A STUDY OF THE CYANIDE COMPOUNDS CONTENT IN THE WALLS OF THE GAS CHAMBERS IN THE FORMER AUSCHWITZ AND BIRKENAU CONCENTRATION CAMPS

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ABSTRACT: In a widespread campaign to deny the existence of extermination camps with gas chambers the „revisionsits" have recently started using the results of the examiantions of fragments of ruins of former crematoria. These results (Leuchter, Rudolf) allegedly prove that the materials under examination had not been in contact with cyanide, unlike the wall fragments of delousing buildings in which the revisionists discovered considerable amount of cyanide compounds. Systematic research, involving most sensitive analytical methods, undertaken by the Institute confirmed the presence of cyanide compounds in all kinds of gas chamber ruins, even in the basement of Block 11 in Auschwitz, where first, experimental gassing of victims by means of Zyklon B had been carried out. The analysis of control samples, taken from other places (especially from living quarters) yielded unequivocally negative results. For the sake of interpretation several laboratory experiments have been carried out.

KEY WORDS: Gas chambers; Auschwitz; Cyanide compounds; Revisionism.

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As early as the first years after the end of World War II single publications began to appear in which the authors attempted to „whitewash" the Hitlerite regime and to call various signs of its cruelties into question. But it was not till the fifties that the trend may be defined as „historical revisionism" arose and started developing; its supporters claim that the history of the World War II has been fabricated for the purposes of anti-German propaganda. According to their statements there was no Holocaust, i. e. no mass extermination of Jews and in that case the Auschwitz-Birkenau Concentration Camp could not have been an extermination camp – it was only a „common" forced labour camp and no gas chambers existed in it.

Historical revisionism is now put forward by members of various nations, who already have their own scientific circles, own publications and also use the mass media for their purposes. Up to 1988 the „revisionists"[1] most frequently manipulated historical sources or simply denied the facts. Then, after the appearance of the so-called

[1] The terms „historical revisionism" and „revisionists" in the sense used there have been introduced into the literature of the field under discussion.

Leuchter Report (2), their tactics changed distinctly. The above-mentioned Report, worked out on the basis of a study of the ruins and remains of the crematoria and gas chambers at Auschwitz-Birkenau, has been considered by them to be specific evidence in support of their allegations and evidence of judicial validity at that, since it was commissioned by the court of law in Toronto (Canada). F. Leuchter, living in Boston, worked on the design and construction of gas chambers still in use to execute the death penalty in some States of the USA. This is considered to give him authority to take the role of expert as regards gas chamber issues. In this connection Leuchter came to Poland on 25 February 1988 and stayed here for 5 days, visiting the camps at Auschwitz-Birkenau and at Majdanek. In his report based on this inspection he states that „he found no evidence that any of the facilities that are usually alleged to have been gas chambers were actually used as such". Moreover, he claims that these facilities „could not be used as gas chambers for killing people" (Item 4000 of the Report).

Leuchter tried to confirm his conclusions with the help of chemical analysis. For this purpose he took samples of material fragments from the chamber ruins to subject them to an analysis for hydrogen cyanide, the essential component of Zyklon B, used – acc. to the testimony of witnesses – to gas the victims. He took 30 samples altogether from all the five structures used formerly as gas chambers. At laboratory analyses performed in the USA the presence of cyanide ions at concentrations of 1.1 to 7.9 mg/kg of material examined was found in 14 samples. He also took one sample from the delousing building at Birkenau, which he treated as a „control sample", and in which cyanides were found to be present at a concentration of 1050 mg/kg of material. The positive results of the analyses of samples from the former gas chambers are explained by Leuchter by the fact that all the camp facilities were subjected to a fumigation with hydrogen cyanide in connection with a typhoid epidemic which really broke out in the camp in 1942.

A later investigation, carried out by a G. Rudolf (4), confirmed the high concentrations of cyanogen compounds in the facilities for clothes disinsectization. This may be so since, being undamaged, these facilities were not exposed to the action of weather conditions, especially rainfall. Moreover, it is known that the duration of disinsectization was relatively long, about 24 hours for each batch of clothes (probably even longer), whereas the execution with Zyklon B in the gas chambers took, according to the statement of the Auschwitz Camp Commander Rudolf Höss (7) and the data presented by Sehn (6), only about 20 minutes. It should also be emphasized that the ruins of these chambers have been constantly exposed to the action of precipitation and it can be estimated, on the basis of the climatological records, that in these last 45 years or so they have been rinsed rather thoroughly by a column of water at least 35 m in height (!).

