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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Complaint of Discrimination	)	Disabilities Issues Task Force
on the Basis of Handicap	)	
Filed by the Cellular Phone	)	ET Docket 93-62
Taskforce on February 2, 1997	)	

EX PARTE COMMENTS

Attached are several Exhibits in support of the Appeal of the Cellular Phone Taskforce which was filed in the above-referenced matter on October 6, 1997, as follows:

1. Studies from Switzerland showing, and letters from the Swiss government acknowledging,as proven, a link between symptoms of radiowave sickness, or what is also known as electrical sensitivity, and electromagnetic field strength from a shortwave transmitter.

2. Study of Bergqvist and Vogel, commissioned by the European Commission, reviewing the literature on electrical sensitivity.

3. The testimony of Arthur Firstenberg in the form of an Affidavit before the High Court in Ireland in a cell phone case.

4. The Comments of the Cellular Phone Taskforce, submitted by its president Arthur Firstenberg in a rulemaking proposal in Australia.

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Respectfully submitted,

Arthur Firstenberg

December 21, 1997
Original + 1 copy

Arthur Firstenberg
President, Cellular Phone Taskforce
Post Office Box 100404
Vanderveer Station
Brooklyn, New York 11210

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Taskforce on Feb. 2, 1997	)	

ADDENDUM TO
EX PARTE COMMENTS

Attached is Exhibit 5, the Dec. 1997 issue of the Cellular Phone Taskforce newsletter, No Place To Hide.

Respectfully submitted,

Arthur Firstenberg

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December 21, 1997
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December 21, 1997

Dr. Robert Cleveland
Office of Engineering and Technology
Federal Communications Commission
2000 M Street, N.W., Room 266
Washington, DC 20554

Regarding: Appeal of the Cellular Phone Taskforce in the matter of its discrimination complaint of Feb. 2, 1997

Dear Dr. Cleveland,

Enclosed are additional documents in support of our Appeal:

1. Studies from Switzerland showing, and letters from the Swiss government acknowledging,as proven, a link between symptoms of radiowave sickness, or what is also known as electrical sensitivity, and electromagnetic field strength from a shortwave transmitter.

2. Study of Bergqvist and Vogel, commissioned by the European Commission, reviewing the literature on electrical sensitivity.

3. My testimony in the form of an Affidavit before the High Court in Ireland in a cell phone case.

4. My comments in a rulemaking proposal in Australia.

Sincerely,

Arthur Firstenberg

Arthur Firstenberg
President

Addendum: Attached is also Exhibit 5, the December 1997 issue of the Cellular Phone Taskforce newsletter, No Place To Hide.

Universität Bern
Institut für Sozial- und
Präventivmedizin

Bundesamt für Energiewirtschaft
Office fédéral de l'énergie
Ufficio federale dell'energia
Federal Office of Energy

BEW Publication Series
Study No. 55

Exhibit 1.9
Cellular Phone Taskforce
Dec. 21, 1997

Study on Health Effects of the Shortwave Transmitter Station of Schwarzenburg, Berne, Switzerland

(Major Report)

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Under the Direction of Prof. Dr. med. Th. Abelin (1)

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4 Repromed, Hamburg, Germany
5 Swiss Telecom PTT
6 Swiss Federal Office of Environment, Forests and Landscape

On behalf of
The Federal Office of Energy

August 1995

Eine Zusammenfassung existiert auf deutsch
Il existe un résumé en langue française

Vertrieb EDMZ: 805.755

Abstract

Objective: The purpose of this study was to establish an association between ill health and the electromagnetic field of the Shortwave radio transmitter of Schwarzenburg (Canton of Berne, Switzerland).

Methods: Results from a cross-sectional health interview survey, two longitudinal studies, partly under modified transmission modes and with determination of urine 6- Hydroxy-melatoninsulfate, and further study elements were associated with measurements of electromagnetic field strength at over 50 locations.

