

This article is dedicated to a chemist, Primo Levi.

Abstract: Holocaust deniers base some of their arguments on the public's ignorance of history and science. Accurate information, not censorship, is the best antidote to their claims. 1.1 to 1.5 million people, most of them Jews, were murdered at the Auschwitz-Birkenau camps. The predominant weapon of mass murder was Zyklon B, hydrogen cyanide in a solid support. Early forensic analysis, shortly after World War II, supports this fact. Several pseudo-scientific reports, most notably by Leuchter, Lüftl, and Rudolf, have attempted to shed doubt on the facts. A forensic analysis by the Institute for Forensic Research in Cracow confirms the presence of cyanide in the buildings said to have been exposed to it. The arguments made by deniers are distortions of fact. The deniers misrepresent the statistics of the dead, and misinterpret air photo evidence. The properties of hydrogen cyanide from Zyklon B are consistent with its use as an agent of mass murder. The fact that Prussian blue is prevalent in delousing facilities but not in homicidal chambers is not evidence that no gassings occurred. In fact, Prussian-blue formation is extremely sensitive to conditions, and it is quite reasonable that Prussian blue formed in the delousing chambers but not all of the gas chambers used for murder. It is easier to tell a lie than to prove a lie to be incorrect; nevertheless, accurate information and not censorship is the best response.

I. Introduction

II. A Brief Description of Auschwitz

III. Zyklon B: A Pesticide and an Agent of Homicide

IV. History of Forensic Reports

V. A Critique of the Forensic Reports

VI. Conclusion

I. Introduction

Holocaust denial, known in Germany as the Auschwitz lie, has been gaining exposure in recent times, in part perhaps, because of the growth of the Internet. Deborah Lipstadt in her thought-provoking book *Denying the Holocaust* argues persuasively that the existence of the Holocaust is not a matter for debate: there is nothing to debate; it is a historical fact. ¹

In principle, I agree with her. The pseudoscience of the deniers, however, has become so widespread, particularly on the Internet, that I do not think their material can be left unanswered. I strongly disagree with censorship. Whereas I agree that no particular publisher, newspaper, or Internet provider is under any obligation to publish the distasteful and false propaganda of the deniers, I do not agree with government intervention to shut down sites that choose to peddle such untruths. Rather, I believe such material must be met head on with accurate information lest the gullible be taken in. This essay is an attempt to provide

such information concerning some of the most persistent deceptions of the deniers as well as to explain to the reader some of the context of those deceptions.

Central to the claims of the deniers is the claim that the Nazis, the SS and their accomplices did not commit mass murder with poison gas at Auschwitz. One of the major methods used by the deniers is to play on the public's ignorance of chemistry as well as its ignorance of the methods of mass murder employed at Auschwitz-Birkenau.

II. A Brief Description of Auschwitz

Auschwitz was more than a camp; in fact it was a vast complex consisting of more than 40 satellite camps: it was a prison camp, a labor camp, an industrial center and a death camp.² The complex included the I.G. Farben Buna rubber plant, the Monowitz camp where Primo Levi was held³, the main Auschwitz camp (Auschwitz I) and the Birkenau (Auschwitz II) extermination camp, three kilometers Northwest of the main camp⁴, where the majority of mass murders by poison gas took place.

In a recent estimate of the victims of the Auschwitz-Birkenau death camps, Franciszek Piper estimates that at least 1.3 million people were deported to Auschwitz-Birkenau among whom 1.1 million were Jews. He estimates that of these 1.3 million at least 1.1 million were killed or died. Piper estimates a maximum of 1.5 million dead including 1.35 million Jews.⁵

It is a fact that an early Soviet estimate placed the victims of Auschwitz-Birkenau at [4 million](#) and that the communist regime in Poland adhered to this number long after it was known to be untrue. It is a favorite tactic of deniers to claim that the untruth of this number should somehow affect estimates of the total number of Jews killed in the Final Solution. This claim is invalid.⁶ With a few notable exceptions⁷, historians did not take the 4 million number seriously. Additionally, estimates for the number of dead were generally made by the overall European demographics and therefore would not depend on an error in a single camp even if it were made. Both of these points are demonstrated by the conservative estimates of Raul Hilberg who estimates that 1 million Jews were killed in Auschwitz-Birkenau and that 5.1 million Jews were killed in all. Hilberg first made his estimate in 1961 and reaffirmed it in 1985 with the "revised and definitive" edition of his seminal work, *The Destruction of the European Jews*.⁸

Murder by poison gas took place at several installations in Auschwitz-Birkenau:

On 3 September 1941 a trial gassing was conducted in block 11 [of Auschwitz I]. Later, one room of the base-camp crematorium was equipped as a gas chamber [Krema I in Auschwitz I]. After these trials, in 1942, two abandoned thatch-roofed cottages in a wood at Birkenau were transformed into gas chambers; they were known as "the bunkers." In the spring of 1943 construction of four modern crematoria [Kremas II-V] was completed on the site of Birkenau itself. Each was divided into three parts: a section for the crematory ovens, a place for prospective victims to undress, and a gas chamber. The bunkers were no longer used except in emergencies.⁹