In our correspondence with the Management of the Auschwitz Museum in 1989, not knowing the Leuchter Report then, we expressed our anxiety as to the chances of detection of cyanogen compounds in the chamber ruins; nevertheless, we offered to carry out an appropriate study. 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.

When the dispute on the Leuchter Report arose, we undertook a closer study of the problem, availing ourselves, among other publications, of J. C. Pressac's comprehensive work (5). In consequence, we decided to start considerably more extensive and conscientiously planned reaserches. To carry them out, the Management of the Auschwitz Museum appointed their competent workers, Dr F. Piper (custodian) and Mr W. Smrek (engineer) to join the commission, in which they co-worked with the authors of the present paper, representing the Institute of Forensic Research. Under this collaboration the Museum workers were providing us on the spot with exhaustive information concerning the facilities to be examined and – as regards the ruins – a detailed topography of the gas chambers we were concerned with. And so they made it possible for us to take proper samples for analysis. We tried to take samples – if at all possible – from the places best sheltered and least exposed to rainfall, including – also as far as possible – fragments of the upper parts of the chambers (hydrogen cyanide is lighter than air) and also of the concrete floors, with which the gas from the spilled Zyklon B came into contract at rather high concentrations.

Samples, about 1–2 g in weight, were taken by chipping pieces from bricks and concrete or scrapping off, 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 the material collected was conducted – to ensure full objectivity – by another group of Institute workers. They started with preliminary work: samples were comminuted by grinding them by hand in an agate mortar, their pH was determined at 6 to 7 in nearly all samples. Next the samples were subjected to preliminary spectrophotometric analysis in infrared region, using a Digilab FTS-15 spectrophotometer. It was found that the bands of cyanide groups occurred in the region of 2000–2200 cm^{-1} in the spectra of a dozen samples or so. However, the method did not prove to be sensitive enough and was given up in quantitative determinations. It was determined, using the spectrographical method, that the main elements which made up the samples were: calcium, silicon, magnesium, aluminium and iron. Moreover, titanium was found present in many samples. From among other metals in some samples there were also barium, zinc, sodium, manganese and from non-metals boron.

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.

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. To isolate cyanide compounds from the materials examined in the form of hydrogen cyanide we used the techniques of microdiffusion in special Conway-type chambers. The sample under examination was placed in the internal part of the chamber and next acidified with 10% sulfuric acid solution and allowed to remain at room temperature (about 20°C) for 24 hrs. The separated hydrogen cyanide underwent a quantitative absorption by the lye solution present in the outer part of the chamber. When the diffusion was brought to an end, a sample of lye solution was taken and the pyridine-pyrazolone reaction carried out by Epstein's method (3). The intensity of the polymethene dye obtained was measured spectrophotometrically at a wavelength equal to 630 nm. The calibration curve was constructed previously and standards with a known CN^- content were introduced into each series of determinations to check the curve and the course of determination. Each sample of materials examined was analysed three times. If the result obtained was positive, it was verified by repeating the analysis. Having applied this method for many years, we have opportunities to find its high sensitivity, specificity and precision. Under present circumstances we established the lower limit of determinability of cyanide ions at a level of 3–4 µg CN^- in 1 kg of the sample.

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 accomodations, which was shown by means of control samples. The concentrations of cyanide compounds in the samples collected from one and the same room or building show great differences. This indicates that the conditions that favour the formation of stable compounds as a result of the reaction of hydrogen cyanide with the components of the walls, occur locally. In this connection it takes quite a large number of samples from a given facility to give us a chance to come upon this sort of local accumulation of cyanide compounds.

To complete this research on the cyanide compound content in various camp facilities, we decided to carry out several pilotage experiments. The renovation of the Institute building, just in progress, provided us with materials for this investigation. We divided particular constituents of these materials (bricks, cement, mortar and plaster) into several 3–4 gram pieces and placed them to glass chambers, in which we generated hydrogen cyanide by reacting potassium cyanide and sulphuric acid. We used high concentrations of this gas (about 2%) and wetted some of the samples with water. Fumigation took 48 hours at a temperature of about 20°C (Table V). Another series of samples were treated with hydrogen cyanide as well, but now in the presence of carbon dioxide. According to calculations, in the chambers in which people had been gassed the carbon dioxide content produced in the breathing process of the victims was rather high and in relation to hydrogen cyanide may have been even as high as 10:1. In our experiment we applied these two gases (CO_2 and HCN) in the 5:1 ratio. Having been subjected to gassing, the samples were aired in the open air at a temperature of about 10–15°C. The first analysis was conducted 48 hours after the beginning of airing.