Results:

1.) No substantial increase of any chronic disease could be found in the exposed population. The number of exposed persons is, however, too small to exclude a potential increase of lifethreatening disease. Various health complaints such as nervosity, restlessness, insomnia, general weakness and tiredness, and limb pains are more frequent in the vicinity to the transmitter. The exposed population does not show a substantial difference in personality compared to the control population.

2.) Among these complaints, sleep interruptions are directly associated with the electromagnetic field strength of the transmitter. This relationship is confirmed in several substudies, whereas the other complaints related to the transmitter seem to be secondary to the sleep interruptions. Sleep quality improved after interruption of transmission activities.

3.) 6-hydroxy-Melatonin-sulfate, as measured in early morning urine of 66 men and women, was not related to the electromagnetic field strength of the transmitter or to sleep disorder, and melatonin levels in saliva from cows were also not associated with variations of the electromagnetic field. Conclusions from the latter part of the study are, however, limited due to small numbers and other technical reasons.

4.) The number of schoolchildren at the highly exposed school is too small for conclusive studies of a poosible effect of electromagnetic fields. The accumulated promotion rate from primary to secondary school since the nineteen fifties, is lower in the exposed than in a control school. An effect of the transmitter is a possible explanation, but other influences including socio-economic differences cannot be excluded either.

5.) The exposure to electromagnetic fields does not exceed IRPA limits at any of the over 50 measurement sites.

Conclusion: Our results indicate a higher frequency of disorders of a neurovegetative nature among residents up to about 1000 meters from the transmitter, and are highly suggestive of a direct effect of the radio shortwave transmitter on sleep quality. The other complaints appear to be mediated by the sleep disorder. There was no evidence relating melatonin metabolism to electromagnetic field strength or to sleep disorder, and little indication for major health problems caused by the transmitter.

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- R. Blattmann and H. Binkeli for participation in the field work;
- U. Rogger and H. Gerber (Central Chemical Laboratory, University Hospital Bern) and A. Wunderlich and B. Manz (Repromed Hamburg) for conducting and supervising the laboratory determinations;
- the veterinarians Katherine Staerk and Ch. Griot (Institute of Virology and Immunoprophylaxis, Mittelhäusern, Switzerland) for direction and participation in the melatonin study in cows;
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- the Swiss Federal Office of Environment, Forests and Landscapes (BUWAL) for support in the exposure measurements and graphical display of results

and last but not least,

- all those men and women in the population of Schwarzenburg who patiently participated in our studies.

Theodor Abelin, M.D., M.P.H., Professor and Head, Department of Social and Preventive Medicine, University of Bern; Principal Investigator
Ekkehardt S. Altpeter, M.D., M.Sc., Research Fellow, Statistician; Principal Editor of this Technical Report.

[0]The Technical Report was written in Tex by means of Scientific Workplace. The maps were prepared by Meteotest, Bern, funded by BUWAL. Statistics and graphics were calculated by means of S-PLUS Vers. 3.3 for Windows 3.1 on a PC. Additional routines such as generalized estimating equations were provided by Statlib.

Chapter 1

Overview

1.1 Introduction and questions

1.1.1 History

The Short Wave Transmitter Schwarzenburg was put into operation in 1939. Its star-shaped main antenna was added in 1954. As a rule, a maximum of three 6.1 - 21.8 MHz antennas are active simultaneously, each with a power of 150 kW. Generally, the broadcasting direction changes every two hours. In 1971, an additional 250-kW LOG PER antenna started operating at the southern end of the Transmitter which is, however, used only occasionally as a substitute for another transmitter in Sottens. Figure 4.1 in Chapter 4 shows the usual broadcasting directions and times.

Ever since the Seventies, health complaints had been reported by the population in the surroundings of the Transmitter, and associated with its activity. On the 2nd of March, 1990, a petition was handed over by a group of inhabitants to the Swiss Federal Department of Traffic and Energy, the authority in charge of licensing the Transmitter, which asked for a scientific evaluation of the health damage allegedly caused by the Transmitter.