III. Zyklon B: A Pesticide and an Agent of Homicide

Raul Hilberg states:

TESTA sold Zyklon in different concentrations. Invoices presented to municipal or industrial clients for fumigation of buildings were printed with columns headed C, D, E, and F, each denoting a category of potency and price. As explained in a letter to Osland, strength E was required for the eradication of specially resistant vermin, such as cockroaches, or for gassings in wooden barracks. The "normal" preparation D was used to exterminate lice, mice, or rats in large, well-built structures containing furniture. Human organisms in gas chambers were killed with Zyklon B.

Hilberg notes in a footnote that the same preparation was used for the delousing of clothes. ¹⁰

The agent of mass gassing at Auschwitz-Birkenau was Zyklon-B, hydrogen cyanide (HCN), and a warning agent impregnated into a solid support. According to Kogon the solid support was diatomite and the appearance of Zyklon-B was of gray-blue pellets. ¹¹ In the instructions for the use of Zyklon B, published by its manufacturer, Degesch, three possible solid supports are mentioned: "Wood fibre discs, a reddish brown granular mass (diagriess -- Dia gravel) or small blue cubes (Erco) are used as carriers." ¹²

There are also patents for a porous support, a felt support, a Diagriess support, and an ERCO support. ¹³ Imscher identifies ERCO as a porous gypsum product. ¹⁴ Such a description sounds like what is now called drierite.

Hydrogen cyanide (HCN), also known as hydrocyanic acid, prussic acid or *Blausäure* was the toxic agent in Zyklon B. Strictly speaking, the term hydrogen cyanide should be used for the pure compound and the term hydrocyanic acid reserved for its aqueous solutions, but this convention has been ignored so much that it is pointless to insist upon it. HCN is a high vapor pressure liquid; the Merck index lists its boiling point as 25.6 degrees Celsius (78.8 degrees Fahrenheit), significantly less than human body temperature. ¹⁵ At room temperature (25 d C, 77 d F) the equilibrium vapor pressure of HCN is 750 Torr (760 Torr= 1 atmosphere), corresponding to 987,000 ppm. At 0 C (32 F) it is 260 Torr corresponding to 342,000 ppm. ¹⁶ The Merck index warns, "Exposure to 150 ppm for 1/2 to 1 hr may endanger life. Death may result from a few min exposure to 300 ppm" ¹⁷ Clearly, it is not necessary to reach equilibrium vapor pressure in order for the fumes of the liquid to be quite deadly.

HCN is explosive at 6% (60,000 ppm.); ¹⁸ it is not necessary to reach such concentrations in order to murder. In its pure state, HCN is very dangerous to transport or to store; the Material Safety Data Sheet (MSDS) states:

Polymerization: Can occur violently in the presence of heat, alkaline materials, or moisture. Once initiated, polymerization becomes uncontrollable since the reaction is autocatalytic, produce heat and alkalinity (NH₃). Confined polymerization can cause a violent explosion. HCN is stabilized with small amounts of acid to prevent polymerization. HCN should not be stored for extended periods unless routine testing confirms product quality. ¹⁹

HCN kills by binding cytochromes, enzymes important in respiration at the cellular level, and preventing them from functioning properly. ²⁰ HCN has a slight odor that has been described as being like almonds. The odor, however, is very difficult to detect and requires training. Zyklon B, accordingly, contained irritants to warn of the presence of HCN. The irritants were designed so that one irritant would be present

sooner than the HCN and that another would linger around later. [21](#)

Zyklon B at Auschwitz-Birkenau was used mainly for two purposes, delousing and murder. The eyewitness testimony to murder by poison is overwhelming. [22](#) Pressac reconstructs a gassing that took place March 13, 1943:

That same night, 1,492 women, children, and old people, selected from a convoy of 2,000 Jews from the Krakow ghetto, were killed in the new crematorium. Six kilos of Zyklon B were poured into the stacks that opened into the four grillework columns implanted between the pillars that supported the ceiling. Within five minutes, all the victims had succumbed. The aeration (8,000 cu m an hour) and deaeration system (same strength) were then started up and, after 15 to 20 minutes, the atmosphere, which had been practically renewed every three to four minutes, was sufficiently pure so that members of the Sonderkommando could enter the stiflingly hot gas chamber. During this first gassing [in the new Krema II gas chamber], the Sonderkommandos wore gas masks as a precaution. The bodies were untangled and dragged to the goods elevator. Hair was clipped, gold teeth pulled out, wedding rings and jewels removed. [23](#)

