference for the purposes addressed here. One can think of the process as having three steps all of which involve a chemical equilibrium. The first step is the dissolution of CO_2 in water; its equilibrium constant is the Henry's Law constant of CO_2, K_{hc}:

$$CO_2 + H_2O <=> H_2CO_3$$

The second step is the acid base reaction between carbonic acid and water; its equilibrium constant is denoted here as K_{c1}:

$$H_2CO_3 + H_2O <=> H_3O^+ + HCO_3^-$$

The third step is reaction between the bicarbonate ion (HCO_3^-) and water whose equilibrium constant is here denoted as K_{c2}:

$$HCO_3^- + H_2O <=> H_3O^+ + CO_3^{2-}$$

Also, one needs to consider the autoprotolysis of water:

$$2H_2O <=> H_3O^+ + OH^-$$

And

> The conclusions to be drawn from the above is clear: the only allegedly "scientific" attempt to refute Fredrick A. Leuchter's sensational argument proves, upon closer examination, to be one of the great scientific falsifications of the 20th century, and it is a pity to see that both Prof. van Pelt and Mr. Justice Gray took this Polish fraud seriously in the first place.

In my opinion, Rudolf's remarks are unjustified. The results of the IFFR study are meaningful.

IV Interpretation of Cyanide Values

Rudolf repeats two principal arguments;

> a. First, Prof. van Pelt and with him Mr. Justice Gray rely on the analysis results of the Cracow Forensic Institute which actually suggest that similar amounts of cyanide residues were formed in both delousing chambers and alleged homicidal 'gas chambers.' As I have sought to show that the Cracow Institute's research is massively flawed, I shall not deal with this claim in more detail here

As shown, above, Rudolf's criticism of the IFFR is misguided. As Prussian blue is not a reliable test for exposure to HCN, they did the correct experiment. Note that Rudolf actually admits that their results "suggest that similar amounts of cyanide residues were formed in both delousing chambers" and the gas chambers. It is little wonder that he does not want to deal with this claim in more detail.

In aqueous solution, one can treat the concentration of water as a constant and derive a constant for the equilibrium, K_w. These constants are reported in John H. Seinfeld, *Atmospheric Chemistry and Physics of Air Pollution*, John Wiley & Sons, New York, 1986, pp. 198-204. The pH of a solution is defined as $-\log[H^+]$ where $[H^+]$ is the concentration of hyronium ions in moles/liter. From the information given it is possible to derive a cubic equation expressing the relationship between $[H^+]$ and the partial pressure of CO_2, P_{CO2}. This equation is also presented in Seinfeld:

$$[H^+]^3 - (K_w+K_{hc}K_{c1}\ P_{CO2})[H^+]-2+K_{hc}K_{c1}\ K_{c2}P_{CO2}=0$$

At 1% CO_2, one can expect a pH of less than 5.0; at 4%, one can expect a pH of 4.6 or less. The effect may be mitigated by other factors that could increase the pH, but the IFFR were not wrong to consider such effects.

> b. Secondly, and more importantly, there are facilities in other concentration camps whose walls are massively stained with Iron Blue.... To my knowledge, in neither case does anybody doubt this blue staining is the result of frequent long-term exposure to Zyklon B/HCN.

This illustrates an elementary logical flaw. If it is true that blue staining originates from HCN exposure, it does not follow that HCN exposure always leads to blue staining.

Rudolf concludes this section by repeating a false argument about detection limits:

> My conclusions are therefore: values lower than 10 mg cyanide per kg sample material cannot be interpreted.

His entire basis for that claim is looking at samples that tested for Prussian blue. He is comparing quantities that cannot be compared. He has no basis for saying what levels of non-Prussian blue cyanides are significant. In contrast, the IFFR have very good reasons for knowing that their measured values are consistent:

1) They measure a value of zero consistently in the barracks.

2) Repeated measurements on the same samples yielded similar results.

3) They calibrated their results against known standards.