1.1.2 Questions

In October 1990, the Head of the Federal Department of Transport and Energy charged the Federal Office of Energy with setting up a study group chaired by Dr. J. Cattin (Head of the Section Energy Management), starting work in April 1991. The following questions served as base of the present study:

1. Are health complaints and disturbances in the near surroundings of the Transmitter more frequent than in more remote areas?

2. If so, are these in a biophysical relation with the electromagnetic fields of the Transmitter, and is there a plausible mechanism for this?

3. If the population in the surroundings of the Transmitter is too small to allow answering certain questions, are there reasons to justify further research, and of what size would a suitable study population have to be?

4. Do the electromagnetic exposures in the surroundings of the Transmitter exceed acceptable exposure levels?

1.1.3 Procedural considerations

Based on the information of the petitioners as well as on the scientific literature which is, however, rather scarce in the area of the health consequences of electromagnetic fields in the radio frequency range, a list of diseases and complaints was made, the frequency of which was to be established in differentially exposed populations in the vicinity of the Transmitter. It included symptoms such as sleep disturbances, headache, tiredness, irritability, lower back pain and limb pain (commonly often referred to as psychovegetative complaints) on the one hand, and serious, but rare diseases such as cancer and diabetes, which had been emphasized by the petitioners, on the other. From the beginning on an obvious problem was that many of the open questions were not just related to the population in the surroundings of the Transmitter, but reflected a generally insufficient scientific knowledge about the health effects of electromagnetic fields within the radio wave range.

The objective of the first phase of the study was to find out whether any complaints or diseases were more frequent in persons who were exposed to stronger electromagnetic fields, and to establish the health problems which they represented. In order to answer these questions, the population was divided into differently exposed sub-populations according to the distance of their residences from the Transmitter, as well as based on direct exposure measurements. While this was done, however, it became clear that the population living in the near surroundings of the Transmitter was too small to allow for proper examination of realistic risk differences for rare diseases.

In the summer of 1992, an extensive health interview survey was conducted among this population. In order to differentiate between direct (biological) and indirect effects (caused or intensified by fear), the interview included questions on social background, personal history and personality of the interviewed persons.

A few weeks after the health interview survey , a health diary survey was conducted, which was connected with experimental changes in broadcasting directions. In this study, randomly selected persons of different exposure status kept an exact record on their complaints and health status during 3 times 10 days. The purpose of this survey was on the one hand to verify the answers of the health interview survey by using another method, and, on the other hand, to find out if the relationship of sleep disturbances with

measured exposure was maintained, when the Transmitter was no longer directed towards the housing of the concerned persons. The statistical data analysis of the experimental part of the health diary survey turned out to be very time-consuming and could not be made since a part of the measurements of the effective electromagnetic field in various living areas was then missing. However, the data are now available and are included in the present report.

After the health interview survey and the health diary survey had shown a relationship between various psychovegetative disturbances and complaints, first of all sleep disturbances, and the Transmitter, further means of distinguishing between biological and psychological mechanisms in causing sleep disturbances were looked for.. For that purpose, another health diary survey was conducted, connected with an experimental 3-day interruption of all transmitting activities. Questions to be answered were: if and with what delay sleep disturbances decreased after the Transmitter had been switched off; and if the sleep disturbances could be explained by a relationship between the neurohormone melatonin and the Transmitter's operation. According to the scientific literature, a mutual effect of this type could be expected. The melatonin study was completed by a substudy in which dependence of melatonin levels on the intensity of electromagnetic fields was examined in dairy cows.

Finally, a study of schoolchildren tried to answer question raised by the petitioners, concerning the influence of the Transmitter on psychological performance capacity of children; this study was, however, limited due to small numbers of schoolchildren.

The investigations were completed by intensive measurements of the electromagnetic fields in the residency zones of the examined persons and animals. The measurements were performed by Telecom Switzerland under supervision of the competent departments of the Federal Institute of Technology. Their statistical analysis as well as the analysis of the health data was carried out at the Institute of Social and Preventive Medicine of the University of Bern.