IV. History of Forensic Reports

From shortly after the war to the present there have been a number of forensic analyses conducted on facilities at Auschwitz-Birkenau including legitimate investigations as well as those conducted by Holocaust deniers. This section will give a brief history of those reports. Section V. will address in more detail the chemistry involved. In 1945 the Cracow Forensic Institute did a forensic analysis of the criminal traces left by the murderers. Pressac summarizes some of their findings:

Toxicological analysis were carried out in 1945 by the Cracow Forensic Institute (7 Copernicus street) on 4 complete plates and 2 damaged ventilation orifices found in the ruins of Krematorium II. After scraping the white substance that covered these objects back to the metal, 7.2 grammes of scrapings were collected and subjected to two *qualitative* analysis, which established the presence of cyanide compounds. The report, signed by Dr. Jan Z. Robel, was written on 15th December, 1945 and transmitted to the Examining Judge, Jan Sehn. [24](#)

Strzelecki describes other early forensic examinations including the following:

In 1945, an examination by the Institute of Judicial Expertise in Krakow of a sample of hair found in Auschwitz revealed the presence of compounds of prussic acid, the basic component of Zyklon B gas used in the gas chambers of Auschwitz. Traces of the acid were also found in metal objects found in the hair, such as pins, clasps, and gold-plated spectacle holders. [25](#)

In 1988, Holocaust denier Ernst Zündel, was preparing for his defense in Toronto. With the help of Holocaust denier Faurisson and soon-to-be Holocaust denier David Irving he procured the services of a self-styled "engineer," Fred A. Leuchter for the price of \$35,000. [26](#) Lipstadt states:

The group spent three days in Auschwitz-Birkenau and one in Majdanek surreptitiously and illegally collecting bricks and cement fragments- Leuchter called them "forensic samples" -from a number of buildings, including those associated with the killing process. On returning

to Massachusetts, Leuchter had the samples chemically analyzed. (He told the laboratory that the samples had to do with a worker's compensation case.) He summarized his findings in *The Leuchter Report: An Engineering Report on the Alleged Execution Chambers at Auschwitz, Birkenau, and Majdanek Poland*, which was published by Zündel's Samisdat Publications and David Irving's publishing house, Focal Point Publications in London. [27](#)

Lipstadt adds a footnote that states in part:

The London edition was entitled *Auschwitz: The End of the Line: The Leuchter Report - The First Forensic Examination of Auschwitz* [28](#).

The title itself is, of course, an untruth; the first forensic examinations were done in 1945 as mentioned above. For the purposes of this article I will refer to Leuchter's report as *the Leuchter Report*. As the Leuchter Report is one of the founding documents for the pseudoscientific claims of Holocaust deniers, it is worth checking on whether Leuchter represented his expertise as an engineer correctly. In fact, in 1991, Leuchter, whose only degree is a BA in History, admitted falsely representing himself:

Leuchter, 48, of suburban Malden, was to face trial later this month on charges of practicing engineering without a license, a violation of Massachusetts law. But on June 11, he signed a consent agreement with the board that licenses engineers.

In it, Leuchter acknowledged that, "I am not and have never been registered as a professional engineer" and that he nevertheless had represented himself as an engineer in dealings with various states that use the death penalty and to which he supplied equipment or advice. [29](#)

More [evidence](#) of Leuchter's lack of expertise is collected in one place at the [Nizkor](#) web site. [30](#) In a document available on the Zündel website, Leuchter summarizes his findings on the gas chambers:

The results published in the Leuchter Report are the important thing. Categorically, none of the facilities examined at Auschwitz, Birkenau or Lublin could have supported, or in fact did support, multiple executions utilizing hydrogen cyanide, carbon monoxide or any other allegedly or factually lethal gas. Based upon very generous maximum usage rates for all the alleged gas chambers, totalling 1,693 persons per week, and assuming these facilities could support gas executions, it would have required sixty-eight (68) years to execute the alleged number of six millions of persons. This must mean the Third Reich was in existence for some seventy-five (75) years. Promoting these facilities as being capable of effecting mass, multiple or even singular executions is both ludicrous and insulting to every individual on this planet. Further, those who do promote this mistruth are negligent and irresponsible for not investigating these facilities earlier and ascertaining the truth before indoctrinating the world with what may have become the greatest propaganda ploy in history. [31](#)

The obviously specious reasoning here is typical of Leuchter's style. No one has claimed that six million people were killed at Auschwitz-Birkenau. The number is closer to one million. His rate of "1,693 persons per week" is arbitrary. Notice how accurately he states the precision of that number. As far as Leuchter's estimate of the killing rate goes, one need only refer to the passage from Pressac quoted above in which almost 1,500 were killed in half an hour. Ironically enough, it is by estimating the throughput of the gas chambers that the Soviets arrived at the erroneous figure of 4 million killed. [32](#) Leuchter's estimate is

discussed in more detail below.

Leuchter also summarizes the results of his forensic tests:

Forensic samples were taken from the visited sites. A control sample was removed from delousing facility 1 at Birkenau. It was postulated that because of the high iron content of the building materials at these camps the presence of hydrogen cyanide gas would result in a ferric-ferro-cyanide compound being formed, as evidenced by the Prussian Blue staining on the walls in the delousing facilities.