It is worthwhile, here to look at some other aspects of the IFFR's findings. In their table I they report "Concentration Of Cyanide Ions in Control Samples Taken From Dwelling Accommodations, which Were Probably Fumigated with Zyklon B Only Once (In Connection With Typhoid [sic: it was actually a typhus epidemic] Epidemic in 1942)." None of the samples in these dwellings exhibited measurable concentrations. These results may be taken as a measure of their ability to measure negative results. Any measurements in excess of this result must be considered significant. Recall that they calibrated these results against measurements of samples with known concentrations.

In the cellars of block 11 where at least one and possibly two experimental gassings of prisoners took place they measured the following results:

Sample results (μg/kg of CN^-)

13 28, 24, 24

14 20, 16, 16

15 0

These results are significant. Deniers might seek to explain them away by claiming that the cellars of block 11 must have been fumigated at one time. Even this claim is implausible considering the negative results in the barracks thought to have been fumigated once. Compare these results, however, to the results of morgue 1 in crematorium II:

Sample results (μg/kg of CN^-)

25 640, 592, 620

26 28, 28, 28

27 0, 0, 0

28 8, 8, 8

29 29, 20, 16, 16

30 30, 168, 156, 168

31 296, 288, 292

Some of these samples, have 10 to 20 times the concentration of cyanide as found in block 11. These samples cannot be written off as the results of a single fumigation. The variation in the samples is not difficult to understand. Different materials have different affinities for cyanide, the weathering affected different samples differently, and there is no guarantee that the initial exposure to HCN was homogenous. Note also that samples 25 and 31 give comparable values to samples number 57 and 58 respectively taken from the inside of walls of the delousing chamber at BW5a.

V. Expected Analysis Results

In his affidavit Rudolf produces some calculations on pages 231-242. His purpose appears to be twofold, 1) to show that the ventilation times would have been unreasonable, and b) to demonstrate that the gas chambers must have had a time-averaged gas phase concentration of 10 g/m^3. Above I have shown that the ventilation times were in fact reasonable. I have also shown that even given gas phase concentrations as high as Rudolf claims that the formation of Prussian blue in the gas chambers with any reasonable efficiency was greatly improbable. His errors are as follows:

1) He assumes that the Zyklon could not be removed and thus continued to outgas during the ventilation.

2) He arbitrarily reduces the replacement rate for non-ideal ventilation. Of course one can expect the actual replacement rate to be different from the ideal rate, his reduction of this rate, however, is arbitrary and is made without any justification for his numbers.

3) He assumes too low of a temperature for the outgassing of the Zyklon.

4) As shown above, in the section on US prison executions, his assumptions about the concentration needed are invalid.

Rudolf's principal error is his claim that the Zyklon could not be removed and thus continues to outgas during the ventilation period. Rudolf writes:

> d. There were no holes in the ceiling of the alleged gas chamber, thus the Zyklon B once introduced by whatever means could not be removed before the chamber would have been cleared. (see the next chapter for this.)

My colleagues[62] have addressed this issue in more detail than it has ever been done before. It should finally be put to rest. There were in fact Zyklon introduction vents.

Because Rudolf assumes that the Zyklon was not removed from the chambers before the ventilation started his equation is more complicated than that assumed above. He calculates the concentration in the gas chamber assuming that the Zyklon is continuously outgassing after the ventilation system is turned on. To do such a calculation he needs a functional form with which to treat the outgassing of the Zyklon. He obtains such a function by fitting the work of Irmscher[63] at 15 °C on the outgassing of Zyklon with an exponential function and adding the effects of outgassing to those of ventilation. Even after performing this unreasonable procedure Rudolf derives results for his 6 minute

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[62] Daniel Keren, Ph.D, Jamie McCarthy, Harry W. Mazal OBE, " A Report on Some Findings Concerning the Gas Chamber of Krematorium II in Auschwitz-Birkenau", an appendix to Robert Jan van Pelt's expert report.