1.2 Study design, methodology and the course of work

1.2.1 Division into population groups with different levels of exposure

The population in the surroundings of the Transmitter was divided, with regard to their electromagnetic exposure, in two ways. At first, three populations, A, B, and C with a high, medium and low exposure, were defined according to the distance from the Transmitter, and then compared with

one another with regard to the frequency of diseases and complaints. Figure 3.1 in Chapter 3 depicts the division into Zones A, B, and C.

Exposure measurements of the magnetic field strength for each broadcasting status at 56 outdoor measuring sites in the immediate neighbourhood of the residencies (utilizable: 55 measuring sites with 2621 measured values) confirm this division and allow differentiated analyses including multivariate time series analysis. These measurements were completed by automatic measurements of electric and magnetic field strengths in 44 bedrooms of the examined persons. A total of 1578 measurements were performed every 15 minutes between 6 p.m. and 6 a.m. Technical details are given in Chapter 4.

1.2.2 Health interview and personality tests

Inhabitants of Zones A and B who were ready to participate, and a randomly selected group of inhabitants of the more remote Zone C were interviewed about their health. The interview included questions about diseases (infectious diseases, cancer, diabetes etc.), complaints, shortcomings and past illnesses; personal characteristics (education, occupation, place where spare time is spent etc.); characteristics of the housing status (influence of electromagnetic fields of the Transmitter on electrical appliances in the household); and daily activities. Refusal of individual question was possible. A part of the participants underwent a voluntary personality test (a standardized personality test known as Freiburg personality inventory) which made it possible to examine differences in personality characteristics between the Zones.

One hundred and nine persons were interviewed in Zone A, 120 in Zone B and 170 in Zone C; out of these interviews 107, 119 and 178 could be utilized. The response rates were 73.3%, 55% and 56.3%. Personality tests were made in the three Zones by 62, 63, and 66 persons.

Health diary survey I

Within a period of 3 times 10 days, the participants kept record of all occurring symptoms and complaints in 1-hour intervals by means of a symptom checklist ("diary"); it inquired about acute complaints such as sleep disturbances, headache, vertigo etc.

During the time of this inquiry the broadcasting directions of various programs were changed in a random sequence so as to make the electromagnetic exposure of the population differ from its usual pattern. A statistical analysis was to examine if the changes in the broadcasting modus were followed by changes in the frequency of symptoms and complaints. This analysis could not yet be conducted. But it was possible to use this health diary survey as a base for examining the relationship between electromag-

netic exposure and sleeping disorders, after taking into account the modified emissions from the Transmitter

1.2.3 Health diary survey

In the summer of 1993, another health diary survey was conducted with the purpose of verifying the findings of the first survey by means of an experimental 3-day interruption of all broadcasting activities. Simultaneously, urine (morning urine) samples were collected from all participants for analysis of melatonin excretion. The study lasted 10 days; after the second night, the Transmitter was switched off for 3 days.

1.2.4 Melatonin study

The urine samples were tested with focus on 6-hydroxy melatonin sulfate a derivative of the neurohormone melatonin; this was done by means of a serological test (ELISA-test) partly in the central laboratory of the University Hospital of the University of Bern (Insel), partly by the Company Repromed in Hamburg. The first hypothesis ("chronic effect") examined whether the melatonin level is lower in more strongly exposed persons than in those with a weaker exposure (Zone A > Zone B > Zone C). According to the second hypothesis ("acute effect"), it was expected that after switching-off the Transmitter, the melatonin level in usually more strongly exposed persons will increase again. Since it is known that melatonin improves sleep quality, it was moreover expected that persons with a decreased melatonin level would show a deteriorated sleep quality, which would improve upon switching off the Transmitter.

In a pilot study of dairy cows, a group of 5 more strongly exposed and a group of 5 weakly exposed cows were compared during the same 10 days. The sample collection for melatonin determination took place every 2 hours with the help of saliva swabs especially adapted for this study. Sleep quality could not be examined in this case.

1.2.5 Further sub-studies

Chronic diseases:

Within the scope of the health interview survey, the participants were asked whether they had ever suffered from and been medically treated for certain diseases such as cancer, increased blood pressure, diabetes etc.

