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Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555

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In the Matter of
Carolina Power and Light Company and
North Carolina Eastern Municipal Power Agency
(Shearon Harris Nuclear Power Plant, Units 1 and 2)
Docket Nos. 50-400 and 50-401 OL

Dear Administrative Judges:

Enclosed for your information is an English translation of the German study provided by Dr. Bassiouni. Copies of this translation are also being served on all the parties to this proceeding.

Sincerely,

Janice E. Moore
Counsel for NRC Staff

Enclosure: Studies of the Effects of Waking Signals
on Sleepers with Different Depths of Sleep
and Dispositions

cc w/encls.: Service List

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FINAL REPORT

on research project:

Studies of the effects of waking signals
on sleepers with different depths of sleep
and dispositions.

* Numbers in margin indicate foreign pagination

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1. Summary

The following report is an account of studies of the reaction capacity of sleepers in relation to the length and depth of their sleep. The measurements were carried out in rooms in the Federal Air Raid School at Waldbroel during the period from 1.1561 to 11.8.61. A total of 617 test subjects - students at the school - were tested on 98 test days. The waking signal used was the howling sound of an air raid siren. When the results were evaluated, the hearing capacities of the test subjects were taken into account by means of audiometric measurements.

Since the effects of waking signals on the sleeper are felt least during the period of deep sleep, the main focus was on this period of time when evaluating the results. For this period of the least sensitivity to stimulus, experiments yielded a waking quota of 60% at a waking signal loudness in the sleeping areas of 60 dB; i.e. with the house walls muffling an average of 10-15 dB of sound, the waking signal has to have a loudness of at least 70-75 dB outside the building, in order for a sound level of 60 dB to be reached in the sleeping areas, thus achieving a waking quota of 60%. A decrease in the loudness of the waking signal of 5 dB caused an average decrease in the waking quota of 7%.

In addition, an attempt was also made to show that the length of the air raid siren signal used as a warning does not need to exceed 60 seconds even for the period of deep sleep.

2. References

/4

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2. Nora, G. and Sapir, M., The healing of sleep, Paris, Masson 1954.
3. Kaiser, W., The Békésy audiometer at the Technical College in Stuttgart, Acust. 1951-52, AB 235.
5. Meister, F.J., Acoustic Measurement in Hearing Testing. Karlsruhe, 1954.
7. Schober, F.W., On the relationship of the upper hearing limit to age, Acust. 1951-52, AB 219.
6. Langenbeck, B., Guidelines to Practical Audiometry. Stuttgart 1952.
8. Siegmund, G., Sleep and Sleep Disturbance, [illegible].

3. Objectives and limits of the study

Research into the depth of human sleep was first begun in the second half of the last century [1, 2]. These studies were carried out using all kinds of waking stimuli (sound, light, touch, heating and cooling, electrical stimulus, etc.). Generally, the result was found to be a curve, the so-called sleep depth curve. The parameters of this curve were the length of the period of sleep and the degree of the waking stimuli. The increasing discrepancy in results that came about with the growing number of studies could be explained by the difficulty of comparing these stimuli and by the psychological effects of the stimuli on the sleepers. Thus, we could not simply use the results of earlier studies, but the reactions to the waking signal used for our tests had to be determined. In order to obtain generally applicable results, it seemed a good idea to carry out the tests on several test subjects at the same time and to determine the sleep depths and dispositions of the sleepers only by changes in intensity and not by means of varying the waking stimuli. It was decided against changing the waking signal, since the object was to study the effects of air raid siren signals on sleepers of different dispositions and sleep depths, i.e., the individual significance of this specific waking stimulus, and thus the susceptibility of sleeping persons to such signals. Since the levels obtained determine directly the sound level that must prevail outside the building, conclusions can in turn be drawn from this as to the number and form [text missing]...

4. Description of the measurement system

/6

In order to obtain supporting information about how strong the waking signals from conventional air raid sirens needed to be for sleepers with different depths of sleep and dispositions, it was necessary to find suitable ways of providing the test subjects with air raid signals of a certain loudness at selected predetermined times of the night. The reaction of the subjects to

these signals was to be observed by means of a light signal system activated by the test participants themselves. The measurement system required for these studies was installed in the Federal School of the Federal Air Protection Association in Waldbroel where classes and courses take place at regular intervals. Since these courses lasted on average one week and after this period of time the participants changed, the possibility of the total test result being influenced by the peculiarities and habits of the individual test subjects was excluded entirely.

The measurement system for providing the air raid signal and at the same time recording the waking reactions was divided into two main parts:

a) the sound production system and b) the reporting system. Figure 1 shows the plan of the entire system.

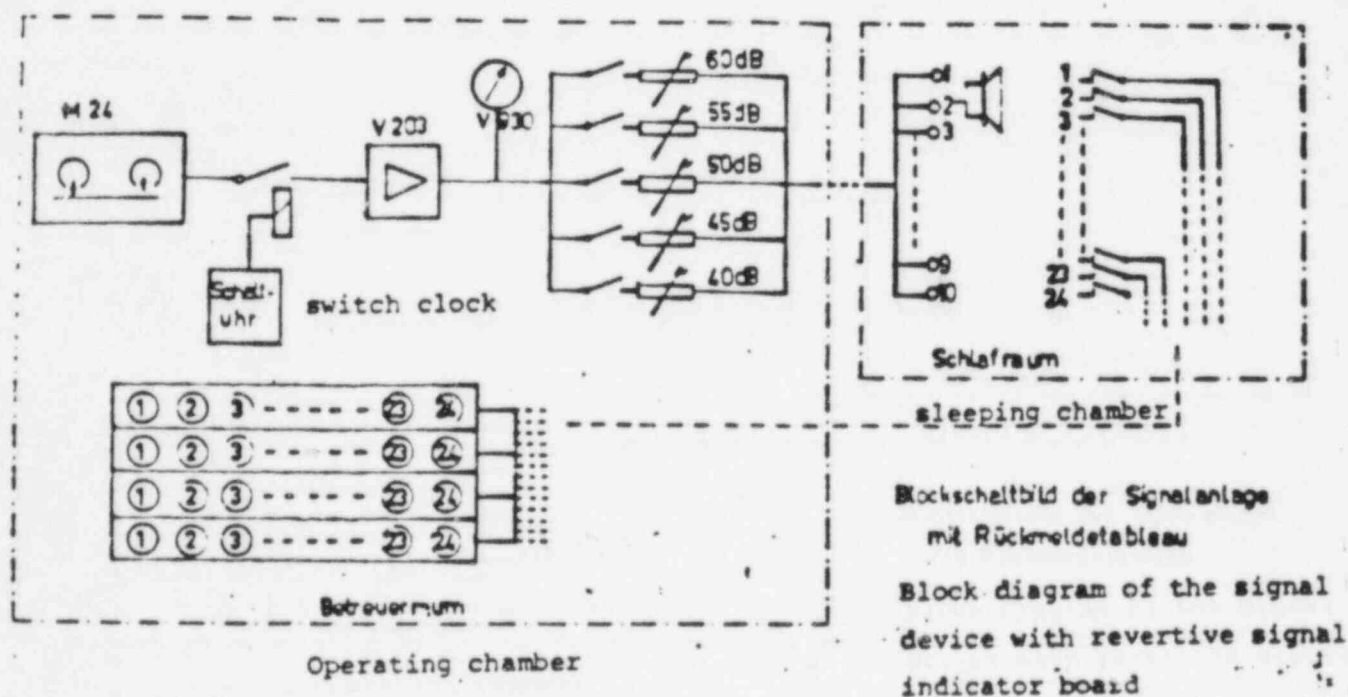


Figure 1

a) Sound production system.

The waking signal chosen was the scream of an air raid siren; this waking signal was played by a tape recorder (Telefunken M 24). The length of the signal could be varied by a timer progressively from 4x10 sec. to a maximum of 4x70 sec. = approximately 5 minutes. The outlet of the amplifier led via an indicator device (control (illegible) for determining the exact sound level) to the inlets of five muffling elements. These muffling elements were arranged in such a way that when the first element was switched on there was a sound level in the room of 60 dB. The other loudness regulators were graduated at intervals of 5 dB below one another so that the following sound levels [illegible and text missing]...

1.	Daempfungsglied:	60 dB
2.	"	: 55 dB
3.	"	: 50 dB
4.	"	: 45 dB
5.	"	: 40 dB

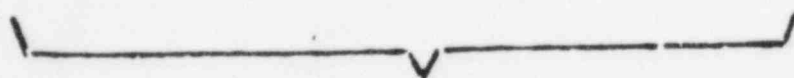
[daempfungsglied = muffling element]

b) Reporting system.

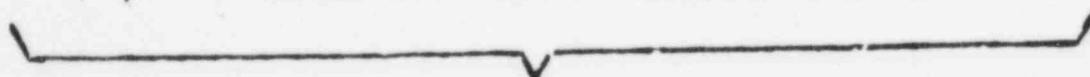
The recording program for a maximum of 24 persons was carried out automatically with the aid of a signal panel. Upon becoming aware of a signal, the test subject activated a switch that released a relay on the signal panel and thus caused a number to light up; in this way a number was assigned to each test subject on the panel. The signal panel contained four rows of numbers so that all 24 numbers were repeated (illegible) times, corresponding to the (illegible) partial periods of equal length (Figure 2) into which the whole waking period was divided; only during the time period of the first three partial periods was the waking signal given in the sleeping areas, i.e., if, for example, the switch clock was set at 1x30 sec. = 2 min. waking period, then the signal was broadcast

by the loudspeaker only for a period of $3 \times 30 \text{ sec.} = 1.5 \text{ min.}$ In /9
 this way, those sleepers could also be determined whose suscept-
 ibility and reaction times were greater than the waking period of
 the first three partial periods of the waking signal; thus the
 reactions of the sleepers to this waking signal could still be
 recorded during the fourth period of a time span that corresponded
 to 30% of the effective waking period.

1. Partial per.	2. partial per.	3. partial per.	4. partial period
1. Teilper.	2. Teilper.	3. Teilper.	4. Teilper.



Dauer des Signals duration of the signal



Zeitdauer zur Registrierung des Signals
 duration of time for registering the signal

Figure 2

The warning system was put into operation according to a program worked out by the Phonetic Institute; pages [ill.] show the programs worked out during the testing period for setting the signal system. Then the data from the signal panel were transferred to an appropriate diagram (an example of one of these diagrams is shown on page 62 [German text]).

a) Participants

The test subjects were people taking courses at the Federal Air Raid Protection School in Waldbroel. Since the ages of the participants ranged from 16 to 70, and the participants came from the most varied professions and sociological backgrounds, the results obtained over a long period of time can be considered representative of a large section of the male population.

b) Waking signal

The types of waking stimuli were already determined by the objective of the studies. In selecting the signal it was very important for the psychological effect of the waking signal to imitate as closely as possible the natural frequency of air raid siren signals. For this purpose, the howling sound of a 5 KW air raid siren was recorded on tape used to make a test tape that could be used in the [ill.] test system. Fig. 3 shows the results of a frequency analysis of one of these siren signals¹.

Since these tests were carried out with a maximum loudness of [ill.] dB and a minimum loudness of 40 dB, the sound study is largely limited to a frequency range of [ill.] Hz. /11

¹ Measured via quinten filter (distance of 30 m from the siren) on 7.10.58 in Butzbach/Hessen.



Fig. 3

c) Audiometry

Since the participants in these studies represented a cross-section of almost all age groups and professions, it was necessary to make a generally applicable determination of the reaction capacities of the participants, i.e. to determine their hearing capacities.

Essentially three subjective methods of measuring the hearing capacity can be differentiated:

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evaluative measurements¹⁾, comparative measurements²⁾, and measurements of threshold curves [3]. Since in the case of waking stimuli it is not a question of evaluations as described nor of comparisons of two sounds, the hearing capacities were tested using the last method [4], by determining the hearing threshold curve [5,6]. In this method, the observer determines, depending on the frequency, at which time the measurement tone is no longer discernible, or becomes discernible again.

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Normal hearing within the frequency range being used for measurement was important for these studies, i.e. anomalies between 200 and 2000 Hz had to be taken into account in the evaluation and possibly eliminated. On the other hand, the decrease in the upper hearing range, i.e. normal hearing loss associated with age, did not need to be taken into account at all, as even at an advanced age hearing loss does not go below a frequency of 3000 Hz. [7]. Hearing losses resulting from working conditions or other circumstances also did not need to be taken into account, as long as they did not fall within the frequency range of 200-2000 Hz. Figures 4 - 7 show the average normal hearing ranges of four age groups.