A detailed analysis of the thirty-two samples taken at the Auschwitz-Birkenau complexes showed 1,050 mg/kg of cyanide and 6,170 mg/kg of iron. Higher iron results were found at all of the alleged gas chambers but no significant cyanide traces. This would be impossible if these sites were exposed to hydrogen cyanide gas, because the alleged gas chambers supposedly were exposed to much greater quantities of gas than the delousing facility. Thus, chemical analysis supports the fact that these facilities were never utilized as gas execution facilities. ³³

Leuchter's primary mistake is his initial assumption that exposure to HCN must result in the formation of [Prussian blue](#). ³⁴ Another error is his claim that the delousing facilities were exposed to less HCN than the homicidal chambers. It turns out that it is more difficult to kill lice than it is to kill humans. Leuchter's sensitivity is not good and it is doubtful that his samples were chosen carefully in regard to being sheltered from the elements. Concentration of cyanide in the gas chambers (at least cyanide not complexed to iron) is at levels less than 1 mg/kg. ³⁵ Additionally, Leuchter should have taken as his control an ordinary building at Auschwitz-Birkenau, such as a barracks. Do the homicidal gas chambers contain more cyanide compounds than an ordinary barracks? The answer is yes as discussed below. A later investigator, Germar Rudolf ³⁶ has made many of these same mistakes albeit more carefully; these issues are discussed in more depth in section V. A point for point [refutation](#) of the arguments in the Leuchter Report can be found on the [Nizkor](#) website. ³⁷

Another report that deserves mention is the Lüftl Report even though it is not strictly speaking a forensic report. The author of the report, a real engineer, Walter Lüftl, makes arguments concerning the supposed physical impossibility of using Zyklon B to murder. He conducts a largely irrelevant simulation concerning the ability of humans to heat a gas chamber and attempts to deceive the reader with the claim that the figure of six million Jews murdered should be lowered to 3.5 million with the recognition that 4 million were not murdered at Auschwitz-Birkenau. I have already discussed the basis of this fallacy above but further information may be found in an [article](#) on the [Nizkor](#) site. ³⁸

An English version of the Lüftl Report was published by a journal specializing in Holocaust denial, *The Journal of Historical Review* without the permission of the author, ostensibly to protect him from prosecution in Austria. ³⁹ Sarah Rembiszewski writes that Lüftl was

president of the Austrian Engineers' and Architects' Association, which [sic?] conducted a "study," disseminated today through the Internet, "proving" that the Holocaust could not have happened. Lüftl conducted his study at the request of a German lawyer and published his conclusions in the Viennese paper *Die Presse* under the title "Holocaust - Belief and Facts." He was forced to resign from his position in the Engineers' and Architects Association;

Süddeutsche Zeitung, March 15, 1992. [40](#)

I will now turn to discussing the background of a report of someone I consider to be one of the more clever and therefore more dangerous of the Holocaust deniers, Germar Rudolf. Rudolf was a graduate student in chemistry working at the prestigious Max Planck Institute (MPI). Owing to the fact that he actually has some understanding of chemistry many of his deceptions are more sophisticated than other Holocaust deniers. Nonchemists should be somewhat careful in addressing his arguments. Ultimately, he engages in the same deceptions and specious arguments as Leuchter and Lüftl, but the case he makes for those deceptions and arguments involves more difficult chemistry. Below, I will address in more detail why the chemical arguments of the deniers regarding the use of Zyklon B in Auschwitz-Birkenau are not valid, but first I will discuss some of the history of the Rudolf Report as I have done for the Leuchter and Lüftl Reports.

The story of the Rudolf Report begins with Otto Remer. Remer was a general during the Nazi regime and put down the attempted coup against Hitler in 1944. [41](#) Remer was a Holocaust denier and was on trial in Germany for inciting race hatred. [42](#) Remer's lawyer Hajo Hermann commissioned Rudolf to write the Rudolf Report. [43](#) Just as Leuchter had done before him, Rudolf collected samples from gas chambers as well as delousing facilities:

He traveled to Auschwitz in summer 1991, and took samples from the walls of one of the gas chambers and one of the delousing chambers. Using Max Planck stationary, he sent the samples to an analytical laboratory in Taunusstein, the Fresenius Institute. [44](#)

Rudolf had an understanding with Remer that his report was only to be used in the court case. The report was never used in that case, but Remer began distributing the report claiming "it had the support of the Max Planck Society." [45](#) Subsequently, Rudolf found his own publisher. In June 1993, Rudolf was forced to leave MPI for improperly using its name. [46](#) In a March 1994 legal settlement Rudolf's dismissal was reworded as an "ending of the contract through mutual agreement." [47](#) A [statement](#) from MPI on the affair is available on the Nizkor web site. [48](#) Rudolf's legal troubles were far from over. Gerald Fleming writes in the foreword to Sarah Rembiszewski's work:

On June 23, 1995, following a seven months' trial, the Superior-Lomt (Landgericht) in Stuttgart sentenced Germar Scheerer to fourteen months imprisonment for spreading premeditated, offensive, mendacious and racist propaganda. The accused is now reportedly a fugitive from justice. [49](#)

Rembiszewski explains that Rudolf changed his name to Scheerer after he got married in 1994. [50](#) If this name change were the only one that Rudolf used, it would be understandable. Sheerer is not the only alternate name Rudolf uses. In many of his reports he cites the papers of "Dr. Ernst Gauss" as an expert on chemistry. It came to light during Rudolf's 1994 trial that "Dr. Gauss" was a graduate student whose Ph.D. thesis was never accepted. That graduate student is named Germar Rudolf. [51](#)

I do not believe that Rudolf's offense would be criminal in the United States of America where citizens enjoy the protection of the First Amendment (a protection that would be lost were people like Rudolf and his hero Remer ever to come to power here). Not only do I disagree with such criminal prosecution on principle, but I think that it is counterproductive in that it gives people like Rudolf the ability to claim

persecution. My task here, however, is to discuss the history of claims concerning the chemistry of Auschwitz-Birkenau and evaluate their validity. The fact that I think that people ought to be permitted to spread untruths does not make untruths into truths.

Next I will turn to what I will refer to as the [IFRC](#) Report, a paper by Jan Markiewicz, Wojciech Gubala, and Jerzy Labadz of the Institute of Forensic Research, Cracow ([IFRC](#)). ⁵² In 1989, these researchers entered into discussions with the management of the Auschwitz-Birkenau museum about the possibility of detecting evidence of exposure to cyanides in the gas chambers; they were skeptical about the possibilities of such detection, but made the attempt anyway in 1990 in a preliminary study of 10 samples and 2 control samples. They were able to confirm the presence of cyanide in Krema II but nowhere else in this preliminary investigation. The results from their control samples were negative indicating that their results were meaningful. ⁵³

After learning of the Leuchter Report, these authors decided to make a more extensive study.

Samples, about 1-2 g in weight, were taken by chipping pieces from bricks and concrete or scraping off [sic], particularly in the case of plaster and also mortar. The materials taken were secured in plastic containers marked with serial numbers. All these activities were recorded and documented with photographs. Work connected with them took the commission two days. The laboratory analysis of material collected was conducted - to ensure full objectivity - by another group of Institute workers. ⁵⁴

The samples underwent qualitative analysis by means of a spectrophotometer. Cyanides were found in many of the samples, but this method was not suitable for quantitative analysis. ⁵⁵

A significant concern in choosing a method for quantitative analysis is the presence of blue-staining in the delousing chambers, that is not obviously present in the homicidal gas chambers. I have written [a brief article](#) available on the world-wide web that discusses the chemistry of this staining and its relevance to forensic analysis. ⁵⁶ The important points of this chemistry are discussed in section V. of the current article. For reasons discussed below, the [IFRC](#) workers chose a method of detecting cyanides that discriminates against the compounds that form this staining, the iron blues. Additionally, they used a calibrated method:

The calibration curve was constructed previously and standards were introduced into each series of determinations to check the curve and the course of the determination. ⁵⁷

The IFRC researchers found significant levels of cyanide in bunker 11, all five Kremas, as well as a facility used to fumigate prisoners' clothing. In contrast, no cyanides were found in dwelling facilities that were "probably fumigated with Zyklon B only once (in connection with typhoid epidemic in 1942)." They summarize their findings as follows:

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. ⁵⁸

V. A Critique of the Forensic Reports

This section will examine the validity of claims made by the deniers as well as further elucidating the significance of the findings of the IFRC researchers. Some of the claims made in the reports of the deniers are not directly relevant to the chemistry of Auschwitz- Birkenau. Nevertheless, a few of these arguments are so pervasive and so easily exposed as specious that they merit a brief discussion. The claims that do involve the chemistry of Auschwitz-Birkenau are divided into two categories: 1) claims of the impossibility of gassing, 2) claims that chemical analyses of forensic samples prove that no gassings could have taken place. For the most part, I will not address claims involving other camps at this time; I will also not address claims concerning the cremation furnaces and the cremation in ditches. These issues deserve a more complete treatment on their own.