The frequencies of answers between Zones A, B, and C were compared. In order to increase the number of the examinees, the interview inquired about those who had lived in the same building before the interviewed persons. This, however, did not lead to any sufficient additional information.

Increased blood pressure:

The results of the health interview survey suggested a certain deviation from the norm of blood pressure of more strongly exposed persons. This finding was verified by blood pressure measurements of those who had reported increased blood pressure in the interview, and of a randomly selected group of persons who had considered their blood pressure as normal.

Schoolchildren:

Finally, an approach was needed to scientifically examine the effect of the Transmitter on exposed schoolchildren. The current numbers of schoolchildren in the exposed school (which volunteered to participate) turned out to be too small to allow for a serious examination by means of tests. It was, however, possible to compare accumulated promotion rates from primary to secondary school since the inauguration of the exposed school in the Fifties, with those of a school in Zone C.

1.3 Results

1.3.1 Health interview survey and personality tests

Based on the analysis of the health interview survey, it became soon obvious that with a decreasing distance from the Transmitter and with an increasing measured magnetic field strength an increasing part of the population reported various complaints; the difference was felt more strongly by older study participants (above the age of about 45 years) than by younger ones. This was most evident and constant in the case of sleep disturbances, with disturbances of falling asleep and in maintaining sleep were of similar frequency. Figure 1.1 shows the frequency of various disturbances and complaints in the 3 Zones A, B, and C, distinguished by age. In addition to the sleep disturbances, symptoms such as nervousness, general weakness and tiredness, headache and limb pain showed the same pattern. In medicine, these are included in the concept of "psychovegetative disorders. There were no obvious differences between the Zones as far as other symptoms including lower back pains and palpitations of the heart were concerned.

A thorough examination of these results showed that the findings could not be explained by differences with regard to age, sex, marital status, educational degree, occupation, experience with disturbances of household appliances in consequence of electromagnetic fields effect or personality characteristics. After correction for various interfering factors, sleep interruption was significantly correlated to the measured field strengths whereas other complaints were related with the Transmitter only indirectly, through sleep interruption.

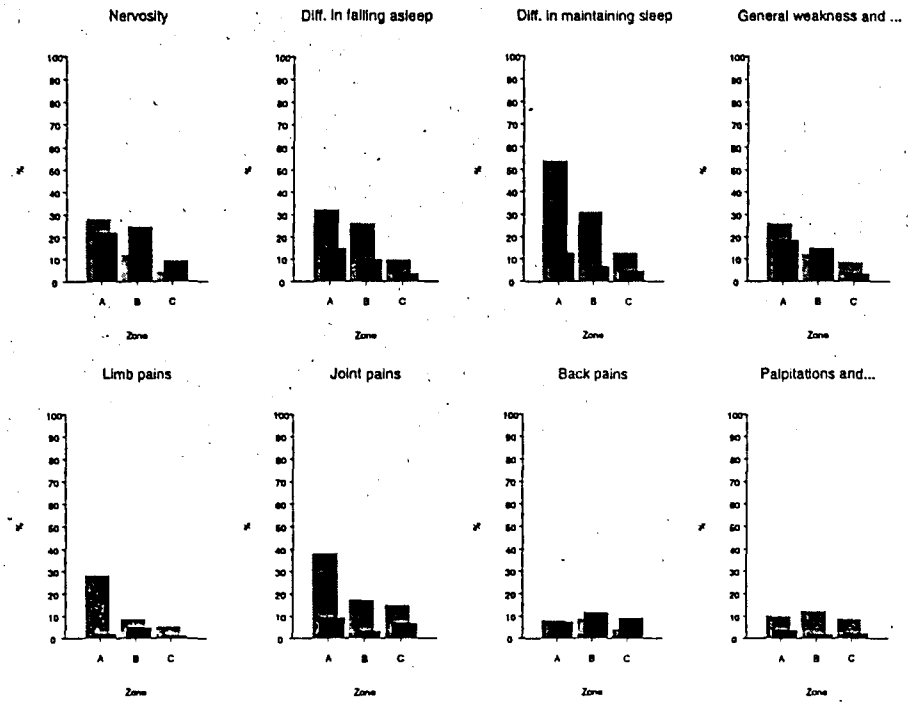

Figure 1.1: *Frequency of different psychovegetative disorders by Zone A, B and C. The light barts concern the persons aged over 45 years, the dark once aged 45 or less.*

An interesting additional finding was that the population of the most strongly exposed Zone A spent their spare time outside their living area significantly more frequently than the unexposed population.