¹⁾ In the case of evaluative measurements, the observer asks the subject to rank a tone, for example, "half as loud" or "twice as loud" as another tone.

²⁾ In the case of comparative measurements, the loudness of an unknown sound is compared to one that is known.

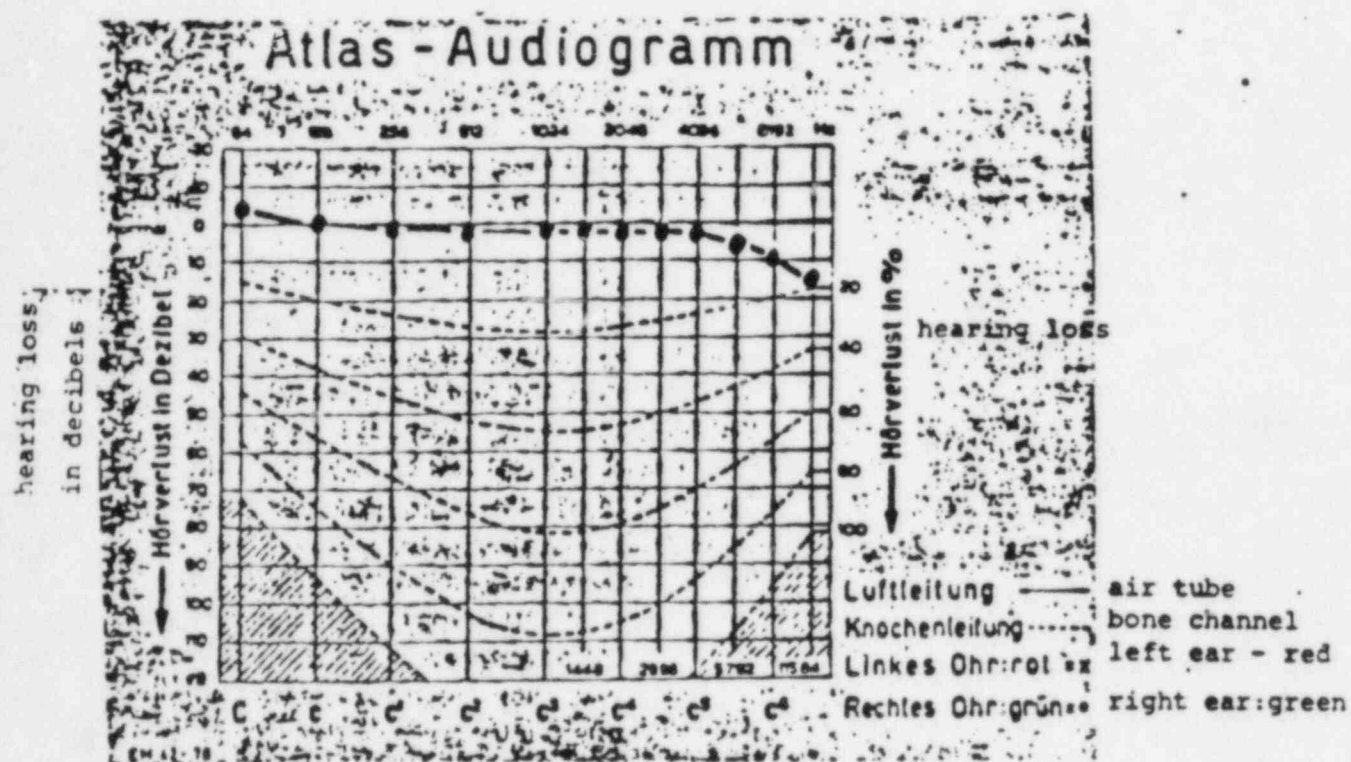


Fig. 4

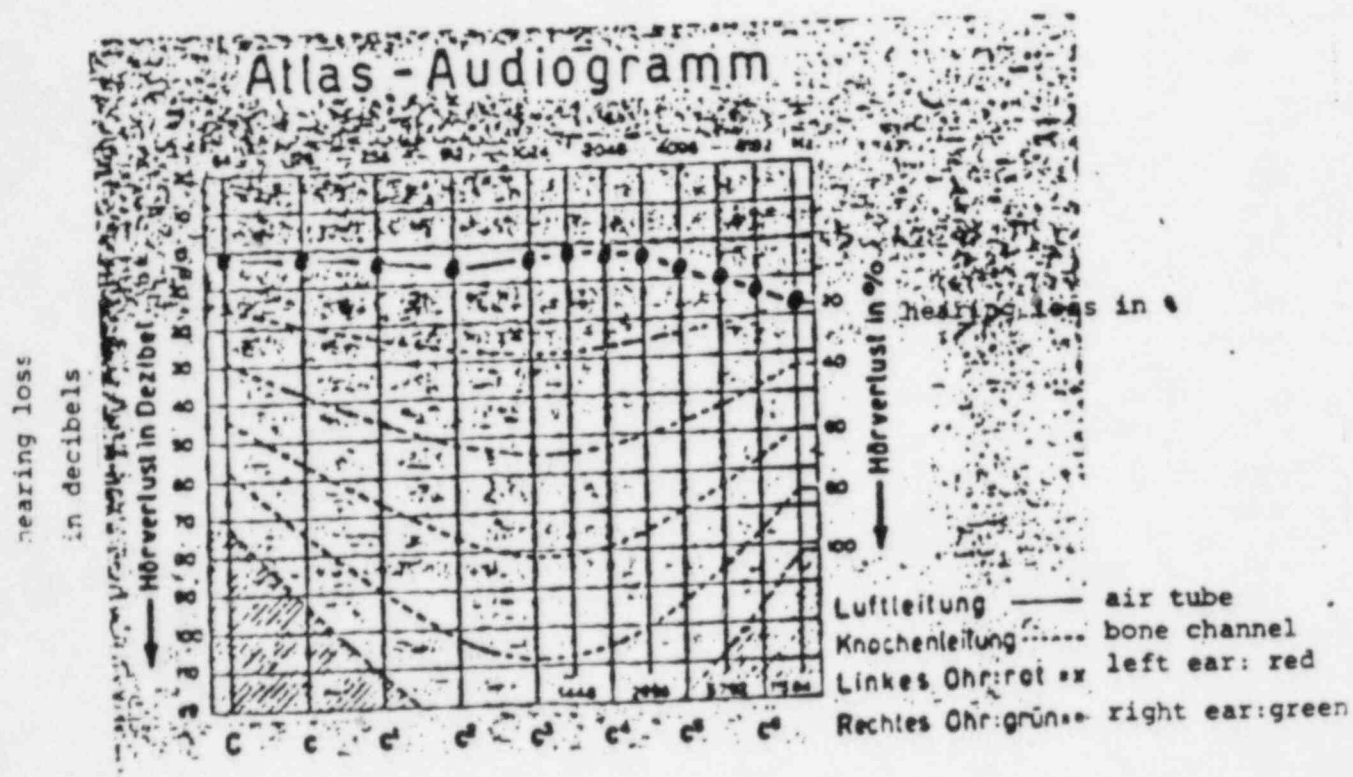


Fig. 5

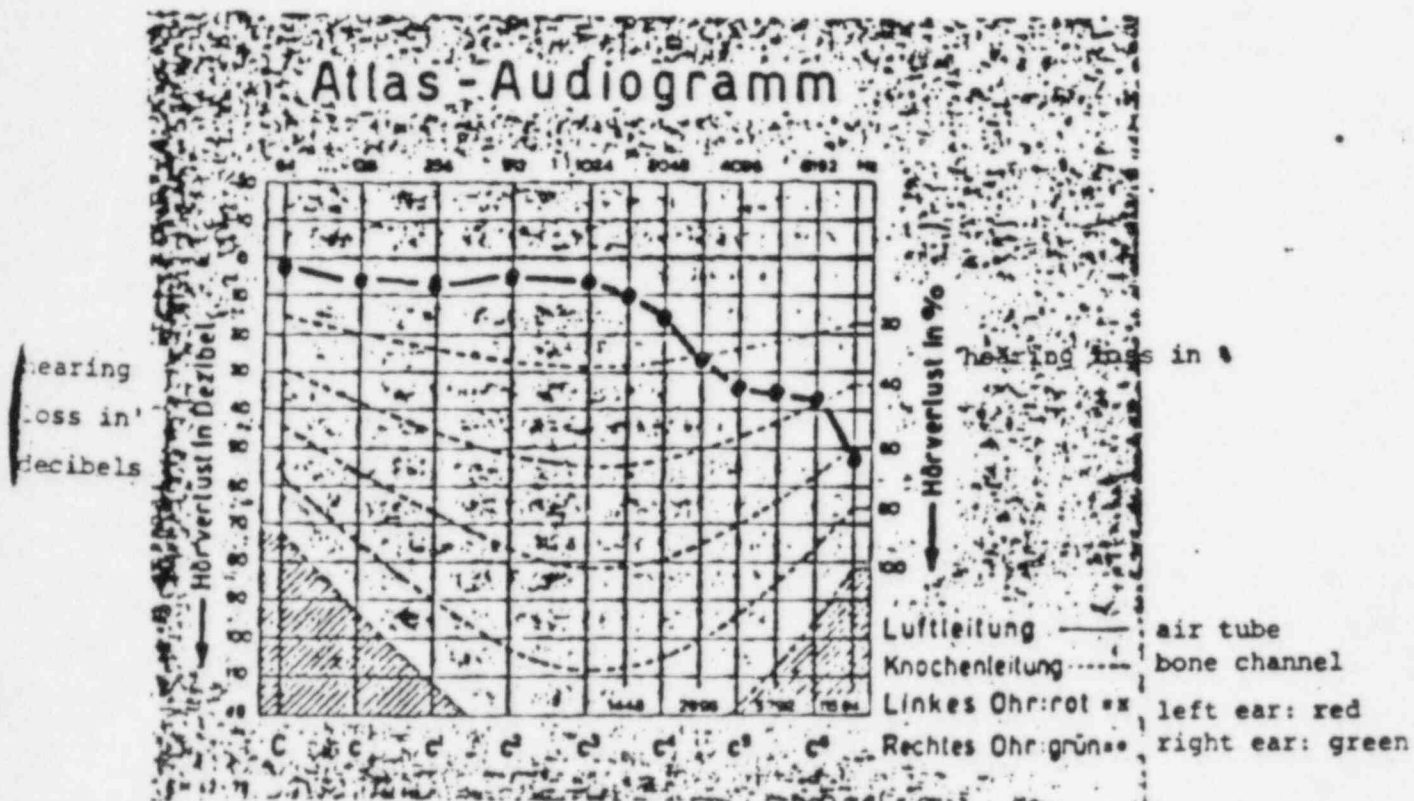


Fig. 6

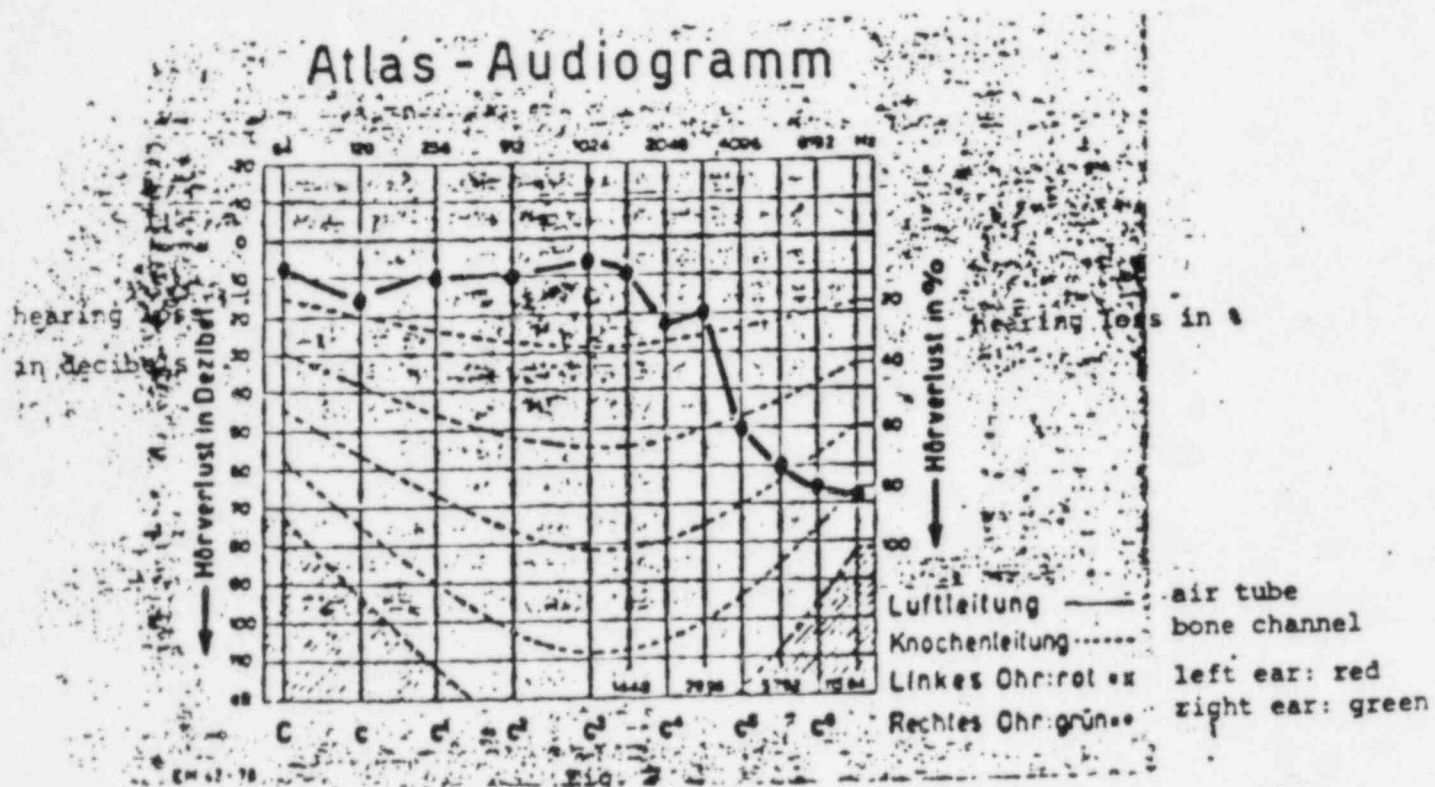


Fig. 7

The sleeping period was set from 0 - 5 o'clock; 60 minutes were divided into 4 measurement periods, so that the sleeping period from 0 - 5 o'clock was divided into 21 possible waking times. In order to cover all the possible waking patterns, given 21 possible waking times and 5 degrees of loudness, 105 individual measurements were necessary (the degrees of loudness ranged from 40 - 60 dB in 5 dB steps). Since one course at the Federal Air Protection School generally lasted one week, after subtracting the days of arrival and departure there remained only 4 measurement days at the most in one week, or rather 4 nights. The results were obtained during the period from 1.15.61 to 11.8.61. Measurements were taken on 98 days and 617 test subjects were tested, the average age of the participants being 43.88 years.

The most important results were obtained in two parts:

a) Determination of the reaction capacity

The depth of sleep and thus the reaction capacity of the test subjects was measured in relation to the duration of the waking stimulus and its loudness. When determining the duration of the signal, an effort was made to reach an optimum between the reaction time and the sensitivity to irritation, i.e. the duration of the signal was to be measured in such a way that the perception time could not be too short nor yet too long so that the waking signal would be considered a disturbance or an annoyance. A waking signal duration of 45 sec., or a time period of 1 minute for recording the signal, appeared to us to be optimal in this respect.

The division of the degrees of loudness into five graduations of 5 dB each had the following effect on the waking quota¹⁾.

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¹⁾ By waking quota is understood the sum of the waking figures measured during the partial periods; Figures 11,13,15,17,19,21-30 give the waking figures, while Figs. 12,14,16,18,20 and 31 show the waking quotas.

The waking quotas were calculated per loudness gradation from the sum of the waking figures without any consideration of the time of night. For the five loudness gradations the following pattern emerged:

Phase 1 (60 dB) : waking quota = 79%
Phase 2 (55 dB) : waking quota = 72%