[63] R. Irmscher, *Nochmals: "Die Einsatzfähigkeit der Blausäure bei tiefen Temperaturen"* (Once More: "The Efficiency of Prussic Acid at Low Temperatures"), *Zeitschrift für Hygienische Zoologie und Schädlingsbekämpfung*, Feb/Mar 1942, pp. 35-37. Available on the web at http://www.holocaust-history.org/works/irmscher-1942/.

replacement time (10 replacements/hour) that would not be too unreasonable in terms of ventilation. To achieve more unreasonable values, he arbitrarily increases the time for each air exchange. He writes:

> j. Since the air intake and outlet at the same wall of the morgue were very close together (2 m) -- in contrary [sic] to those at the opposite wall (7.3 m) -- this would have led to a air short circuit, drastically reducing the performance of the ventilation. (Fig. 30: cross section through morgue 1 of Crematoria II & III. [Rudolf's note 496])
>
> k. Since the room would have been filled with a huge mass of corpses, the ventilation's performance would have been reduced furthermore.
>
> l. Thus, we assume an effectiveness of the ventilation system that is comparable with a perfectly working ventilation of 12 min per air exchange at best, perhaps even only comparable to one with 24 min /exchange or longer.

There is no justification given for these numbers. This appears to be a completely arbitrary assumption.

More reasonable calculations are shown in my treatment of the ventilation capacity above. The implications for removing the bodies by slave laborers are also discussed above. Rudolf repeats his argument about the formation the iron blue in the delousing chambers and the gas chambers, but does not adequately treat the differences in condensed phase concentrations of cyanide ions. I discuss the matter amply above and do not repeat the treatment here.

VI. Limits of the Chemical Method

After his long treatment of the chemistry Rudolf writes:

> The cyanide evaluation values indicated above are therefore only the well-founded conclusions of an expert; under no circumstances do they constitute dogmatic truth.

Above, I have shown that Rudolf's conclusions are not at all well-founded, but it is worth noting that even he acknowledges that he has not proved anything.

Conclusion

I have shown that Rudolf's arguments based on chemistry do not undermine what is known about the history of mass murder by poison gas in the facilities at Auschwitz and Birkenau. Rudolf's chemical arguments concern the outgassing and ventilation of Zyklon B as well as the chemical traces that remain in the facilities after 50 years. His claim regarding ventilation times is based on an erroneous assumption that there were no Zyklon introduction vents. His argument concerning the traces of cyanides found in

the gas chamber are based upon: 1) an erroneous comparison of his supposed sensitivity levels to those of the IFFR, 2) an incorrect assumption that exposure to HCN should produce an equivalent amount of Prussian blue in the gas chambers as in the delousing chambers, which owes to a comparison of gas phase concentrations without adequate examination of the condensed phase concentrations or the kinetics, and 3) questioning the intellectual honesty of the researchers at the IFFR. He fails on all counts. Chemistry alone, of course, cannot prove mass murder: one has to look at all of the evidence together and see if it converges to the same conclusion. These chemical arguments are not new. In fact, I have addressed the main points before alone and together with Jamie McCarthy. Rudolf like other Holocaust deniers attempts to use chemistry to trump historical evidence. The effort to disprove history on chemical grounds failed. In fact, Germar Rudolf admitted just that. To quote him, "[C]hemistry is not the science which can prove or refute any allegations about the Holocaust 'rigorously'"[64] In abandoning the chemical argument Rudolf went back to echoing Faurisson's claim about the lack of introduction vents for Zyklon B. "No holes, no Holocaust," is their argument now that the chemical one has failed. That argument also failed given the evidence of CIA photographs and the fact that Lucas has shown the lack of tampering with these photographs.[65] Indeed that argument has now been completely put to rest with the findings of Keren, McCarthy and Mazal. In fact, the only explanation that is consistent with all of the evidence, physical and historical, is that mass murder by poison gas at Auschwitz and Birkenau did in fact take place.

I have been advised by my Instructing Solicitors of my overriding duty to the Court, which I understand is paramount in my role as an expert of the Court. I understand that I am to assist the Court in all matters within my expertise regardless of whom my instructions are from and who is paying my fee. I confirm that this report is impartial, objective and unbiased and has been produced independently of the exigencies of this litigation.