Findings concerning chronic diseases and blood pressure will be dealt with later in this report.

1.3.2 Health diary survey I

The analysis of the health diary survey I with its thousands of information components, as well as of the corresponding detailed field strength measurements under various broadcasting conditions turned out to be especially time-consuming, and actually surpassed he limits of the available computer hardware and statistical programs capacities. The diary entries by 2 x 70 (e.g. 70 in each of Zones A and B) and 47 (Zone C) persons were sufficiently complete to allow statistical analysis.

The diary entries on sleep disturbances were in consistence with the statements made in the interview, although, as it is common in similar

investigations, certain discrepancies could not be avoided.

As a principal result, sleep disturbances were significantly more frequent with increasing strength of the electromagnetic field in time and space, even when the experimental reduction of the exposure (change in broadcasting direction) was taken into account . The odds ratio per 10 mA/m was 1.13, (95% confidence interval 1.04 - 1.23).

1.3.3 Health diary survey II

Equal numbers of persons with and without sleep disorders were invited from Zones A, B, and C to the second health diary survey, conducted between the 5th and 15th of September, 1993. Out of a total of 102 invited persons, 12 persons from each Zone without sleep disturbances and 12 (Zone A), 9 (Zone B) and 8 (Zone C) persons with sleep disturbances agreed to participate. The number of 60 participants, calculated as necessary, was thus surpassed. From the 7th to the 10th of September the broadcasting operation was interrupted.

It turned out that the shut-down of the Transmitter was followed with 1-day delay by a statistically significant improvement of sleep quality as recorded in the diaries. Apart from this, the differences between more and less strongly exposed persons, observed in the preceding sub-studies, were confirmed.

1.3.4 Melatonin study

Study of humans:

During the 10-day experimental period, morning urine was collected from the 65 participants of the health diary survey II. They were deep-frozen and transported to the laboratory. The melatonin laboratory analysis, which is not a standard offer of medical laboratories, turned out to be rather difficult. To secure measurement reliability, tests were done both at the Bern University Hospital, and Repromed Company in Hamburg which supplied the reagents.

It became obvious that melatonin levels were independent of the magnetic field strength of the Transmitter. The interruption of the broadcasting operation was not associated with a change in measured melatonin levels. The hypothesis of an effect of electromagnetic fields on melatonin metabolism and, as a consequence, on sleep quality, as it had been derived from the scientific literature, could thus not be confirmed for the frequencies and field strengths existing in the vicinity of the Transmitter.

Study of cows:

As in the human study, the analysis of saliva samples collected every 2 hours from 10 cows in differently exposed stables, could not find evidence for an association between melatonin levels and magnetic field strength. Neither the geographical comparison (chronic effect), nor the longitudinal observation after the shut-down of the Transmitter brought statistically significant results. The diagram showing 24-hour cycles of melatonin levels suggested an effect, as the shutdown of Transmitter was followed by increased nightly maximum values of melatonin in saliva. But these differences, observed visually in the diagram, were not statistically significant; as a result, it cannot be said whether they were real or purely accidental. The figures of this pilot study were, however, small, and further study of the problem would be of interest. This study confirmed again the reliability of the laboratory examinations as the expected day-night melatonin rhythm was clearly demonstrated.

1.3.5 Further sub-studies

Chronic illnesses:

The health interview survey questions concerning chronic diseases brought no remarkable results. Diabetes was found 5 times each in Zones A, B and C, cancer 4 times in Zone A, twice in Zone B and 3 times in Zone C. These figures are clearly too small for serious statistical analyses. The question about former inhabitants of the same buildings did not result in a significant increase of the figures. There is surely no alarming increase in incidence of cancer or other chronic diseases in the surroundings of the Transmitter; combined studies in the vicinity of several shortwave transmitters would be necessary to examine possible smaller risk increases.