Phase 3 (50 dB) : waking quota = 66%
Phase 4 (45 dB) : waking quota = 59%
Phase 5 (40 dB) : waking quota = 52%

Evaluation of these data would give the following picture: with a decrease in sound level of 5 dB, the waking quota was reduced by about 7%.

Since, however, no calculation of the time entered into the waking quotas given above, and the values for the different [ill.] represent average values, accordingly the calculated percentage reduction in waking quotas of 7% should be considered a guiding value. Therefore, for certain times of the night there are deviations from this value that are greater, the deeper the sleep at that point in time.

In general, human sleep can be divided into three phases (Fig. 8):

a) the time of so-called deep sleep, b) a transition zone that leads from deep sleep to c) the zone of shallow sleep. This chronological sleep curve pattern can be detected in the waking quotas measured for all degrees of loudness., as is shown by Fig. 9. It can be seen here that, regardless of the degree of loudness, the deepest sleep was found between 0.00 and 1.15 a.m.¹⁾, i.e. the sensitivity of the sleeper is lowest during this period. This observation is verified by sleep curves given in the literature (Fig. 10), from which it can be seen that so-called deep sleep is reached during the first 1 - 2 hours of sleep [1].

¹⁾ Based on this observation, the period of deep sleep was found to be between 0.00 and 1.15 a.m. Obviously this time period is only valid for this series of tests.

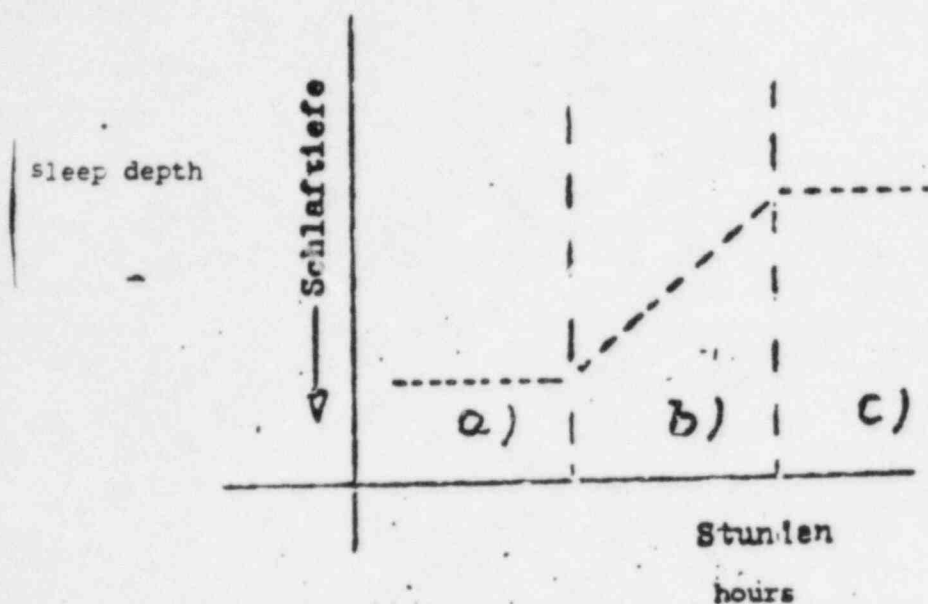


Fig. 8

The amount of sleep can be found from the product of the length and depth of sleep. At a given duration of sleep, the depth of sleep is greater, the greater the need for revival. Since the greatest sleep depth occurs during the period of deep sleep, i.e. between 0.00 and 1.15 a.m., the main focus should be on this time period for the acoustical and chronological dimensioning of the waking stimuli. The studies showed that for the period of deep sleep and using a loudness of 60 dB and a waking duration of 45 sec., on average 60% of the test subjects were awakened [11.]

at 40 dB this figure drops to about 35%. It would be natural to draw the conclusion that increasing the waking duration to, for example, 2 or 5 minutes, would achieve a more favorable waking quota. In our opinion, this would only be useful if lengthening the duration of the waking stimulus were to produce a significant increase in the waking quotas and no negative psychological effects on the population were to be expected.

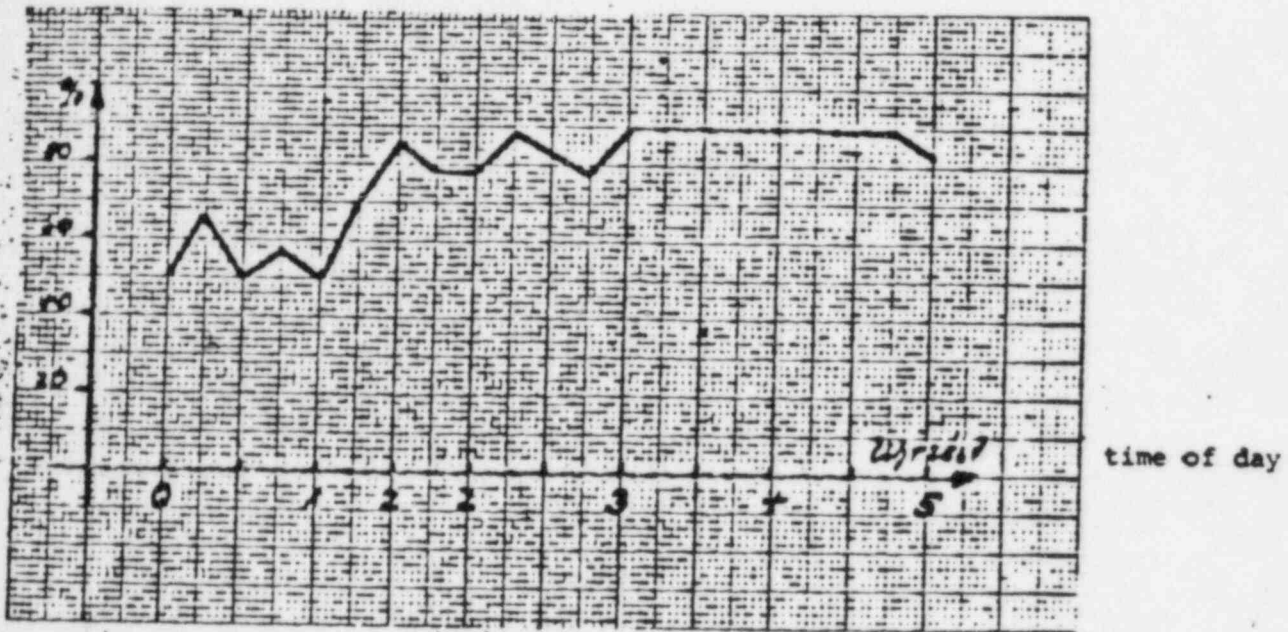


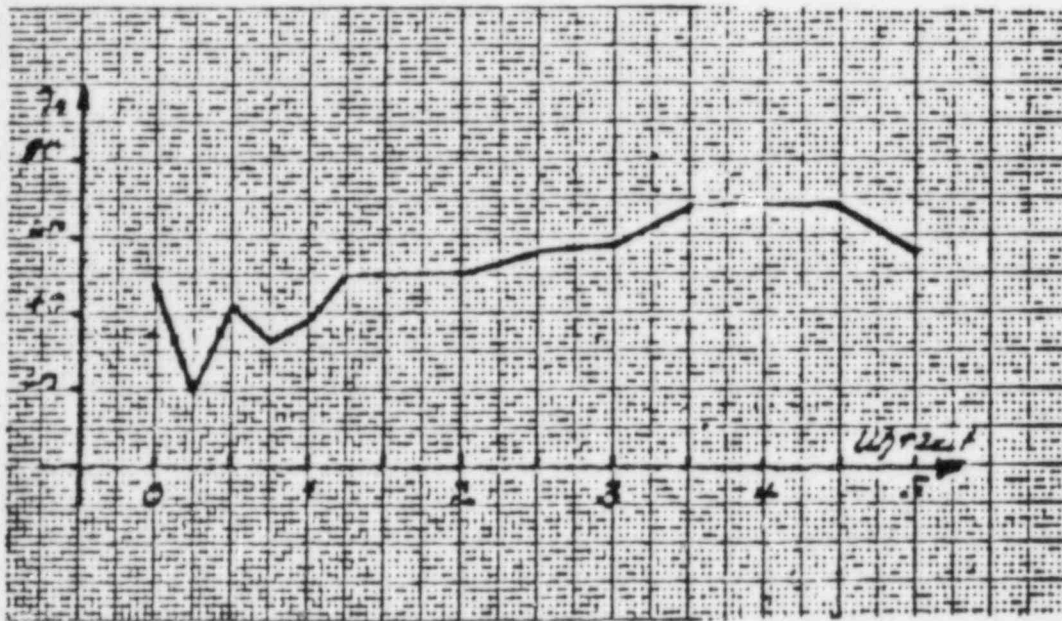
Abb. 9a
 Fig. 9a
 Lautstärke 60 dB
 loudness 60 dB