The deniers like to play the numbers game. They state that it is impossible for 6 million people to have been killed in gas chambers at Auschwitz-Birkenau. They are quite right: the death toll at Auschwitz is closer to 1 million. The others murdered in the Final Solution were killed in other camps, ghettos, as a result of the *Einsatzgruppen* mobile killing squads, by death marches and other means. ⁵⁹

Nevertheless, Leuchter underestimates the capacity of Auschwitz-Birkenau. Leuchter's assumptions about the capacity for murder of the gas chambers assume

that the people could occupy the gas chambers at a density of maximum 1 person per 9 square feet (!!) and that it would take a week (!!) to ventilate the gas chambers before they could be used for another mass execution. These assumptions are absurd. ⁶⁰

Deniers also like to take credit for debunking the incorrect claims of the Soviets that 4 million were killed at Auschwitz-Birkenau. Unfortunately for them, it was the respectable historians who provided the evidence for more accurate numbers. They also make the false claim that this change in the death toll of Auschwitz-Birkenau should drastically reduce the death toll of the final solution. This argument has been thoroughly discredited elsewhere. ⁶¹

Another claim is to echo Faurisson's notorious statement, "No vents, no holocaust." Air photos are supposed to show that vents in Krema II that were used, according to eyewitness testimony, to introduce Zyklon B in the gas chamber, were forged by the CIA or other unspecified conspirators. Michael Shermer, editor of Skeptic Magazine, writes:

Thanks to Dr. Nevin Bryant, supervisor of cartographic applications and image processing applications at Caltech/NASA's Jet Propulsion Laboratory in Pasadena, California, I was able to get the CIA photographs properly analyzed by people who know what they are looking at from the air. Nevin and I analyzed the photographs using digital enhancement techniques not available to the CIA in 1979. We were able to prove that the photographs had not been tampered with, and we indeed found evidence of extermination activity. ⁶²

Shermer reproduces a 1944 aerial photo of Krema II (figure 23) and a 1942 picture taken from the ground (figure 24).

The aerial photograph in figure 23 shows the distinctive features of Krema II. Note the long shadow from the crematorium chimney and, on the roof of the adjacent gas chamber at right

angles to the crematorium building, note the four staggered shadows. [Holocaust denier, John C.] Ball claims these shadows were drawn in, but four small structures that match the shadows are visible on the roof of the gas chamber in figure 24, a picture taken by an SS photographer of the back of Krema II... [63](#)

John Ball, at least, seems to be aware that his claims do not stand up. He offered on his web page a \$100,000 for anyone who could get three air photo experts to disagree with the accuracy of his claims. When John Morris inquired about accepting Ball's offer, Ball did not respond even though Morris made every effort to communicate his interest. [Details](#) are available on the [Nizkor](#) website. [64](#)

The primary claims made by the deniers concerning the supposed impossibility of gassing with Zyklon B center on the rate of evaporation of HCN from Zyklon B. It evaporates too slowly, they claim, so that either it will not kill as fast as is claimed, or alternatively it will be too dangerous to the operators of the gas chambers. Lüftl writes:

Hydrocyanic acid vapors are not released immediately after the cans are opened. The evaporation of Zyklon B requires as many as 32 hours or as few as six hours, depending on whether the ambient temperature ranges from five to 30 degrees Celsius. The evaporation rate is not exactly proportional to time. [65](#)

Jamie McCarthy has addressed this claim:

[Lüftl] ripped those figures from their context and cited them dishonestly. The "six to 32 hours" figure comes from the Degesch manual, but it refers *only* to the total exposure time required for lice. Since the metabolism of lice, like all cold-blooded creatures, is much slower at 5 C than at 30 C, the exposure time is necessarily longer. [66](#)

In other words, Lüftl is mixing apples and oranges. The times he quotes have nothing to do with the release time from Zyklon B. They have to do with the necessary fumigation times to kill lice. In answer to a criticism of the Leuchter Report that human body heat would be sufficient to raise the temperature to the "temperature of evaporation" of HCN Lüftl responds:

Like so many Holocaust writers, Auerbach is mistaken. An experiment was carried out by this writer to simulate the heating of a chamber by human beings...

The chamber took an hour to heat using an 1.8 Kw electric convection heater, after which the room was "ventilated" for 30 minutes...

Even [in a room] with people "tightly packed crushed together," an air temperature in excess of 30-32 degrees Celsius would not be attained. In addition, the gassings are supposed to have taken place quickly and on a quasi- industrial basis. [67](#)

This simulation would be a comedy of errors were it not in the service of denying a tragedy of barely imaginable proportions. First of all, 1.8 kW is roughly equivalent to the heat output of 18 people, far fewer than would have been in the 5.43 square meters of floor space in the simulation. Secondly, and more importantly, it is not at all necessary to come near (or over!) the boiling point of HCN for it to evaporate rapidly. The boiling point of a liquid is the temperature at which its equilibrium vapor pressure is equal to the pressure of the atmosphere. Below the boiling point the vapor pressure of a liquid can be quite large.

HCN has an extremely high vapor pressure even at very cold temperatures. Anyone who doubts this fact should obtain some diethyl ether, open a small amount, and observe it evaporating. Ether boils at 34.6 Celsius; in other words its boiling point is greater than HCN. ⁶⁸

This discussion is worthwhile because it shows how the deniers play on the public's relative ignorance on such technical details. The argument, however, is moot because Gerhard Peters, who was the general director of Degesch, the company that sold Zyklon B has written a book on the topic, in which he gives the evaporation times of Zyklon B. ⁶⁹ Ulrich Roessler translates:

The development of the gas from the Zyklon sets in with great vehemence immediately following the pouring out of it. The thinner the layer of the disseminated support material the faster will be the development of the gas. Depending on the species of the pests to be controlled, and on the characteristic of the rooms to be gassed, one may choose to reach the maximum of the gas concentration to arise very quickly or more slowly by the thickness of the disseminated layer. Usually, the material will be disseminated in a layer of 1/2 to 1cm thickness, then the greatest part [*der größte Teil*] of the HCN will have developed already after half an hour at normal temperature. [i.e. 20 degree C]. ⁷⁰

Roessler comments further:

Now, *der größte Teil der Blausäure* is by no means only 50% - it means rather **nearly all** of the HCN. ⁷¹

Even at -10 C Peters states that the evaporation is essentially complete in 1 hour with an upper bound for complete evaporation of 2 hours. ⁷²

These facts should not be taken to mean that gassing with Zyklon B was 100% safe. Kremas II and III were equipped with ventilation systems; the gas chambers in Kremas IV and V were built above ground to allow natural ventilation. Pressac in the quote near the beginning of this article states:

the Sonderkommandos wore gas masks as a precaution. ⁷³

If the Nazis and their accomplices were smart enough to handle the hazards of Zyklon B for delousing purposes, it is reasonable to suppose that they were smart enough to handle those hazards when committing murder. In [Nizkor's Leuchter FAQ](#), another spurious objection is answered swiftly and accurately:

2.09 If the gas chambers were ventilated, the gas would kill people outside.

Nonsense; it is all a question of concentration. Once the gas is released into the atmosphere, its concentration drops and it is no longer dangerous. Also, HCN dissipates quickly. The execution gas chambers in US prisons are also ventilated directly into the atmosphere. Furthermore, if this argument would hold for the extermination chambers, it would hold for the delousing chambers as well, and one would have to conclude that no delousing chambers existed either. ⁷⁴

Another claim is refuted merely by reference to the Merck Index. In order to be explosive HCN requires a

concentration of 6% (60,000 ppm).⁷⁵ There is simply no reason to add enough Zyklon B to allow such a concentration to build up.

In considering the forensic measurements, I will make the not necessarily warranted assumptions that Rudolf and Leuchter can be trusted to have handled their samples carefully and honestly. What they claim to measure is a large discrepancy between the levels of cyanide in the blue-stained delousing chambers compared to the homicidal gas chambers that do not have obvious staining in Auschwitz-Birkenau (the Majdanek chamber is an interesting exception that deserves some comment below).

These measurements are essentially meaningless. The information content is not more than the fact that some of the delousing chambers have blue-staining and the homicidal chambers do not.

There are three conceivable explanations for this difference.

1. The presence of Prussian-blue staining is a necessary consequence of exposure to HCN and the fact that it is not present in the homicidal chambers proves they were not used for homicidal gassing.
2. The Prussian-blue staining is present for reasons having nothing to do with the exposure to HCN. For example Bailer has suggested it may be a pigment from paint.⁷⁶
3. The Prussian-blue staining indeed owes its presence to exposure to HCN, but the conditions under which it formed were not universally present in all facilities exposed to HCN. The rate of Prussian-blue formation may be very different under the conditions used in homicidal chamber versus the conditions in delousing chambers.

Answer number one is, of course, untenable. We know that homicidal gassings occurred from historical evidence independently of the chemistry involved. Nevertheless, I will suspend my disbelief for a moment. If the lack of Prussian blue is supposed to prove that no gassing took place, possibilities 2 and 3 must be disproven. If it is not possible to do so, then the impossibility of gassings at the Kremas has not been shown.

My article on Prussian blue discusses some of the issues involved in its possible formation.⁷⁷ The iron in Prussian blue exists in two oxidation states Fe(II) and Fe(III) (the Roman numeral in parenthesis denotes the formal positive charge on iron). The significant question is how the Fe(III) present in construction materials forms Fe(II). Such a process is called reduction and requires a reducing agent, *viz.*, something that gets oxidized when Fe(III) gets reduced. (Oxidation means the formal loss of electrons, i.e., negative charge, whereas reduction means the gain of electrons.)

Bailer could not think of a possible reducing agent and looked elsewhere for a reason for the Prussian blue stains.⁷⁸ I consider his explanation unlikely but not disproven.

Rudolf has suggested HCN acts as the reducing agent,⁷⁹ and that suggestion is possible. I have shown that if Rudolf's explanation for the presence of Prussian blue in the delousing chambers is correct that its formation in the gas chambers would have been unlikely at best.⁸⁰ Alich *et al.* have shown that this method of Prussian blue formation is extremely sensitive to concentrations, pH, presence of water, and the presence of Fe (III) that is already complexed with cyanide.⁸¹ It should be mentioned that Rudolf tried and

failed to produce Prussian blue. [82](#)

The difficult part comes into play in understanding the kinetics of how Prussian blue forms. How fast does it form and under what conditions? The exposure conditions of the delousing chambers and the homicidal gas chambers were quite different, if the Degesch directions for delousing were followed. The walls in the delousing chambers may have been exposed to HCN for over 20 hours at a time at levels up to 16,000 ppm. Additionally, the amount of water present, the amount of carbon dioxide present (from humans exhaling) and the temperature are crucial to understanding the differences. I suspect that the kinetics are too difficult to model without resort to experiment. In order to prove his thesis, Rudolf must demonstrate that it is necessary for Prussian blue to form under the conditions employed in the homicidal gas chambers.

The control used in the measurements of Leuchter and Rudolf is biased. They contain Prussian blue as the major form of cyanide and the kinetics of Prussian blue formation are far from obvious. Cyanide residues, not in the form of Prussian blue are far more susceptible to weathering away. The [IFRC](#) researchers experimented with exposing building materials to HCN and found that the cyanides were easily removed with exposure to water. [83](#) The samples that they found containing cyanides from the Kremas were carefully taken from places in the chambers that were as sheltered from the elements as possible. [84](#) Leuchter and Rudolf, collecting their samples illegally could not afford that luxury.

The IFRC being aware of the problems using a biased control containing Prussian blue used a method that discriminated against such compounds that only measure other cyanides present. The IFRC found traces of cyanide at levels significantly above background in all 5 Kremas as well as bunker 11. They also measure concentrations in bath-house B1-A in Birkenau, which was used for delousing prisoners' clothing. Samples from the bath house did indeed have higher concentrations of cyanides, but it is not the case that every sample from the bath-house had higher concentrations than every sample in the Kremas. For example, sample number 25 from Krema II had measurements of 640,592, and 620 ug/kg. Sample 46 from Krema V had measurements of 244, 248, and 232 ug/kg. In contrast sample 53 from the bath-house camp B1-A in Birkenau had measurements of 24, 20, and 24 ug/kg. Overall concentrations for the fumigation chambers ranged from 0-900 ug/kg. In the Kremas they ranged from 0-640 ug/kg. So it is true that the highest measurements were higher in fumigation chambers (discriminating against iron blues), but not by much. There is another important fact. Concentrations in control samples from dwelling accommodations were 0 +/- 1 ug/kg. In other words, there is no doubt that the Kremas were exposed to a source of HCN. If the intent is to prove that the Kremas could not have been homicidal gas chambers, it has failed. [85](#)

Before concluding it is worth mentioning the case of the gas chamber at Majdanek. This chamber has Prussian blue staining. Pressac has interpreted this fact to mean that delousing must have taken place in this chamber.

The red-ochre bricks stained with dark blue were for him [Maître Jouanneau] material and visible proof of the existence of homicidal gas chambers. The problem, for there is one, is that the gas chamber presented all the characteristics of a DELOUSING installation. I am not saying that it was never used to kill people, for that is still possible, but the traces of Prussian blue are an absolutely certain indication of use for delousing purposes.... [86](#)

Pressac believes that the presence of Prussian blue proves that the chamber was used for delousing. Whereas he does not view Prussian blue as proof that the chamber was not used for homicidal purposes,

he implies that homicidal purposes alone would not produce Prussian blue.

Happy to be logically inconsistent as long as they can spread a bit of confusion to obfuscate the truth, at least one denier has claimed on the basis of Pressac's statement that the chamber in question was only a delousing chamber.

I am not yet convinced of Pressac's reasoning. I do not think it is obvious that homicidal gassing can never produce Prussian blue stains, and I would suggest that a counterassertion demands the same kinetic arguments that the deniers are unable to produce.

VI. Conclusion

In this article I have discussed some of the history as well as the chemistry of mass murder at Auschwitz-Birkenau. I have shown that the arguments of the deniers do not hold up when shown the light of day.

It is much easier to tell a lie than to expose one. Perhaps, that is one of the unspoken reasons that motivates people to advocate censoring hate-speech. Whereas I am opposed to censorship and hate speech laws, I am not embarrassed to call Holocaust-denial hate speech. That is what it is. People who are smart enough to obfuscate using pseudoscientific arguments are also smart enough to know what they are doing: propagating a lie. Although some people may be attracted to Holocaust denial because of gullibility and/or mental illness, these people are not the same people who write these clever but mendacious pseudoscientific reports. The people who write these reports are motivated by a desire to rehabilitate Nazism, an ideology of hate. Hate-speech is what it is, and in calling it that I am merely exercising my right of free speech.

The arguments made by the deniers are, of course, repulsive, but they can only have an effect if the public is not educated enough to see the poor scholarship disguised with footnotes. It is because of this restriction on the possibility of the deniers to have an effect that I believe that accurate information is the best possible response.

[Further Reading](#)

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