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[64] Germar Rudolf, Some considerations about the Gas Chambers‹ of Auschwitz and Birkenau, http://www.vho.org/GB/c/GR/Green.html

[65] Carroll M. Lucas, “Appendix IV: An Analysis of the Auschwitz I,II/Birkenau Complex” in John C. Zimmerman, *Op. Cit.*

I believe that the facts I have stated in this report are true, and that the opinions I have expressed are correct.

*** **** **, April 21, 2001.

Richard J. Green, PhD.

Appendix I: US Executions

With respect to US executions, it is worth examining some of Rudolf's sources for what he does not report. The reader is forewarned that the descriptions of executions are not pleasant. I think it is important to quote from these sources, however, to evaluate the accuracy of Rudolf's claims. In footnote 449, Rudolf cites C.T. Duffy as claiming that death in an execution gassing occurred between 13-15 minutes. Duffy, on the very same page cited by Rudolf says:[66]

> Death in the gas chamber was caused by dropping cyanide from a container into a mixture of sulphuric acid and distilled water in a well under each chair. The poisonous fumes that resulted [HCN, my note RJG] caused **almost instant loss of consciousness**, although it took anywhere from thirteen to fifteen minutes for death actually to occur.[emphasis mine]

On the next page Duffy tells how the time of death was reported:

> When he was seated in one of the chairs, his hands and feet were strapped and the stethoscope was hitched to a tube connected with a valve outside the chamber, where the attending physician could listen to the man's heart beats and report the time of death.

Who is likely to report death sooner, a witness standing outside a gas chamber listening to the screams stop, or an attending physician with a stethoscope? Another one of Rudolf's sources states:

> Rejecting the state's assertion that that cyanide gas causes virtually instant unconsciousness, Judge Patel cited doctors' reports and witnesses' accounts of numerous past executions as evidence that dying inmates remain conscious for 15 seconds to a minute or longer.[67]

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[66] C.T. Duffy, *88 Men and 2 Women*, Doubleday, Garden City, NY, 1962, p.101.

[67] *The New York Times*, Oct. 6, 1994, p. A20

In addition, to showing that unconsciousness commonly occurs well before the times cited by Rudolf, I wonder how this article is supposed to support Rudolf's claim of an "average" time of death of 10-14 minutes. Another of Rudolf's sources also fails to demonstrate this assertion:[68]

> His words were not clear through the double-paned windows of the death chamber, but he seemed to scream "I'm human! I'm human!" as the airtight door to the room was clamped shut.
>
> **Screams for Five Minutes**
>
> The screams continued for about five minutes as cyanide gas rose about him. At 2:01 AM., Mr. Lawson convulsed. He gasped several times and was still.

Note that the time it took until medical death is not clearly stated, although certainly it was greater than five minutes. It is still hard to see how this citation supports Rudolf's contention. Another source gives this account:[69]

> The News & Observer gave this account of Boykin's execution in 1961:
>
> "When the cyanide gas first streamed up, Boykin's hands, which had rested in seeming calm on the arms of the death chair, jerked upwards, then curled calmly back in place. "Medical officials said the first breath of the gas made Boykin unconscious. Stomach muscle spasms came quickly for less than a minute. For the next quarter hour, however, Boykin's body was immobile as a statue. Medical officials periodically listened through the long-tubed stethoscope."

Note that whereas a medical observer might conclude that Boykin was still alive after a minute that he was "immobile as a statue." It should be mentioned in fairness that not all reports from prison gas chambers are equivalent; some come closer to Rudolf's average. The account of Lawson's death reads:[70]

> Then, three minutes into the execution, Lawson is silent and still. His head moves slowly and slightly from right to left. Then it rocks back against the chair. Again, he rises slightly, pushing against the leather straps. His left hand is clenched.

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[68] *The New York Times*, Jun. 16, 1994, p. A23

[69] Bill Krueger, "Execution Will Use Gas Chamber" in The News & Observer, Raleigh, NC, June 11, 1994, p. A1. Rudolf cites this article as p. A14, I believe. See text regarding his 0.3-1% concentration for more discussion.