Fig. 9a



Loudness 50 dB

Fig. 9b



time of day

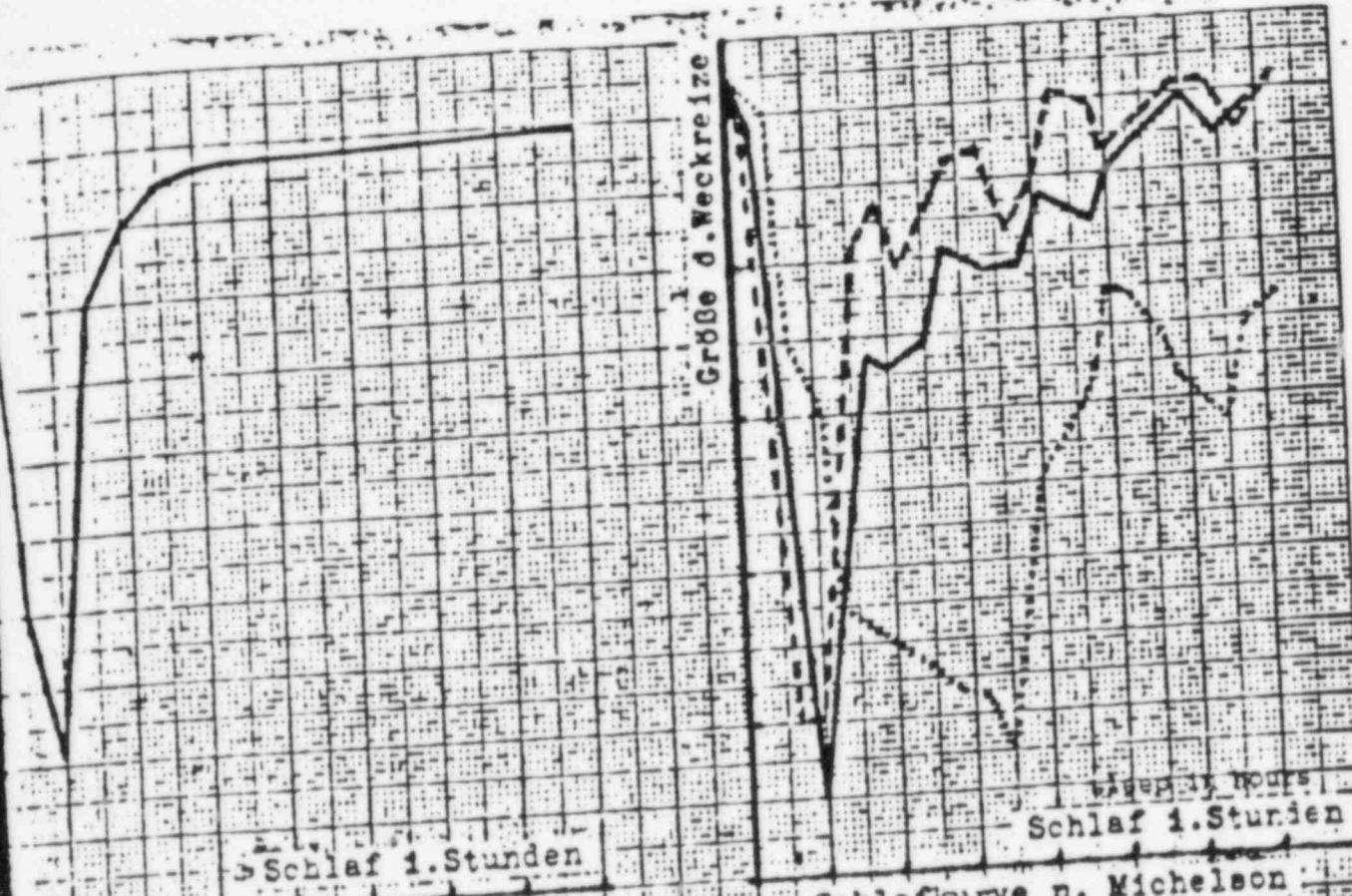
Fig. 9c

Abb. 9c

Lautstärke 40 dB
loudness 40 dB

Fig. 9c

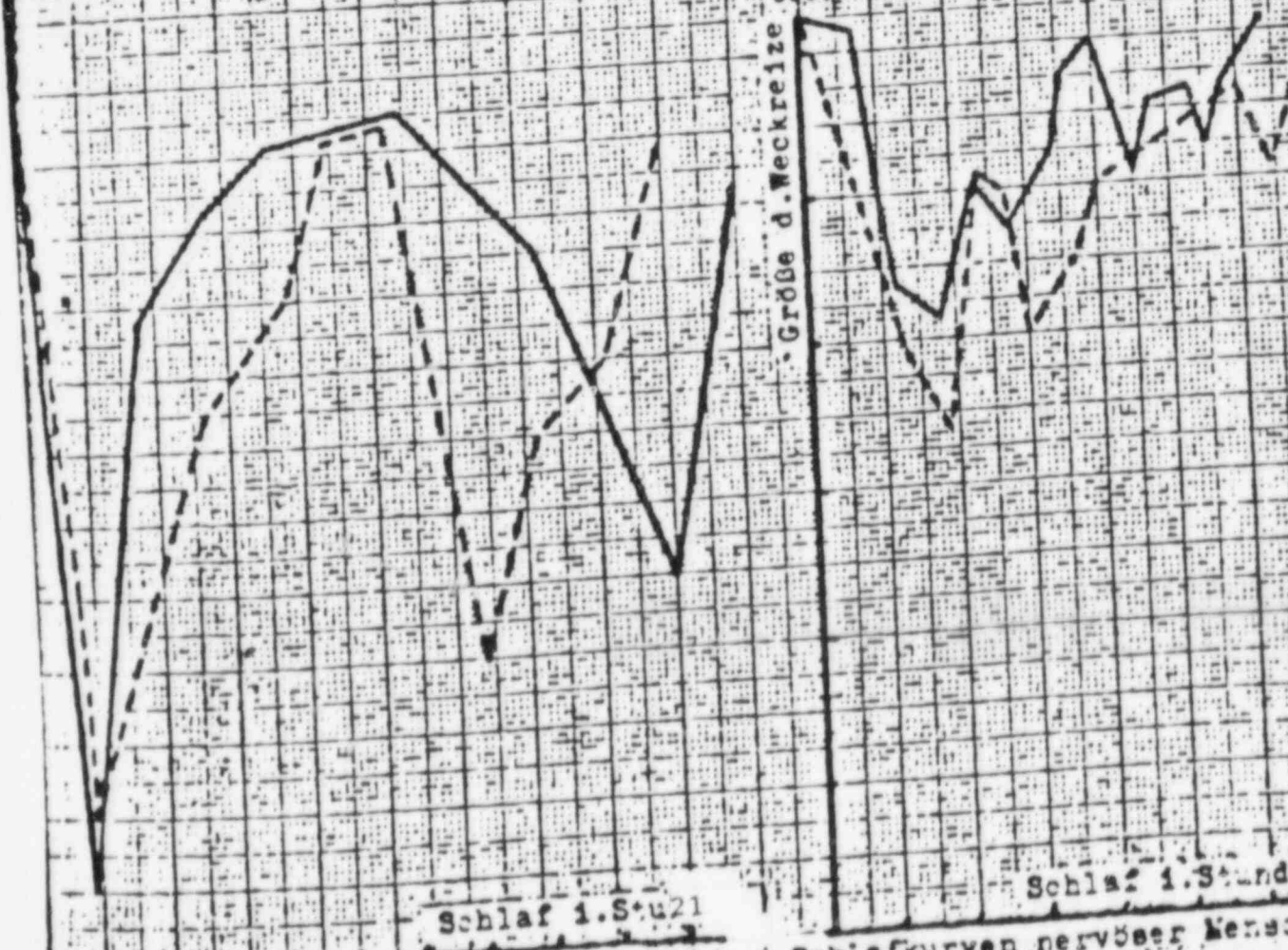
Figure 9 (a,b,c)



Schlafstiefenkurve n. Kohlschütter

Schlafkurve n. Michelson

Sleep curve according to Michelson



Sleep curves of nervous people according to Michelson

Schlaf 1. Stunden

Schlaf 1. Stunden

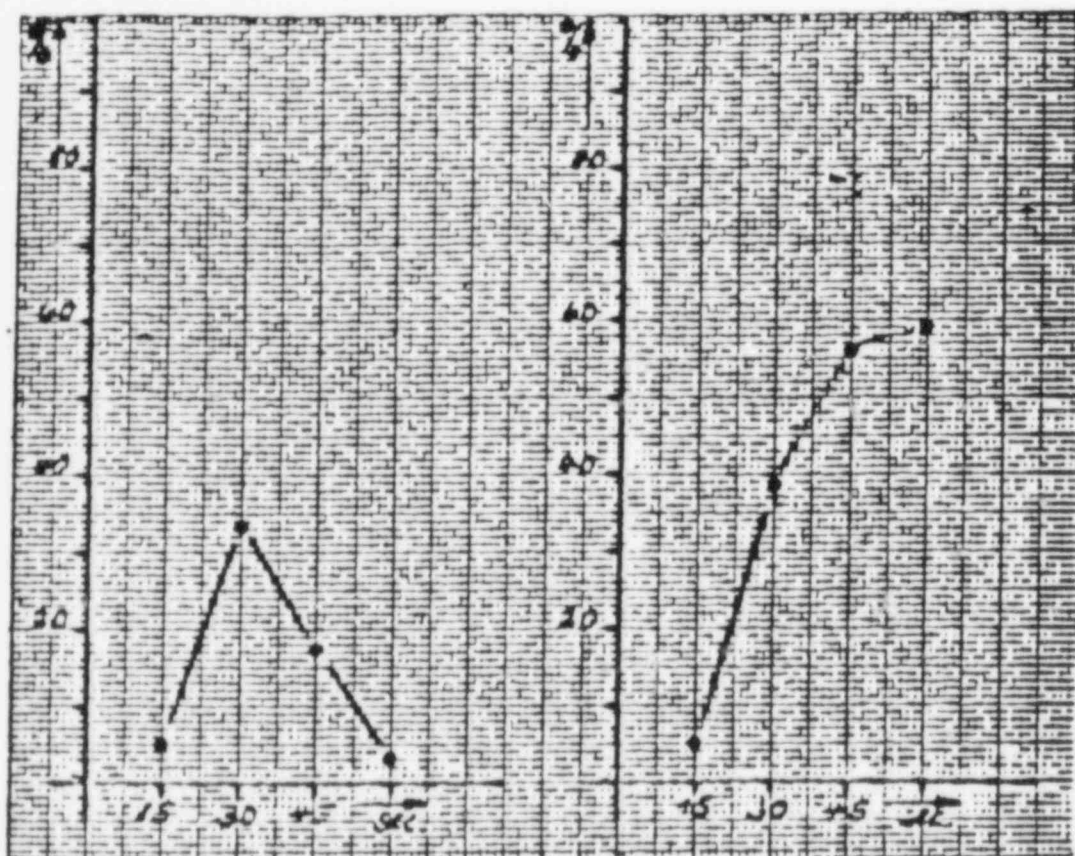
Schlafkurven nervöser Menschen

Figures 11-30 show the waking figures and ratios for the five different degrees of loudness and for different sleep periods. Figures 11-20 show the results for the period of deep sleep (cf. Fig. 8, sec. a); Figs. 21-25 show waking figures for the time between 1.30 and 2.30 a.m., Figs. 27-31 show figures for the time between 4.00 and 5.00 a.m.

A striking feature of these figures is that the curves of the waking figures almost always show the same pattern. With the exception of Figs. 26 and 27, the main waking figure is always in the second partial period of the waking time; (in the two exceptions, this main waking figure even shifted to the first partial period). This fact can also be observed in the waking curve pattern of deep sleep (Figs. 11,13,15,17,19).

This means that the duration of the waking signal of 45 seconds is sensible here.

In our opinion, this result makes it appear logical that the length of siren signals used for warning purposes does not need to exceed 60 seconds even during the period of deep sleep.