This series of tests allows the statement that mortar absorbs and/or binds hydrogen cyanide best and also that wet materials show a noticeable tendency to accumulate hydrogen cyanide whereas brick, especially old brick, poorly absorbs and/or binds this compound.

TABLE I. CONCENTRATION OF CYANIDE IONS IN CONTROL SAMPLES TAKEN FROM DWELLING ACCOMODATIONS, WHICH WERE PROBABLY FUMIGATED WITH ZYKLON B ONLY ONCE (IN CONNECTION WITH TYPHOID EPIDEMIC IN 1942)

Site	Block No	Sample No	Concentration of CN^- in µg/kg
Auschwitz	3	9	0
		10	0
	8	11	0
		12	0
Birkenau	3	60	0
		61	0
		62	0
		63	0

Note: In screening tests of 1990 two control samples also produced 0 results.

TABLE II. CONCENTRATION OF CYANIDE IONS IN SAMPLES TAKEN IN THE CELLARS IN WHICH THE FIRST GASSINGS OF CAMP-PRISONERS TOOK PLACE ON NOVEMBER 3rd, 1941

Site	Place	Sample No	Concentration of CN^- in µg/kg
Auschwitz	cellars of Block 11	13	28, 24, 24
		14	20, 16, 16
		15	0

Note: The CN^- content in a sample of diatomaceous earth – a component of Zyklon B (material from the Museum, sample No 24) – was 1360 µg/kg, 1320 µg/kg and 1400 µg/kg.

TABLE III. CONCENTRATIONS OF CYANIDE IONS IN SAMPLES TAKEN FROM THE CREMATORIUM CHAMBERS (OR THEIR RUINS) IN WHICH THE VICTIMS WERE GASSED.
A – Sample No;
B – Concentration of CN^- (μg/kg).

Crematorium I							
A	16	17	18	19	20	21	22
B	28	76	0	0	288	0	80
	28	80	0	0	292	0	80
	26	80	0	0	288	0	80
Crematorium II							
A	25	26	27	28	29	30	31
B	640	28	0	8	20	168	296
	592	28	0	8	16	156	288
	620	28	0	8	16	168	292
Crematorium III							
A	32	33	34	35	36	37	38
B	68	12	12	16	12	16	56
	68	8	12	12	8	16	52
	68	8	8	16	8	16	56
Crematorium IV							
A	39	40	41	42	43	–	–
B	40	36	500	trace	16	–	–
	44	32	496	0	12	–	–
	44	36	496	0	12	–	–
Crematorium V							
A	46	47	48	49	50	51	52
B	244	36	92	12	116	56	0
	248	28	96	12	120	60	0
	232	32	96	12	116	60	0

Notes:
Crematorium I at Auschwitz – building preserved but reconstructed several times
Crematoria II–IV at Birkenau – ruins. Only the ceiling of the chamber of Crematorium III is in part fairly well preserved.

TABLE IV. CONCENTRATIONS OF CYANIDE IONS IN SAMPLES COLLECTED IN THE FACILITIES FOR THE FUMIGATION OF PRISONERS' CLOTHES

Site	Place	Sample No		Concentration of CN^- in μg/kg
Auschwitz	Block No 1[(1)]	1		4, 4, 4
		2		0
		3, iron hook		0
		4, piece of wood from a door		0
	Block No 3[(2)]	5		0
		6		900, 840, 880
		7		0
		8		16, 12, 16
		Two series of determinations were made in block No 3 in 1990	I	70, 30, 74, 142, 422
			II	118, 52, 80, 60, 214
Birkenau	Bath-house Camp B1-A	53[(3)]		24, 20, 24
		53a[(3)]		224, 248, 228
		54[(3)]		36, 28, 32
		55[(3)]		736, 740, 640
		56[(4)]		4, 0, 0
		57[(5)]		840, 792, 840
		58[(5)]		348, 324, 348
		59[(6)]		28, 28, 28