[70] Bill Krueger "Lawson's Final Moments," *The News and Observer,* Raleigh, NC, June 19, 1994, p. A1

> It is silent in the witness room, all eyes fixed on the dying man. Lawson's balding head turns bright red. He takes a heavy gasp for air, but is otherwise still. His head tilts down slightly toward his chest, and he slumps into the chair. He twitches and a drop of clear liquid falls from his nose. His head is no longer red. The execution has been under way for five minutes.
>
> Lawson takes a deep breath, but is otherwise still. His hands remain clenched. He takes two short gasps. Then another. His body is motionless. Another gasp. Then another. His chest heaves slightly. Two more short gasps and, again, his chest heaves. Another gasp. The execution is seven minutes old. Lawson lets loose a short and muffled scream.
>
> Lawson takes a deep gasp. His body does not move. He takes another gasp. His head, tied to the chair, remains erect and facing straight at the witnesses. Sultan looks down the row of chairs to Creech. Another gasp. Then another. And another.
>
> Lawson's chest heaves slightly, almost imperceptibly. A gasp. Two more gasps. It is impossible to tell whether Lawson is conscious. Two more gasps. The top of his head has now turned an ashy white.
>
> Two more gasps. A very slight gasp, his last. The execution has been going on for nine minutes. His hands remain clenched in fists. Moreno reaches across Sultan to grab Dayan's hand.
>
> For several minutes, Lawson's body is still and silent. Dayan glances at the clock on the wall. It is 2:17.
>
> "David is with God now." Moreno whispers to Creech.
>
> "Yes, he's OK," Creech whispers.
>
> At 2:19, Dixon opens the door to the witness room.
>
> "Can I have your attention?" he says. "The judgment of the court has been carried out."
>
> The official time of death is 2:18.

For example Trombley writes:[71]

> After Mississippi's 1983 execution of Jimmy Lee Gray, several witnesses reported that he had convulsions for eight minutes; that he gasped eleven times during that period; and that he repeatedly struck his head on a pole behind him while struggling in the gas chamber.

Trombley reports a similar case during the 1976 gas execution of Aaron Mitchell in California. It could very well be that the difference between these two cases and the case that Duffy reports is a difference in concentration. The citation from *Newsweek* also gives some credence to his assertion: [72]

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[71] Stephen Trombley, *The Execution Protocol*, Crown Publishers, NY, 1992, p.13. (Interestingly enough Trombley reports these facts during an interview with none other than Fred Leuchter).

> In San Quentin's apple-green death house, one or two prisoners at a time are strapped in chairs built around a vat of sulphuric acid and water. A bag of cyanide eggs hangs over it. When the executioner releases a lever, the cyanide is submerged. The resulting gas kills by means of cellular asphyxia - cells can't use oxygen. Within a few seconds of his first breath, the prisoner convulses. Most buck and writhe against the straps. Consciousness lasts from 10 seconds to eight minutes.

I searched for Amnesty International's "Botched Execution, Fact Sheet" on their website. I did not find it, but I did find relevant information that also did not corroborate Rudolf's claims:[73]

> This was the first court ruling in the USA that any method of execution constituted cruel and unusual punishment. The judge found that prisoners suffered "excruciating pain for between 15 seconds and several minutes" and that a gas chamber execution violates "evolving standards of human decency and has no place in a civilized society." Four other US states have provisions for the use of the gas chamber: Arizona, Maryland, Mississippi and North Carolina.
>
> In an attempt circumvent the ban, California introduced a new law allowing inmates to choose to be executed by lethal gas rather than lethal injection. California appealed the decision, but were denied by the Ninth US Circuit Court of Appeals, who also found that execution by lethal gas caused "extreme pain for several minutes".

Despite the fact that there is evidence that some of the executions lasted up to the range Rudolf specifies, there is little support to conclude that this number is an average. I have not checked two of his sources: Bettina Freitag, "Henker warten nicht," New Yorker Staats-Zeitung, 13 March - 19 March, p. 3, nor the Amnesty International Botched Executions, Fact Sheet December 1996. I also did not check the reference to Holocaust denier Conrad Grieb on Rudolf's own website (vho.org). Perhaps one of these sources gives such an average. Even if so, more support would be needed to take this number as the gospel truth. Furthermore, the sections quoted above show that apparent death occurs before medical death.