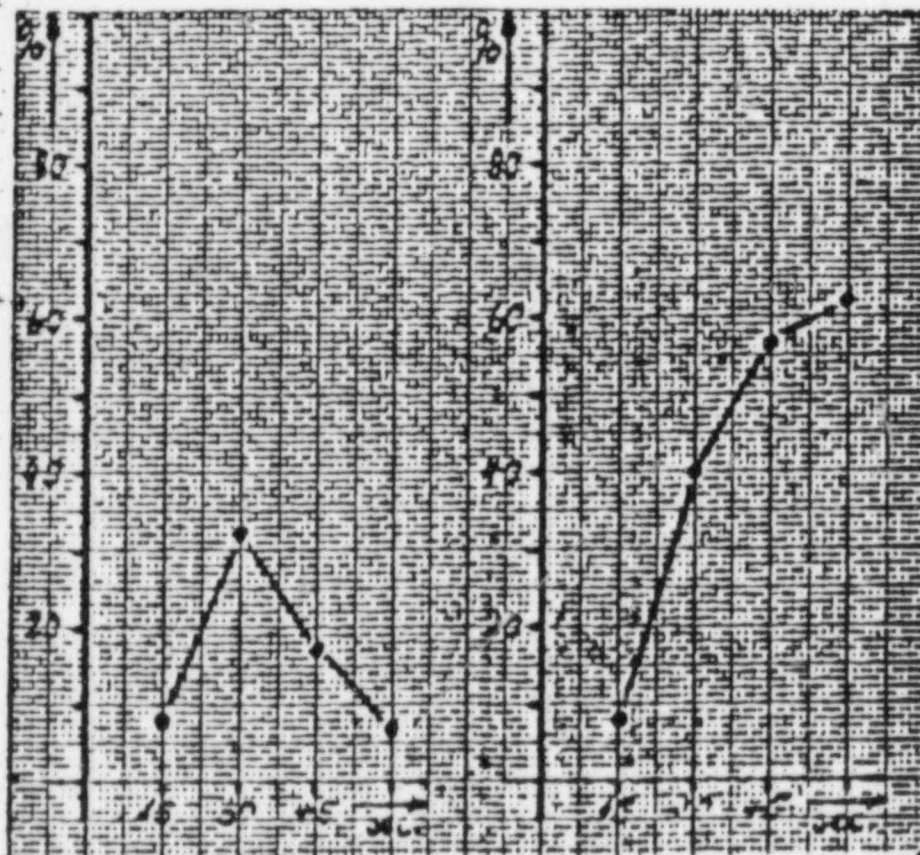
loudness 60 dB
Lautstärke 60 dB

Abb. 11 Fig. 11

Zeit des Tiefschlafes, 0⁰⁰ - 1¹⁵
time of deep sleep Abb. 12 Fig. 12

Fig. 11

Fig. 12

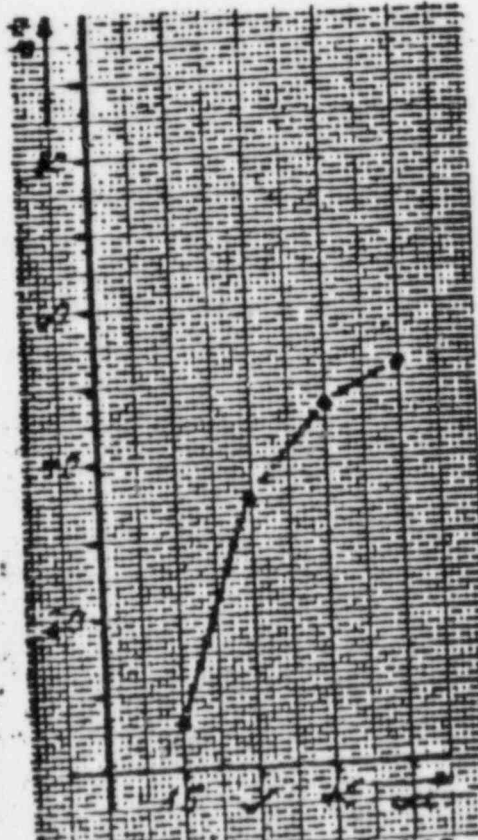


Lautstärke 55 dB
loudness Abb. 13 Fig. 13
waking numbers

Fig. 13

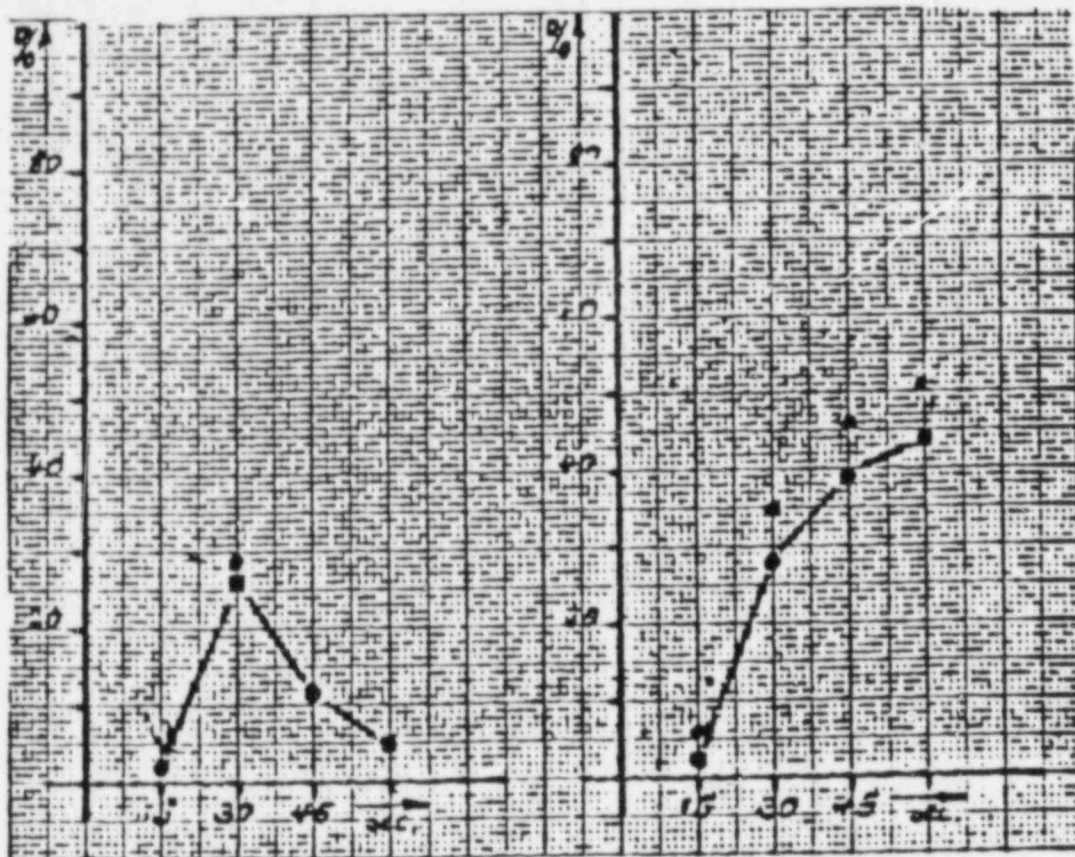
Zeit des Tiefschlafes, 000 - 115
Time of deep sleep Abb. 14 Fig. 14
waking ratios

Fig. 14



loudness
Abb. 15 Fig. 15
waking numbers
Fig. 15

Zeit des Tiefschlafes, 000 - 115
Time of deep sleep
Abb. 16 Fig. 16
waking ratios
Fig. 16