Notes:
(1) Dwelling quarters next to cobbler workshop and disinsectization chambers
(2) Disinsectization facilities
(3) Materials taken from dark-blue stains on the outer side of the building wall
(4) Mortar taken from the outer side of the building wall
(5) Plaster taken from dark-blue stains on the inner side of the building wall
(6) Plaster from white walls inside the building

TABLE V. CONCENTRATIONS OF HYDROGEN CYANIDE AND/OR ITS COMBINATIONS IN MATERIALS SAMPLED 48 HOURS AFTER FUMIGATION

	Fresh plaster		Fresh mortar		New brick		Old brick	
Sort of material	dry	wetted	dry	wetted	dry	wetted	dry	wetted
Concentration of CN^- in µg/kg	24	480	176	2700	4	52	20	0

After a lapse of one month the concentration of hydrogen cyanide and its combinations in the materials examined decreased on the average by 56% (from 28% to 86%). An apparent rise in the concentration occurred only in single samples. That is so because the samples used for examination were not always the same. When they had been used up in the first run, they had to be replaced by new samples taken from the same bigger lumps of material. This supports the thesis on the local binding of hydrogen cyanide.

The results obtained in the next series of tests, in which the materials were subjected to gassing with a mixture of HCN + CO_2 are presented in Table VI.

TABLE VI. CONCENTRATIONS OF HYDROGEN CYANIDE AND ITS COMBINATIONS IN MATERIALS SAMPLED AFTER FUMIGATION WITH HCN+CO_2

	Fresh plaster		Old mortar		Fresh mortar		New brick		Old brick	
Sort of material	dry	wetted	dry	wetted	dry	wetted	dry	wetted	dry	wetted
Concentration of CN^- in µg/kg	5920	12800	1000	244	492	388	52	36	24	60

In this case the CN^- content in mortar (old and fresh) and in new brick was for the most part lower in the wetted materials than in the dry ones. It seems that here a tendency is revealed towards the competitive action of carbon dioxide, which dissolves in water. In this series of tests fresh plaster showed an exceptionally high affinity to hydrogen cyanide.

After an interval of a month the mean decrease of hydrogen cyanide content in this material was 73% 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.

The following experiment illustrated to what extent water elutes cyanide ions. Two 0.5-gram plaster samples, previously subjected to a fumigation with hydrogen cyanide (after the determination of cyanide combinations in them) were placed on filter paper in glass funnels and either of them was flushed with 1 l of clean, deionized distilled water. The results of the test are presented in Table VII.

TABLE VII. RESULTS OF EXAMINATION CONCERNING THE EFFECT OF WATER UPON THE CONCENTRATION OF CYANIDE IONS IN PLASTER

Sample	Initial concentration (CN^- in μg/kg)	Concentration after flushing with water (CN^- in μg/kg)	Loss, in%
I	160	28	82.5
II	1200	112	90.7

Consequently, water elutes cyanide compounds in considerable measure. The fact that they have survived so long in the chamber ruins is probably due to the possible formation of cyanide combinations in the walls of those chambers at the time of their utilization from about mid-1943 to the last weeks of 1944 (except for Crematorium IV, which was blown up earlier). The significance of rainfall in the process of elution of these combinations out of the ruin walls is exemplified by Crematorium II in the Birkenau camp, where we have found the highest (mean) concentrations of cyanide compounds, because many fragments of the gas chamber were to a great degree protected from precipitation.

FINAL REMARKS

The present study shows that in spite of the passage of a considerable period of time (over 45 years) in the walls of the facilities which once were in contact with hydrogen cyanide the vestigial amounts of the combinations of this constituent of Zyklon B have been preserved. This is also true of the ruins of the former gas chambers. The cyanide compounds occur in the building materials only locally, in the places where the conditions arose for their formation and persistence for such a long time.

In his reasoning Leuchter (2) claims that the vestigial amounts of cyanide combinations detected by him in the materials from the chamber ruins are residues left after fumigations carried out in the Camp „once, long ago"(Item 14.004 of the Report). This is refuted by the negative results of the examination of the control samples from living quarters, which are said to have been subjected to a single gassing, and the fact that in the period of fumigation of the Camp in connection with a typhoid epidemic in mid-1942 there were still no crematoria in the Birkenau Camp. The first crematorium (Crematorium II) was put to use as late as 15 March 1943 and the others several months later.

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