Increased blood pressure:

A verification by means of blood pressure measurements confirmed, with few exceptions, the statements of the interview; it, however, did not allow to confirm the finding that blood pressure depended on electromagnetic exposure or on the distance from the Transmitter.

Schoolchildren:

In the light of the participants' allegations a detailed study with focus on performance and psychological health of children living and attending school in the exposed zone would, on the whole, be desirable. Such a study, however, turned out to be of insufficient value due to the small number of children attending at present the exposed school. The comparison of the accumulated promotion rates from primary to secondary schools revealed a statistically

significant disadvantage of the pupils from the school situated in the vicinity of the Transmitter. The interpretation of this difference must, however, remain open, as promotion is not based on a standardized procedure. The low promotion rate could also be explained by the structure of the exposed population (more adults without complementary education). As in the case of other questions, an examination of the problem within larger population groups would be desirable; this would, however, be possible only in combined international studies.

1.4 Discussion

In our investigation of the relationship between the electromagnetic field of the Radio Transmitter of Schwarzenburg and the health of the population living in its surroundings, we had to overcome the same difficulties which have frequently posed problems in studies on environment and health: The problem of small population numbers which can make conclusive studies impossible. In the present study, this was the case for the questions on chronic diseases, and for the investigation of schoolchildren. Another problem of this type was to differentiate between biophysically caused disturbances of well-being and complaints caused or enhanced by anxiety related to the influence of an unknown radiation factor.

Taking into account existing constraints, we practically exhausted the possibilities provided for such a study. The objective of answering the questions formulated at the outset was largely reached, and the following presentation and discussion of conclusions should take the results into account.

Question 1:

> *Are health complaints and disturbances in the surroundings of the Shortwave Transmitter Schwarzenburg more frequent than in more remote areas?*

A concentration of health disturbances in the sense of actual physical disease such as cancer could not be shown in this study. An increased risk, for example of cancer, of an extent which would call for protective measures can be excluded. Our observations are in agreement with the fact that no excess of cancer has ever been observed worldwide within the frequency range of transmitters' electromagnetic fields. Neither in the case of humans nor of cows did the present study establish a relationship between melatonin levels and transmitter-produced magnetic fields; this can be considered as a reassuring fact, since, according to the current state of knowledge, a reduction of body-produced melatonin could play a part in causing cancer.

The population living in the strongly exposed surroundings of the Transmitter is, however, too small to allow demonstration of slightly increased risks; this forces us to leave this question open.

A statistically highly significant excess was established in the more strongly exposed population in case of sleep disturbances and with regard to a number of health complaints such as nervosity, inner restlessness, limb and joint pains and general weakness and tiredness; these cannot be explained by characteristics of the examined groups with regard to such factors as age, sex, social and economical situation.

Finally, the question of possible consequences of the Transmitter's activity on psychological performance of schoolchildren was examined; this examination,too, was strongly limited due to small numbers. An analysis of promotion rates from primary to secondary schools (accumulated for the period since the exposed school had been opened) showed slightly lower rates for the exposed than for an unexposed school. Although too much significance should not be attributed to this finding, it yet justifies further studies, including larger numbers of pupils,than would be possible in the surroundings of the Shortwave Transmitter of Schwarzenburg.

Question 2:

> *In case that health complaints and disturbances are more frequent in the near surroundings of the Shortwave Transmitter of Schwarzenburg than in remoter areas, are these in a biophysical relation to the Transmitter-produced electromagnetic fields, and is there a plausible mechanism for this?*

The question whether the observed sleep disturbances can be related to a biophysical or to a psychological mechanism was examined intensively. It was possible to show under experimental conditions in which broadcasting activities had been stopped without previous notification of the examined persons; that a reduction of the electromagnetic exposure was followed by an improvement of sleep quality as registered in the diary. This leads to the conclusion that the Transmitter has a direct (e.g. not only psychological) effect on sleep quality. However, no plausible biochemical mechanism for this relationship could be found. The hypothesis that this relationship can be explained by the often postulated melatonin mechanism was not confirmed. Based on our results the Shortwave Transmitter of Schwarzenburg produces electromagnetic fields in a frequency range and of such intensity which do not change melatonin levels.

Question 3:

If the population in the surroundings of the Shortwave Transmitter of Schwarzenburg is too small, are there any essential factors which would justify further examinations, and of what size would a suitable study population have to be?

Based on the small population size in the surroundings of the Shortwave Transmitter of Schwarzenburg, some observations make more profound studies of radio transmitters' effect appear desirable in at least in three areas:

- It was already mentioned that there was no indication of a substantially increased risk of cancer, and that larger population groups would be necessary for examining of the presence of a slight increase. To be able to demonstrate a 50%- increase of cancer risk and assuming 2.6%positive answers in the general population in a study design similar to ours, at least 2500 persons in the exposed and 5000 in the unexposed group would be needed. In order to recruit such large numbers of exposed persons, a major international study including several radio transmitters would be needed.

- Due to small numbers of schoolchildren, a study by means of psychological and pedagogical tests could not be conducted. The necessary number of schoolchildren can be calculated only when the type of tests and the specific hypotheses to be examined are defined.

- The examination of melatonin levels in cows, considered as a pilot study, did not result in a significant association with the Transmitter's operation. The graphical presentation of the results, however, gives the impression that the nightly peak values of melatonin increased slightly after the Transmitter had been turned off. To further examine this question, which is mainly of scientific interest the study of larger livestocks would be necessary. But again, it would be premature to calculate exact numbers before precise study questions have been formulated.

Further progress could also be reached in studies conducted under controlled laboratory conditions. In such studies, volunteers could make available their blood or saliva specimen for determination of melatonin several times per night, which would come closer to the study of cows presented here. Such a study, however, would go beyond responding to the petitioners' demands.

Question 4:

Do electromagnetic exposures in the surroundings of the Transmitter exceed the acceptable exposure levels?

The guide lines for acceptable exposure levels of magnetic field strength were not exceeded at any of the numerous measuring sites at any point in time. This is reassuring and in agreement with the fact that no significant increase of the frequency of physical disease could be found. But in view of the observation of a relationship between the Transmitter and sleep quality by this study, the question arises as to whether the present guide lines for acceptable magnetic field strengths should not be adapted. In this case, the inhabitants of Zone A as defined in this study would have to be re-classified as excessively exposed.

1.5 Conclusions

It does not belong to the objective of this study to make suggestions for practical consequences which might result from the presented investigations. Few considerations, however, appear appropriate to us:

- There is no immediate danger to the population living in the surroundings of the Transmitter, and there is no reason for urgent protection measures.
- On the other hand, it was clearly demonstrated that the Transmitter is associated with a marked deterioration of the sleep quality of the most exposed group of persons, which amounts to a considerable affection of well-being. It will be up to the responsible bodies to review current guidelines for acceptable exposure levels in the light of this observation.
- As in the context of other immissions (air pollutants, noise), all technically and operationally possible and economically feasible steps should be taken to reduce exposure. This principle of environmental protection has to be given increased significance in the current situation, both in the context of continued operation of the existing and of the potential planning of new transmitting facilities.
- It could be that in individual cases persons in the nearest surroundings of the Transmitter affected by sleep disturbances might make claims related to the Transmitter. Current knowledge will, however, hardly allow to prove such a relationship in an individual case with sufficient certainty .The question must be left open whether the shown statistical relationship is sufficient for decisions with material consequences, similarly as is the case with certain occupational diseases.

- Further studies concerning the health consequences of electromagnetic fields within the range of shortwave radio transmitters are necessary, but are considered as belonging to basic science. As far as further epidemiologic studies are to be concerned, in view of necessary population sizes, they will have to be international multicenter studies. The present study may be of use in this context and should therefore be published in the international scientific literature.