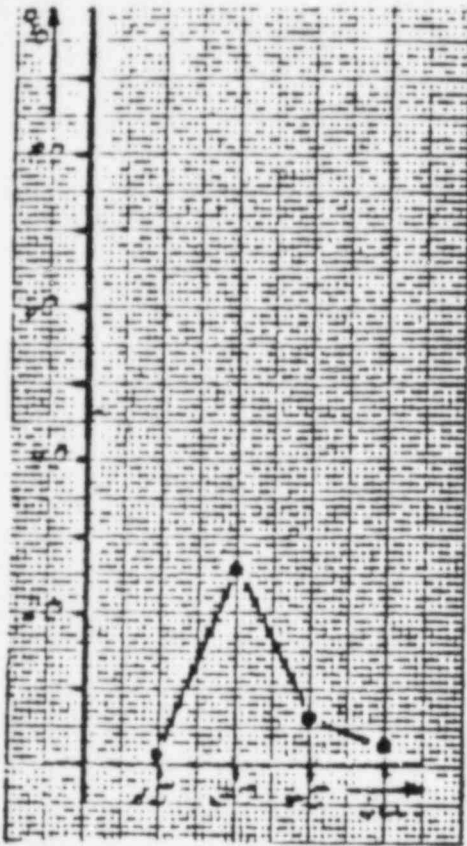


Lautstärke 45 dB
 loudness Abb. 17 Fig. 17
 waking numbers

Fig. 17

Zeit des Tiefschlafes, 0 - 15
 time of deep sleep Abb. 18 Fig. 18
 waking ratios

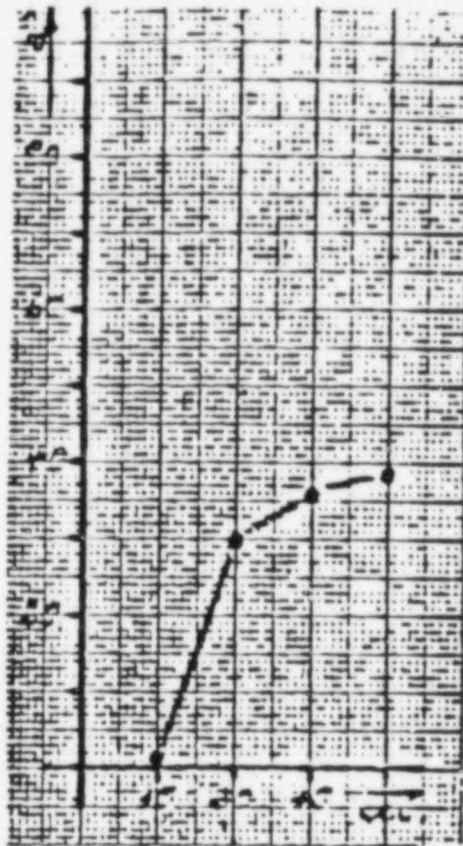
Fig. 18



Leutstärke 40 dB
loudness Abb. 19 Fig. 19

Weckzahlen
waking numbers

Fig. 19



Zeit des Tiefschlafes, 0000 - 115
time of deep sleep Abb. 20 Fig. 20

Weckquoten
waking ratios

Fig. 20

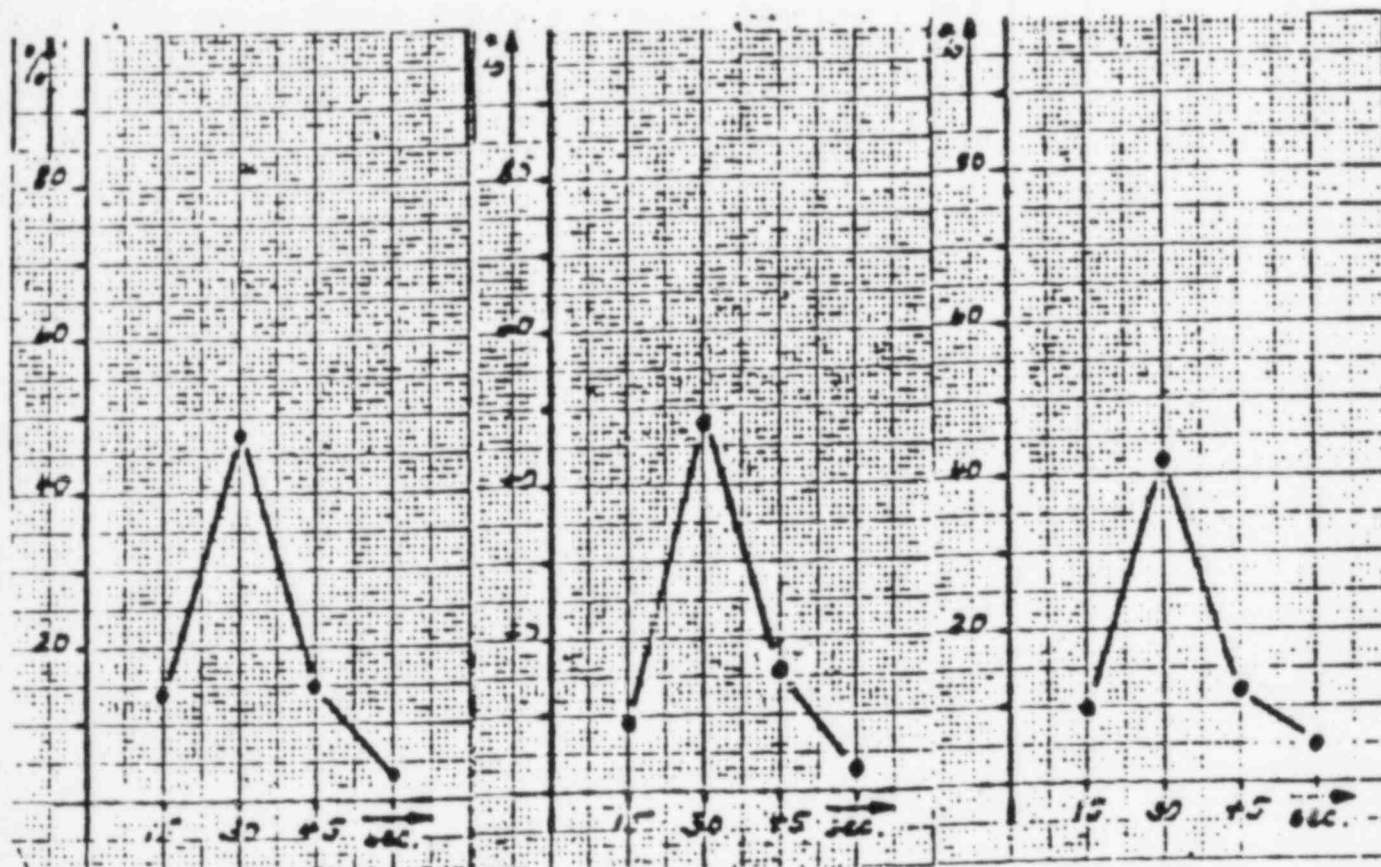


Abb. 21 Fig. 21
Lautstärke 60 dB
loudness

Abb. 22 Fig. 22
Lautstärke 55 dB
loudness

Abb. 23 Fig. 23
Lautstärke 50 dB
loudness

Fig. 21

Fig. 22

Fig. 23

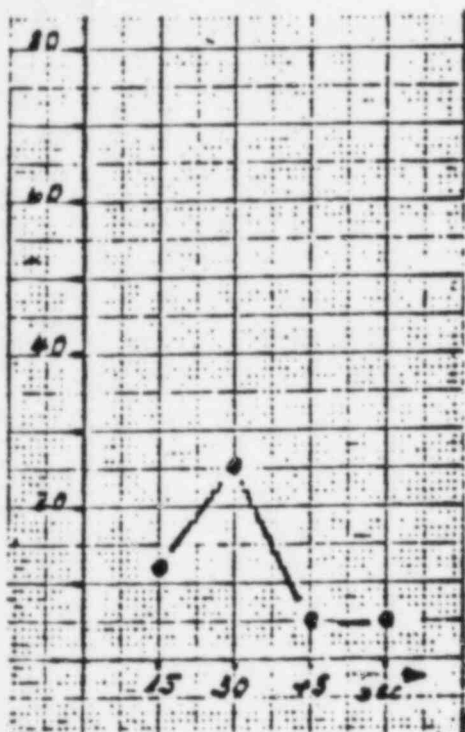


Abb. 24 Fig. 24

Fig. 24

Lautstärke 45 dB
loudness

Uhrzeit 1³⁰ - 2³⁰
time of day

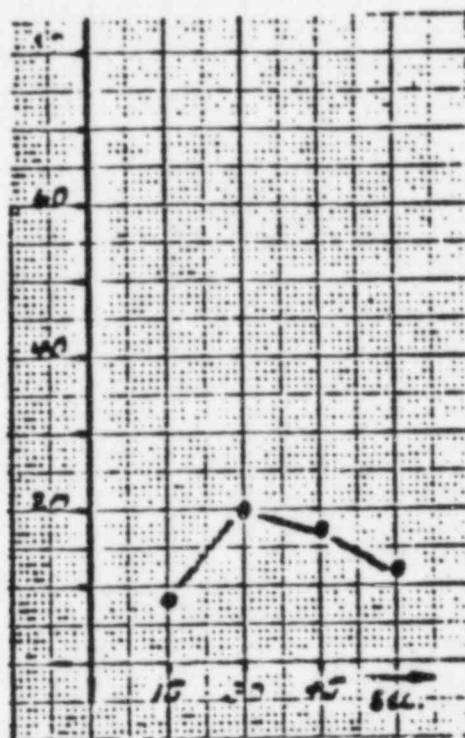


Abb. 25 Fig. 25

Fig. 25

Lautstärke 40 dB
loudness

Uhrzeit 1³⁰ - 2³⁰
time of day

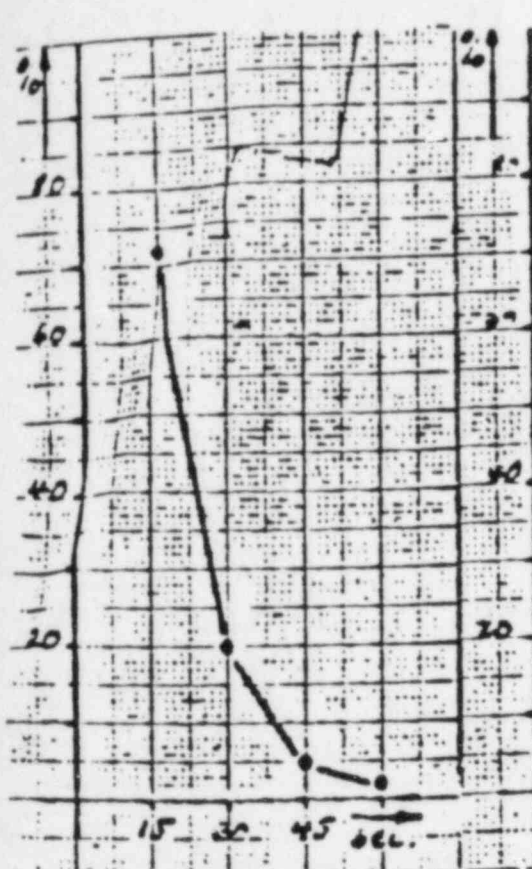


Abb. 26 Fig. 26

Lautstärke 60 dB
loudness



Abb. 27 Fig. 27

Lautstärke 55 dB
loudness
Uhrzeit 4 - 500
time of day



Abb. 28 Fig. 28

Lautstärke 50 dB
loudness

Fig. 26

Fig. 27

Fig. 28

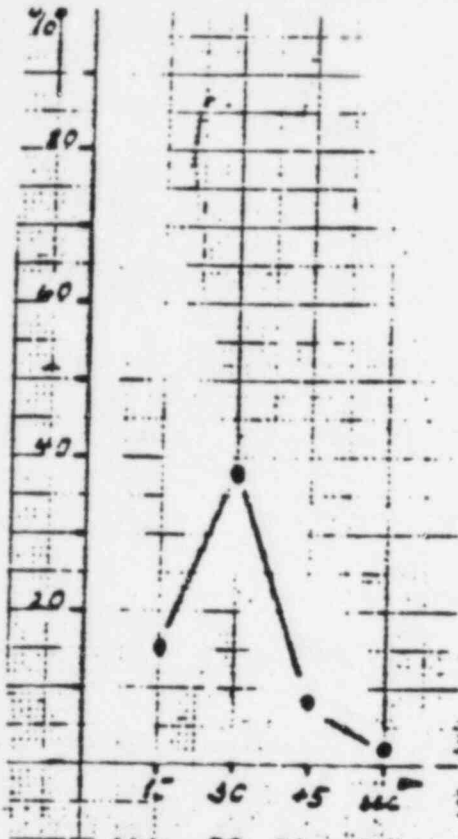


Abb. 29 Fig. 29

Lautstärke 45 dB
loudness

Uhrzeit 4 - 5⁰⁰
time of day

Fig. 29

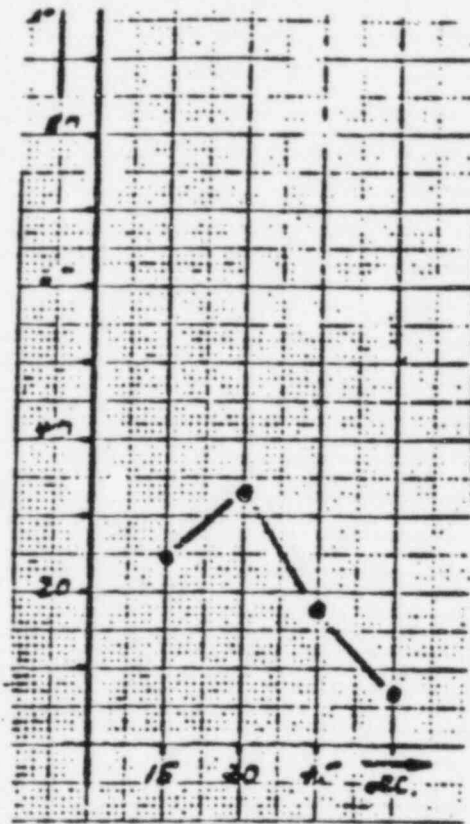


Abb. 30 Fig. 30

Lautstärke 40 dB
loudness

Fig. 30

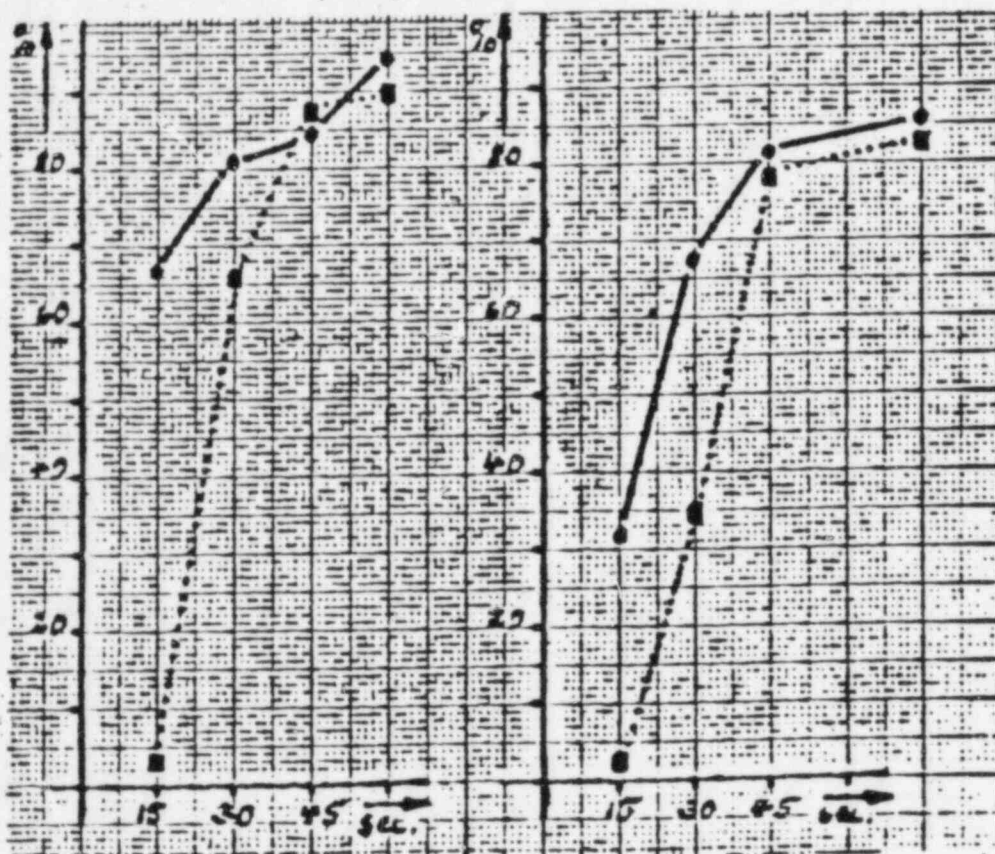


Abb. 31a Fig. 31a

Lautstärke 60 dB

loudness

16 1/2 130

Fig. 31a

Abb. 31b Fig. 31b

Lautstärke 55 dB

loudness

Fig. 31b

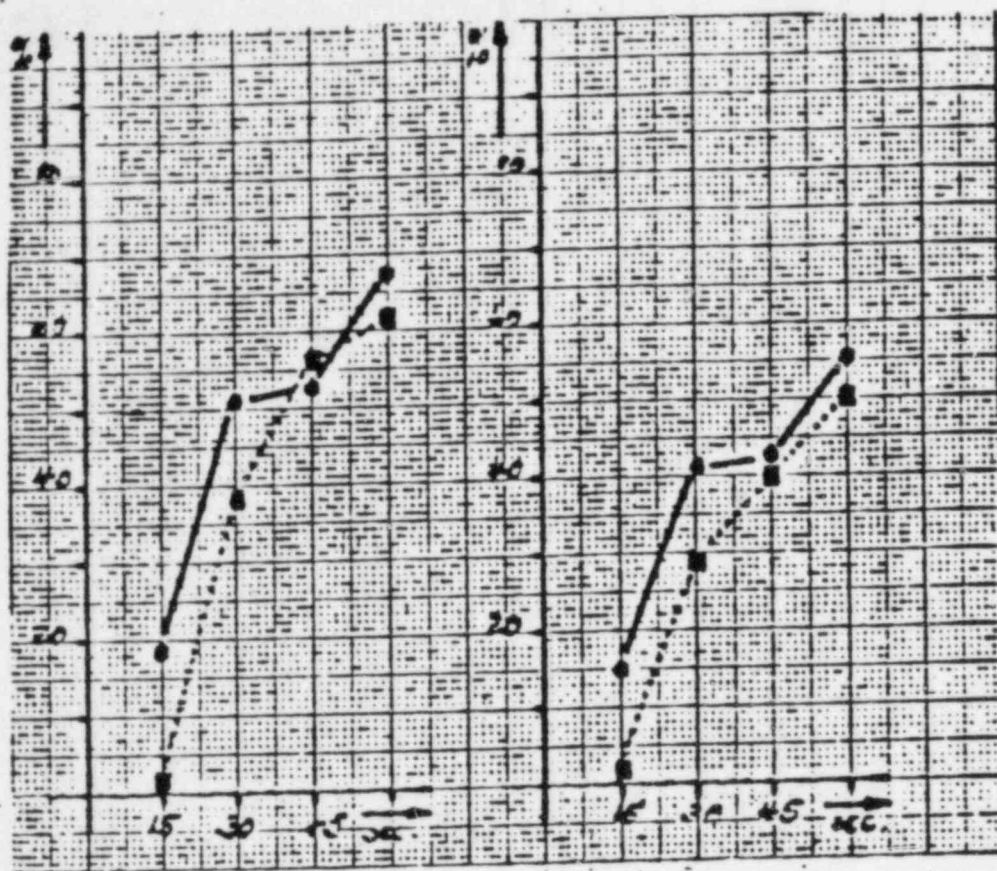


Abb. 31c Fig. 31c

Lautstärke 50 dB
loudness

Abb. 31d Fig. 31d

Lautstärke 40 dB
loudness

Abb. 31 Fig. 31

Wachkurven verschiedener Uhrzeiten (..... 3³⁰, —•—•— 3⁰⁰)
Waking curves of different times of day.

Fig. 31c

Fig. 31d

The susceptibility of the test subjects decreased, as would be expected, with decreasing loudness and proportional to the length of sleep. during the period up to 3.00 a.m., most people were awakened in the second partial period, but this maximum shifts to the first partial period of the waking time between 3.00 and 5.00 a.m. (Figs. 11-30). At a loudness of 60 dB, two thirds of all the test subjects were awakened during the first partial period during the period from 4.00 to 5.00 a.m. (Fig. 26). It is striking that during the time of deep sleep the waking figure at all degrees of loudness was below 5% in the first partial period.

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Figure 31 shows in addition waking curves for various degrees of loudness (40, 50, 55, 60 dB) and specific times (1.30 and 3.00 a.m.). As Figs. 31a and 31b show, 90% of the people awakened by the signal were already woken during the first three partial periods of the duration of the waking signal. Up to 15% are still woken during the fourth partial period, i.e. during the time of recording when there is no further waking signal in effect; i.e. with these people, either the cessation of the waking signal has an effect or, however, the memory perception causes the nerve centers to be stimulated and the waking stimulus to be perceived.

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When evaluating the measurement diagrams, it was striking that substantial differences in the waking ratios appeared relative to the comparative measurements corresponding to the times, e.g. for a loudness of 45 dB at 1.45 a.m. on 4.20 there was a waking ratio of 92%, while a repeat of the same measurement on 7.13. produced a percentage of only 60%. These discrepancies observed from one class to another and also between two measurement days can be explained as follows. The variety in the sleep curves (cf. Fig. 10) of the participants as well as the artificial effects of narcotics on the sleep pattern may be determinative for the sleep depth reached at the waking time and thus also for the sensitivity or perception of the participants. It was also found that a higher number of younger participants reduced the percentages for the waking figures, i.e., in other words, the higher the average age of the class, as a rule the better the percentage of waking [text missing]

"Depending on the areas of responsibility and interest, even during the apparently complete unconsciousness of sleep there remains a residue of waking perception that does not, of course, reach directly detectable consciousness, but can be deduced from the susceptibility to corresponding stimuli..."

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The explanation for the varying effects from one day to another can be found in the lack of information about the course of the day and its psychological effect on the participants. In addition, mutual wakening of the participants by one another cannot be regulated or eliminated.

The phenomena listed above are not, however, deficiencies that are determined by the construction of the test and the measurement system, but they represent natural phenomena of disposition and normal processes and should thus be treated as such.

b) Evaluation of the audiograms.

The evaluation of the audiograms is of great importance for determining the reaction capacity of the nerve centers of the test subjects. A sleeper who is now awakened does not necessarily possess a deficient reaction capacity. It is entirely possible that the sensitivity of the nerve centers of the test subject is normal if the degree of the waking stimulus reaches the level of intensity that suits his ear.

The change in the reaction capacity of the nervous system during sleep consists, regardless of the results of audiometry, not just of a reduction in sensitivity to exterior stimuli, but also of a decrease in the perception capacity, [1], a "non-hearing" and [text missing]

explained by the heavier participation of young test subjects despite good hearing capacities.

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Basically it can be said that an abnormal hearing capacity in the frequency range up to 2000 Hz results in turn in a greater sensitivity of the nerve centers. Hearing losses of 5-10 dB within the given frequency range can be disregarded. The reasons for a deviation from these guidelines lie in the physical and psychological make-up and the attitude of the participants to these studies

[8]. Thus the waking figure for a hearing loss of 30 dB was 60%, but waking ratios of 20-25% for a hearing loss of only 10 dB were not uncommon.

7. Conclusion

Over the course of a ten month period studies were carried out on the effects of waking signals on sleepers of various sleep depths, and the reaction capacity of the sleepers was measured in relation to the time, taking into account the hearing capacity. For the period of deep sleep a waking figure of about 60% at a loudness of 60 dB in the sleeping areas was determined. This means that the loudness of warning air raid sirens outside the building must be at least 70 dB, if one assumes that the house walls muffle the loudness by about 10 dB. A decrease in the loudness of the signal of 5 dB resulted in each case in a reduction in waking of about 7%. In addition, an attempt was made to show that the length of the warning signal does not need to exceed a maximum of 60 seconds.

The results of the audiometry are not so easy to define. It was shown that the hearing capacity of a test subject was not the only determining factor for the reaction capacity and the degree of sensitivity, but these are determined to a high degree by the physical make-up and the personality of the test subjects.

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At this point we would like to express our special thanks to the directors of the Federal Air Protection School in Waldbroel for their willingness to provide the rooms for our studies and to satisfy our special requests.

We also thank the people attending the school for their support in carrying out the measurements.

Dieter Krallmann

BUNDESLUFTSCHUTZSCHULE WALDBRÖL

Blatt 1a

Sheet 1a

Date Datum	Time Zeit	Duration of time Zeitdauer	Setting of switch Schalterstellung
16.1.	0 ³⁰	1 min.	5
17.1.	4 ⁴⁵	"	1
18.1.	1 ¹⁵	"	5
19.1.	1 ⁰⁰	"	2

Belegungstärkte: 21 Pers.

Number of persons:

Nicht belegte Nr.: 2, 8, 13

Unoccupied Nr:

Sonstiges:

Remarks

BUNDESLUFTSCHUTZSCHULE WALDBERG

Blatt 2a
Sheet 2a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
23.1.	4 ⁰⁰	1 min.	4
24.1.	4 ⁴⁵	"	5
25.1.	4 ⁰⁰	"	4
26.1.	2 ³⁰	"	5

Belegungsstärke: 24 Pers.
Number of persons

Nicht belegte Nr.: _____
Unoccupied Nr:

Sonstiges

Remarks

BUNDESLUFTSCHUTESCHULE WATZDORF

Blatt 3a
Sheet 3a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
30.1.	2 ⁰⁰	1 min.	2
31.1.	2 ⁴⁵	"	3
1.2.	2 ¹⁵	"	4
2.2.	0 ⁴⁵	"	5

Belegungstärkte: 21 Pers.

Number of persons

Nicht belegte Nr.: 12, 14, 17

Unoccupied Nr:

Sonstige:

Remarks

BUNDESLUFTSCHUTZSCHULE WALDBRÜL =====

Blatt 5a
 Sheet 5a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
6.2.	0 ⁴⁵	1 min.	1
7.2.	4 ⁴⁵	"	1
8.2.	3 ³⁰	"	3
9.2.	2 ⁰⁰	"	1

Belegungsstärke: 24 Pers.
 Number of persons

Nicht belegte Nr.: _____
 Unoccupied Nr:

Sonstiges: 6.2. nicht gemessen
 Remarks: 6.2. not measured

BUNDESLUFTSCHUTZSCHULE WALDBRÖL

Blatt 6a
Sheet 6a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
14.2.	1 ¹⁵	1 min.	3
15.2.	1 ⁴⁵	"	3
16.2.	2 ³⁰	"	3
17.2.	5 ⁰⁰	"	2

Belegungestärke: 24 Pers.

Number of persons

Nicht belegte Nr.: _____

Unoccupied Nr:

Sonstiges: Anreise erst 14.2., am 17.2. ausgefallen

Remarks: arrival only Feb 14, dropped out Feb. 17

BUNDESLUFTSCHUTZSCHULE WALDBRÜL

Blatt 7a
Sheet 7a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
20.2.	3 ³⁰	1 min.	2
21.2.	4 ¹⁵	"	4
22.2.	3 ¹⁵	"	3
23.2.	5 ⁰⁰	"	2

Belegungsstärke: 23 Pers.
Number of persons

Nicht belegte Nr.: 13
Unoccupied Nr:

Sonstiges:

Remarks

FUNDESLUFTSCHUTZSCHULE WALDBRÖL

Blatt 8a
Sheet 8a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
27.2.	2 ³⁰	1 Min.	1
28.2.	0 ¹⁵	"	3
1.3.	0 ⁴⁵	"	4
2.3.	4 ⁰⁰	"	5

Teilungssstärke: _____ Pers.
Number of persons

Nicht belegte Nr.: _____
Unoccupied Nr:

Sonstiges: Ausgefallen: Manöver

Remarks: Cancelled - maneuver

BUNDESLUFTSCHUTZSCHULE WALDERFELD

Blatt 9a
Sheet 9a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
6.3.	5 ⁰⁰	1 min.	5
7.3.	4 ⁴⁵	"	1
8.3.	3 ⁰⁰	"	4
9.3.	1 ⁴⁵	"	1

Belegungstärkte: 23 Pers.
Number of persons

Nicht belegte Nr.: 9
Unoccupied Nr:

Sonstiges: 6.3. nicht getestet
Remarks: 6.3. was not tested

FUNDSTUPTSCHUTZSCHULE WALDSEE

Blatt 10a
Sheet 10a

<u>Date</u>	<u>Zeit</u> <u>Time</u>	<u>Zeitdauer</u> <u>Duration of time</u>	<u>Leuchteinstellung</u> <u>Setting of switch</u>
13.3.	5 ⁰⁰	1 min.	1
14.3.	1 ³⁰	"	1
15.3.	2 ¹⁵	"	2
16.3.	3 ⁰⁰	"	1

Belegungsnummer: 21. Febr.

Number of persons

Belegte Nr.: 3, 6, 7

Unoccupied Nr:

Belegungsdatum: 13.3. Lehrgangsschluss

Remarks: 13.3 test in course of study

Betten 6 u. 7: Brücke alter Kasten
Beds 6 and 7: switch short circuit

HUNDESLUFTSCHUTZSCHULE WALDBRONN

Blatt 11a
 Sheet 11a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
20.3.	2 ³⁰	1 min.	2
21.3.	2 ⁴⁵	"	2
22.3.	2 ⁴⁵	"	1
23.3.	3 ³⁰	"	4

Belegungsstärke: 22 Pers.

Number of persons

Nicht belegte Nr.: 6, 7

Unoccupied number

Sonstiges:

Remarks

BUNDESLUFTSCHUTZSCHULE WALDBRÜL

Blatt 12a
Sheet 12a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung setting of switch
27.3.	1 ³⁰	1 min.	2
28.3.	1 ⁰⁰	"	4
29.3.	2 ⁰⁰	"	5
30.3.	0 ¹⁵	"	1

Belegungsstärke: 20 Pers.

Number of persons

Nicht belegte Nr.: 8, 12, 15, 17

Unoccupied Nr:

Sonstiges: 30.3. ausgefallen

Remarks: 30.3 cancelled

Betten 23 und 24 am 28. - 29.3.

beds 23 and 24 on 28. to 29. March

ohne Wertung (Kurzschluß)

without value (short circuit)

BUNDESLUFTSCHUTZSCHULE WILDBERG

Blatt 13a
sheet 13a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
4.4.	4 ⁰⁰	1 min.	2
5.4.	4 ³⁰	"	3
5.4.	5 ⁰⁰	"	1

Belegungsstärke: 22 Pers.
Number of persons

Nicht belegte Nr.: 7. 12

Unoccupied Nr:

Sonstiges:

Remarks

BUNDESLUFTSCHUTZSCHULE WALDBRÖL

Blatt 14a
Sheet 14a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
10.4.	5 ⁰⁰	1 min.	5
11.4.	2 ⁰⁰	"	3
12.4.	4 ¹⁵	"	5
13.4.	0 ¹⁵	"	2

Belegungstärke: 14 Pers.
Number of persons

Nicht belegte Nr.: 1, 2, 4, 5, 8, 15, 18, 19, 20, 24

Unoccupied Nr:

Sonstiges:

Remarks

BUNDESLUFTSCHUTZSCHULE WADDJRE

Blatt 15a

Sheet 15a

Datum Date	Zeit Time	Zeitdauer Duration of time	Stellung Setting of switch
17.4.	5 ⁰⁰	1 min.	3
18.4.	3 ³⁰	"	2
19.4.	0 ¹⁵	"	1
20.4.	1 ⁴⁵	"	4

Personenstärke: 24 Pers.

Number of persons

Belegte Nr.:

Unoccupied Nr:

Sonstiges:

Remarks

BUNDESLUFTSCHUTZSCHULE WALDBLUM

Blatt 16a

Sheet 16a

Tag Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
24.4.	1 ⁰⁰	1 min.	5
25.4.	0 ³⁰	"	2
26.4.	4 ⁰⁰	"	2
27.4.	2 ¹⁵	"	1

Belegungstabelle: Person.
Number of persons

Nicht belegte Nr.:
Unoccupied Nr:

Bemerkungen: Ausgefallen

Remarks: Cancelled

Blatt 16a entspricht Blatt 18a
Sheet 16a is same as Sheet 18a

8.5. - 14.5.

keine Lehrgänge
no classes

29.5. - 3.6.

BUNDESLUFTSCHUTZSCHULE WALDBRÖL

Blatt 17a
sheet 17a

Datum	Zeit	Zeitdauer	Schalterstellung
Date	time	duration of time	Setting of switch
2.5.	3 ⁰⁰	1 min.	5
3.5.	3 ³⁰	"	5
4.5.	4 ¹⁵	"	1

Belegungsstärke: 19 Pers.
number of persons

Nicht belegte Nr.: 3, 8, 13, 18, 22
unoccupied Nr:

Sonstiges:
Remarks

BUNDESLUFTSCHUTZSCHULE WALDERFEL

Blatt 18a
Sheet 18a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
15.5.	1 ⁰⁰	1 min.	5
16.5.	0 ³⁰	"	2
17.5.	4 ⁰⁰	"	2
18.5.	2 ¹⁵	"	1

Belegungsstärke: 24 Pers.

Number of persons

Nicht belegte Nr.: _____

Unoccupied Nr:

Sonstiges: Messung am 15.5. ausgefallen

Remarks: Measurement omitted in May 15

BUNDESLUFTSCHUTESCHULE WALDBRÖL

Blatt 19a
Sheet 19a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
23.5.	1 ⁰⁰	1 min.	1
24.5.	3 ⁴⁵	"	4
25.5.	2 ¹⁵	"	5

Belegungstürke: 23 Pers.
Number of persons

Nicht belegte Fr.: 8

Unoccupied Nr:

Sonstiges: Am 25.5. Nachtübung.

Remarks: May 25 night exercise

Messung nicht verwertbar.
Measurement not usable

BUNDESLUFTSCHUTZSCHULE WALDBRÖL

=====

Blatt 20a
Sheet 20a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
5.6.	2 ³⁰	1 min.	1
6.6.	1 ⁰⁰	"	3
7.6.	3 ¹⁵	"	2
8.6.	2 ⁰⁰	"	4

Belegungstärke: 22 Pers.
Number of persons

Nicht belegte Nr.: 6, 21
Unoccupied Nr:

Sonstiges: Schule am 5.6. nicht belegt
Remarks: school not in session on June 5

BUNDESLUFTSCHUTZSCHULE WALDBRÜL

Blatt 21a

Sheet 21a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
12.6.	0 ¹⁵	1 min.	4
13.6.	0 ⁰⁰		2
14.6.	1 ³⁰		3
15.6.	4 ³⁰		4

Belegungsstärke: 24 Pers.

Number of persons
Nicht belegte Nr.:

Unoccupied Nr:

Sonstiges: 12.6. keine Messung

Remarks: no measurement on June 12

BUNDESLUFTSCHUTZSCHULE WADBRÖL

Blatt 22a

Sheet 22a

<u>Datum</u> Date	<u>Zeit</u> Time	<u>Zeitdauer</u> Duration of time	<u>Schalterstellung</u> Setting of switch
19.6.	0 ⁰⁰	1 min.	3
20.6.	1 ¹⁵	"	2
21.6.	0 ³⁰	"	3
22.6.	0 ⁰⁰	"	4

Belegungsstärke: 24 Pers.

Number of persons

Nicht belegte Nr.: _____

Unoccupied Nr:

Sonstiges:

Remarks

BUNDESLUFTSCHUTZSCHULE WALDERÖL

Blatt 23a

Sheet 23a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
10.7.	0 ¹⁵	1 min.	3
11.7.	1 ¹⁵	"	1
12.7.	0 ³⁰	"	4
13.7.	1 ⁴⁵	"	4

Belegungsstärke: 20 Pers.

Number of persons

Nicht belegte Nr.: 3, 7, 22, 24

Unoccupied Nr:

Sonstiges:

Remarks

BUNDESLUFTSCHUTZSCHULE WALDBROL

Blatt 24a

Sheet 24a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
---------------	--------------	-------------------------------	---------------------------------------

3.7.	015	1 min.	5
------	-----	--------	---

4.7.	130		5
------	-----	--	---

5.7.	000		1
------	-----	--	---

6.7.	115		4
------	-----	--	---

Belegungstärke: 24 Pers.
Number of persons

Nicht belegte Nr.: _____

Unoccupied Nr.: _____

Sonstiges: _____

Remarks: _____

BUNDESLUFTSCHUTZSCHULE WALDBRÜL

Blatt 25a

Sheet 25a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
17.7.	0 ⁴⁵	1 min.	
18.7.	0 ⁰⁰	"	
19.7.	2 ³⁰	"	
20.7.	0 ³⁰	"	

Belegungszahl: 16 Pers.
Number of persons

Nicht belegte Nr.: 7, 12, 15, 17, 19, 20, 22, 24
Unoccupied Nr.

Sonstiges: Eingekreiste Zahlen ungültig
Remarks: circled numbers are invalid

BUNDESLUFTSCHUTZSCHULE WALDERO.

Blatt 26a
Sheet 26a

Datum Date	Zeit time	Zeitdauer Duration of time	Schalterstellung Setting of switch
---------------	--------------	-------------------------------	---------------------------------------

24.7.	045	1 min.	4
-------	-----	--------	---

25.7.	045	.	1
-------	-----	---	---

26.7.	100	.	5
-------	-----	---	---

27.7.	045	.	3
-------	-----	---	---

Belegungsstärke: 17 Pers.

Number of persons

Nicht belegte Nr.: 2, 7, 9, 10, 12, 17, 22

Unoccupied Nr:

Sonstiges:

Remarks

BUNDESLUFTSCHUTZSCHULE WANDERO

Blatt 27a
Sheet 27a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
4.9.	0 ¹⁵	1 min.	4
5.9.	0 ⁴⁵	"	4
6.9.	0 ¹⁵	"	4
7.9.	0 ³⁰	"	5

Belegungstärke: - 22 - Pers.
Number of persons

Nicht belegte Nr.: 14, 20
Unoccupied Nr:

Sonstiges:

Remarks

BUNDESLUFTSCHUTZGEWERKSCHAFTEN

Blatt 28
Sheet 28a

Datum	Zeit	Zeitdauer	Schalterstellung
Date	Time	Duration of time	Setting of switch

11.9.	12 ⁴⁵	1 min.	5
12.9.	1 ⁴⁵	"	2
13.9.	1 ¹⁵	"	1
14.9.	0 ³⁰	"	1

Telefonnummer: 30 Fern.
Number of persons

Nicht belegte Nr.: 7, 12, 13, 17

Unoccupied Nr.:

Sonstiges:

Remarks

BUNDESLUFTSCHUTZSCHULE WALDBROU

Blatt 29a

Sheet 29a

Datum Date	Zeit Time	Zeitsauer Duration of time	Schalterstellung Setting of switch
---------------	--------------	-------------------------------	---------------------------------------

18.9.	0 ¹⁵	1 min.	3
19.9.	3 ¹⁵	"	3
20.9.	0 ⁴⁵	"	1
21.9.	0 ³⁰	"	3

Belegungsstärke: 23, aufgeteilt in 13 Pers. von 10. - 21.0. - 11. - 21.9.

Nicht belegte Nr.:

Unoccupied Nr:

Sonstiges:

Remarks

BUNDESLUFTSCHUTZSCHULE WALDBRÖL

Blatt 30a

Sheet 30a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
---------------	--------------	-------------------------------	---------------------------------------

2.10.	015	1 min.	2
-------	-----	--------	---

3.10.	000		5
-------	-----	--	---

4.10.	030		4
-------	-----	--	---

5.10.	030		2
-------	-----	--	---

Belegungstärkte: 20 Pers.

Number of persons

Nicht belegte Nr.: 3, 10, 11, 22

unoccupied Nr.

Sonstiges:

Remarks

BUNDESLUFTSCHUTZSCHULE WALDBRÖL

Blatt 31a

Sheet 31a

Datum Date	Zeit Time	Zeitdauer Duration of time	Schalterstellung Setting of switch
---------------	--------------	-------------------------------	---------------------------------------

9.10.	0 ⁰⁰	1 min.	2
-------	-----------------	--------	---

10.10.	0 ⁴⁵	"	2
--------	-----------------	---	---

11.10.	3 ³⁰	"	3
--------	-----------------	---	---

12.10.	0 ¹⁵	"	5
--------	-----------------	---	---

Belegungstärke: 20 Pers.

Number of persons

Nicht belegte Nr. 10, 11, 12

Unoccupied Nr.

Sonstiges: - Nr. 12 und Nr. 13 am 11.10. Zimmer verlassen

Remarks: Nr. 12 and Nr. 13 left room on October 11

BUNDESLUFTSCHUTZSCHULE WALDERÖL

Blatt: 17b

Sheet 17b

1. Relaisst. 2. Relaisst. 3. Relaisst. 4. Relaisst.
Relay Current ?

1 X 3 4 5 6 7 X 910111213141516 1718192021222324	1 2 3 4 5 6 7 8 910111213141516 1718192021222324	1 2 3 4 5 6 7 8 910111213141516 1718192021222324	1 2 3 4 5 6 7 8 910111213141516 1718192021222324
--	--	--	--

1 X 3 4 5 6 7 X 910111213141516 1718192021222324	X 2 3 X 5 6 7 8 910111213141516 1718192021222324	1 2 3 4 5 6 7 8 910111213141516 1718192021222324	1 2 3 4 5 6 7 8 910111213141516 1718192021222324
--	--	--	--

1 X 3 4 5 6 7 X 910111213141516 1718192021222324	1 2 3 X 5 6 7 8 910111213141516 1718192021222324	1 2 3 4 5 6 7 8 910111213141516 1718192021222324	1 2 3 4 X 6 7 8 910111213141516 1718192021222324
--	--	--	--

1 2 3 4 5 6 7 8 910111213141516 1718192021222324	1 2 3 4 5 6 7 8 910111213141516 1718192021222324	1 2 3 4 5 6 7 8 910111213141516 1718192021222324	1 2 3 4 5 6 7 8 910111213141516 1718192021222324
--	--	--	--

1 2 3 4 5 6 7 8 910111213141516 1718192021222324	1 2 3 4 5 6 7 8 910111213141516 1718192021222324	1 2 3 4 5 6 7 8 910111213141516 1718192021222324	1 2 3 4 5 6 7 8 910111213141516 1718192021222324
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