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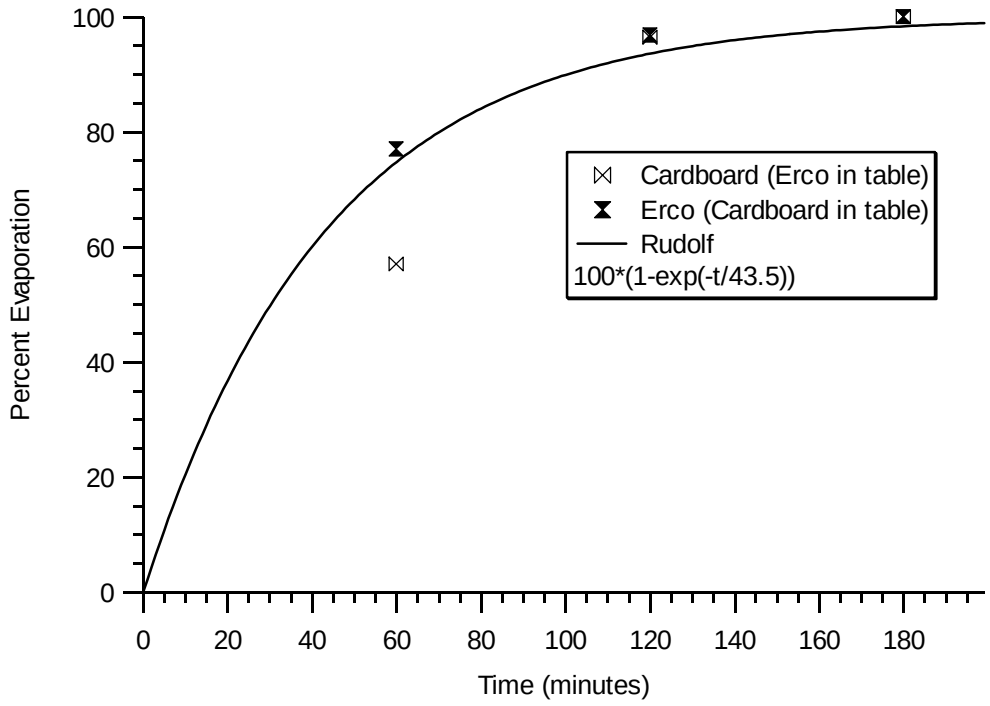
[72] "Killing Me Cruelly," *Newsweek*, November 8, 1994, p. 73. Note that Rudolf erroneously cites this as p.75. Page 75 has an article entitled "Putting the High in High Tech" about brain salons.

[73] Amnesty International, United States of America, Death Penalty Developments in 1996, AI-index: AMR 51/001/1997, 01/03/1997http://web.amnesty.org/802568F7005C4453/0/DC74ACD0D943AA3F8025690000692D56!Open

Appendix II: Evaporation of HCN from Zyklon B

In his 1942 paper,[74] Irmscher studied the study of evaporation rate of hydrogen cyanide from Zyklon B as a function of temperature at temperatures ranging from -18°C or -19°C up to 15°C. There is an error in Irmscher's original report: he has swapped captions between cardboard and Erco, on either his tables or his graphs. The graph for cardboard depicts the numbers for Erco, and vice versa. In previous work, Jamie McCarthy and I[75] assumed that the graphs had the correct labels and the tables were mislabeled, and I continue that assumption here, although I note that it is of little importance. At 15 °C, Irmscher reports three data points for each support. Rudolf has fit this data with an exponential function. The following graph shows Irmscher's data for both supports as well as Rudolf's functional fit.



[74] Irmscher, *Op. Cit.*

[75] Richard J. Green and Jamie McCarthy, *Op. Cit.*

Rudolf's function fits the Erco data fairly well. It should be noted, however, that the earliest data point is at 60 minutes, and that Rudolf uses his function to make predictions at earlier times, *e.g.*, 10 minutes. In this affidavit, I use Rudolf's function at early time as well. In doing so, I show, based on Rudolf's own reasoning that most of his claims are invalid.

Signed:

RICHARD J GREEN, PHD

Dated: