STATENS
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NATIONAL BOARD FOR SPENT NUCLEAR FUEL

SKN Report 20

# Time Orientation, Planning Horizons and Responsibility into the Future

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# TIME ORIENTATION, PLANNING HORIZONS

# AND

# RESPONSIBILITY INTO THE FUTURE

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Britt-Marie Drottz
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Psykologisk Metod AB, Stockholm
Januari 1988
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SKN Rapport 23

# ATTITYDER TILL RADIOAKTIVT AVFALL

(Attitudes to Radioactive Waste)

Lennart Sjöberg
Britt-Marie Drottz
Psykologisk Metod AB, Stockholm

Januari 1988

(160 pages in Swedish)

Stockholm i januari 1988

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## Abstract

Subjects of four categories (social science students, engineering students, retired people and nuclear waste experts) were asked about past events, planning, risks and future time with emphasis on energy related issues and in particular questions concerning spent nuclear waste. Among, the results reported it was found that events in the past were located more or less correctly and that events further back systematically too close to the present. Today's responsibility into the future was judged to cover 3 to 6 generations ahead and an adequate planning horizon for a local community to be on the average 11 to 14 years. Adequate planning horizons for the handling of spent nuclear fuel were judged to be from 100 to 500 years. The responsibility for effects of today's decisions was judged to be from about 100 to 300 years into the future for environmental pollution and from about 50 to 600 years for nuclear waste. However, non-negligable proportions of the subjects choose a more moral standpoint and gave answers indicating that responsibility had to be unlimited. Some sex differences were found and an interaction with age offered as a hypothesis to be investigated in the future. Interrelations between clusters of questions revealed some links from past time and planning to judgments of environmental and nuclear power related risks.

While the events of the past have taken place once and for all, many alternative paths exist in the future. The decisions about this future are always made in the present and involve the creation of scenarios and alternative futures forming today's decision alternatives. Because of a seemingly unlimited number of alternatives and time extending beyond all limits into the future some simplifying principles must be used to make the decision problems about the future managable.

One of these principles is to discount the future and another to avoid drastical changes and use a "muddling through" principle for deciding about the future (Braybrooke & Lindblom, 1963). Samuelson (1937) considered discounting the future an aspect of how we percieve time and Strotz (1956) considered a goal's utility to decrease with delay as a natural function. Ainslie (1975) relates studies by sociologists concerning deferred gratification patterns and psychologists interested in reward-delaying behavior. The results show that personality and social setting influence how people are discounting the future and that postponement of gratification and temporary toleration of unpleasure are important in the development of a realistic adjustment to the realities of life for all of us.

Jungerman and Fleischer (1985) give a review of research on preferences over time from a decision theoretic perspective and they find that very few researchers have paid attention to such questions. However, there are a few exceptions and McNeil, Parker, Sox & Tversky (1982), Björkman (1984), Christensen - Szalanski (1984, 1985) Svenson & Karlsson (1983) and Svenson (1984) have treated discounting effects in different ways. However, most research related to discounting of the future has been concerned with time intervals within the decision maker's own life span contrasting with the present study's focus on time perspectives extending also beyond the present generation.

In the following different time horizons will be introduced which taken together provide a framework for research in the area. Wright and Weitz (1977) gave such a presentation which was used as a starting point for the following.

The (1) immediate processing horizon delimits the time interval during which it is possible to search (and process) information for a decision. The (2) commitment horizon delimits the time interval beyond which a decision maker believes he has to make a final decision involving a committment (e.g., through implementation of the decision or announcing it publicly). (3) The close outcome horizon is the time a decision maker belives will elapse before the outcome of the decision can be experienced and (4) the remote outcome horizon delimits the time interval beyond which no effects of the outcome of the decision are experienced. Finally, (5) the suspense horizon signifies the time elapsed from the implementation of a decision to the first outcome.

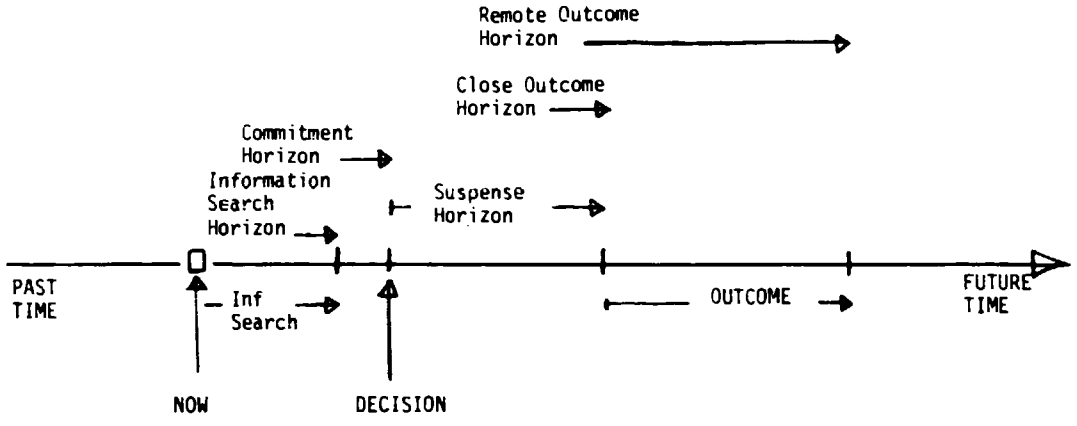



Figure 1. Distribution of time horizons over time.

Figure 1 illustrates these concepts and extends the time axis into the past. Time horizons for information gathering and processing and commitment horizons may be manipulated experimentally (cf. Svenson & Edland, 1987) to find out what the effects of time pressure are. The suspense horizon is the time after a decision until its consequences can be experienced. This is of interest as well as the close outcome horizon in the long-time perspective chosen in the present study, but the main interest will be devoted to the remote outcome horizon. That is, when the effects of a decision made today can no longer be experienced or can be ignored. In addition, perception of past time will also be induced in the present study to find out if there exists any clear relationships between past and future time perception. One important aspect of the study is its frequent reference to storage of spent nuclear fuel because decisions related to this issue are particularily interesting in a long-time perspective. In addition, questions about risk-perception will also be addressed in the following.

The general aim of the present study is to explore where into the future people locate their remote outcome time horizons for different decisions. In particular, issues related to decisions about spent nuclear fuel disposal and consequences of these decisions will be in focus. Furthermore, time horizons will be related to other issues such as time in the past, responsibility, planning activities and risk perceptions. The fact that the study is mainly explorative in nature is an effect of the limited research done earlier in this field (cf. Svenson, 1984).

## Study 1

### Procedure

#### Subjects

Twentytwo psychology students from the University of Stockholm and 40 students of engineering (machinery) from the Royal Technical University of Stockholm served as subjects. The psychology students took part in the study in fulfillment of a course requirement and the technology students were paid SEK 30 each. Nineteen of the psychology students were female and 37 of the technology students were male which was expected to lead to extreme but opposite opinions as both profession and sex have been found to correlate with attitudes to nuclear power issues. The mean age of the psychology students was 32.2 years and the engineering students were 21.8 years old on the average.

#### Questionnaire

The following main areas were adressed in the questionnaire (1) past time, (2) future time, (3) planning horizons in general (4) personal planning (5) age and sex, (6) perception of risks associated with disposal of nuclear waste.

The questions about past time asked when a number of events had taken place. The questions concerned (a) technological events (e.g., when did man start using the wheel, when did someone fly an aeroplane for the first time?) (b) biological events (e.g., when was the mammoth extinct, when did man first appear? (c) geological events (e.g., when were the Alpes created, when was the calcine rock in the .pa island of Gotland created?) and (d) societal and cultural events (e.g., when did the arabs colonize the south of Spain?)

The questions on future time asked when in the future the subjects believed an event to take place. The questions concerned (a) technical events related to energy production (e.g., when will it be possible - if ever - to increase the speed of a nuclear decay process, when will Sweden have doubled the capacity for wind generated electric power?) (b) medical events (e.g., when will it be possible to cure cancer, when will a vaccin against AIDS be invented?), (c) geological events (e.g., when will California next time be hit by an earth quake that causes at least one causality), (d) nuclear power related events (e.g., when will the first accident with a core down melt take place in a Swedish nuclear power plant, when will the last Swedish nuclear power plant be closed down?) and (e) nuclear waste related events (e.g., when will radioactive substances start leaking out? From a permanent storage of spent nuclear fuel in Sweden, when will the radioactive radiation from today's nuclear waste have decreased to half?)

The questions about planning horizons in general asked questions like "How far into the future do you think people should plan their economy?" and "how far into the future do you think that Swedish energy politics should be planned?"

This section also included one question about nuclear waste (how far into the future do you think the handling of nuclear waste should be planned?).

A few questions asked the subjects concrete questions about their own personal planning (e.g., Have you planned what to do tonight, Have you planned what to work with in 5 years from now?). Age and sex of the subjects were also registered.

Finally, the subjects' judgments of the risks of permanent storage of spent nuclear waste in granite rock and in sediments on the bottom of an ocean were collected on scales ranging from 0 (no risk at all) to 10 (very great risk).

## Results

Geometric means were computed for each group as well as correlations between the answers to the questions within each group. The distributions were positively squewed and therefore geometric means were used instead of arithmetic means. Some of these data will be presented in the following starting with the location of events in the past.

Figure 2 gives the relation between subjectively estimated location in the past and years back when an event happened according to science.

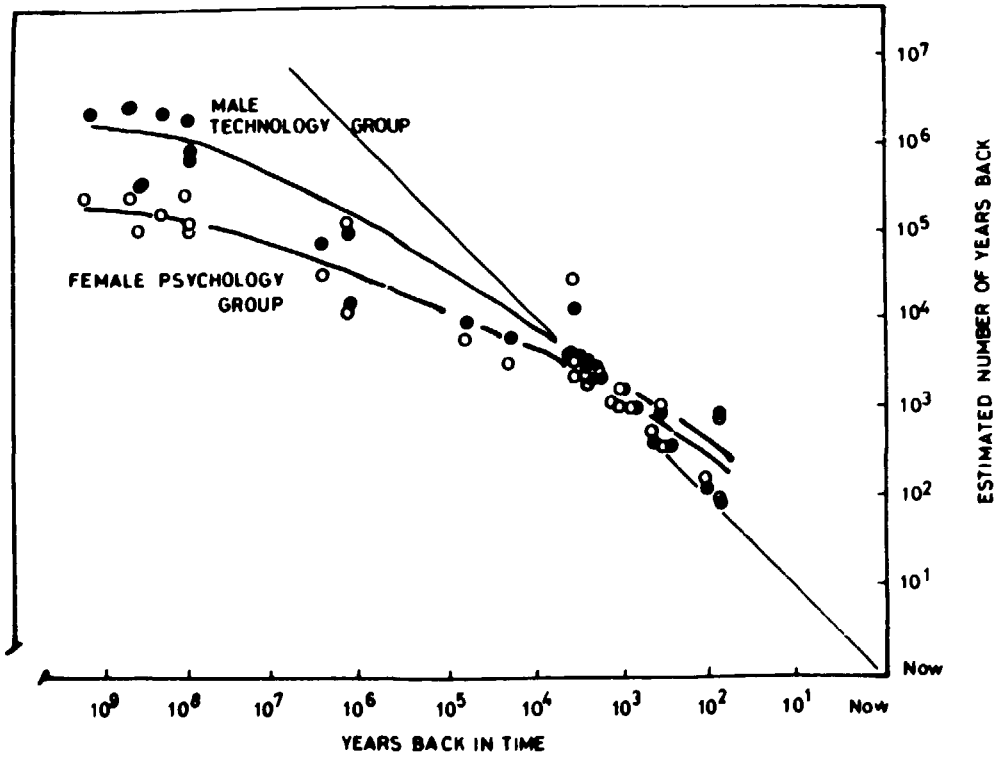



Figure 2. Relation between estimated location of an event in the past and its actual location. Data from Study 1, machine engineering and psychology group respectively.

The relations appear curvilinear in the log-log plot. Shorter time intervals seem to be, if anything, overestimated and longer ones clearly underestimated (by a factor up to $10^3$). In general, the psychology (predominantly female) group under-estimated the time interval even more than the engineering (predominantly male) group.

The percent of subjects having planned for different periods of time into the future were computed. There were no great difference between the two groups. However, there was a non-significant tendency for the (younger) engineering students to have thought more about planning "for tonight" and for the "next weekend" than the psychology students who had thought a little more about "retirement" and "where to be buried".

Subjects were also asked about how far into the future different activities should be planned, that is, the extent of the remote outcome horizons. The means of the logarithms of the answers were computed and shown in Figure 3.

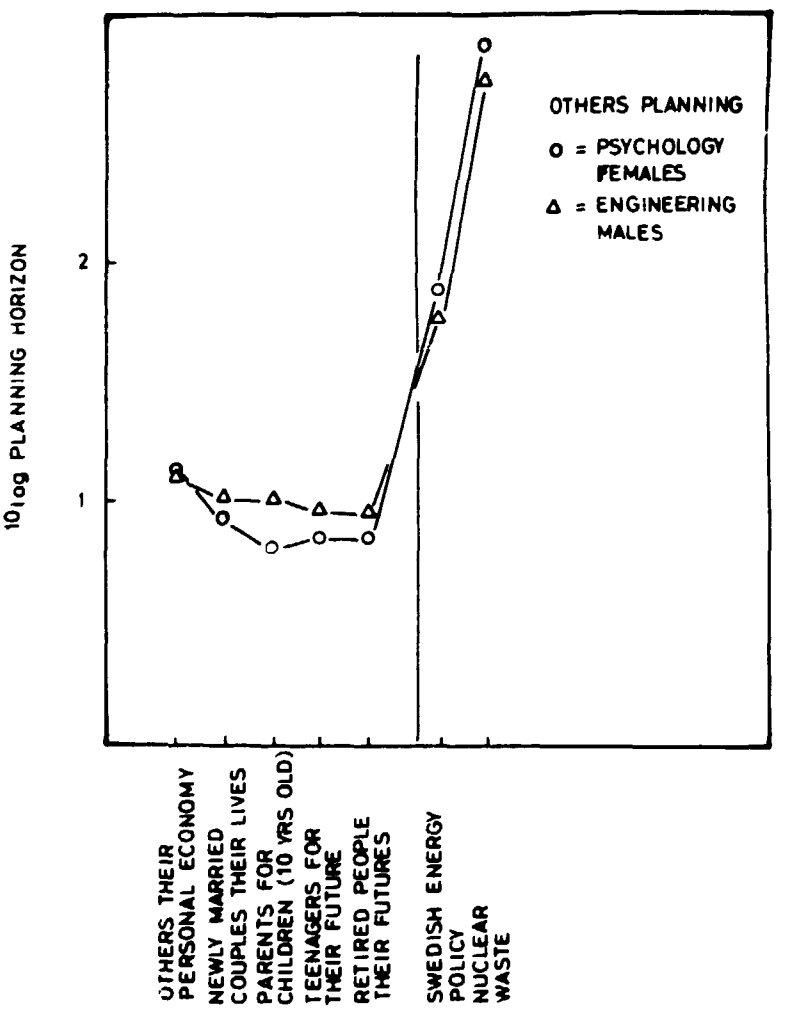



Figure 3. Mean logarithms of planning horizons that should be used accoding to psychology and engineering subjects in Study 1.

The activities in Figure 3 represent others personal planning (to the left of the vertical line) and society's planning (the two items to the right of the vertical line). The curves represent two different planning horizon profiles. A planning horizon profile describes over a set of activities, for each activity, the length of time into the future, it is, was or should be planned.

The data in Figure 3 describe others personal planning horizons in the range of 6 to 40 years. For the two energy issues, the societal planning horizons extend from about 60 to 250 years into the future. There is a non-significant tendency for male engineers to advocate longer perspectives for others personal planning and shorter perspectives for energy related planning than the female psychology group.

It is reasonable to assume that planning horizons depend on the subjective location of different events into the future . Table 1 illustrates this and gives geometric means for some energy related events for the two groups ("never" answers were excluded and reported separately if they were significant in number). The two groups give similar predictions for many of the events but differ in their nuclear related answers. First, a notable difference concerned when in the future "a Swedish nuclear core melt down will occur". While the psychology group expected this to happen before the planned ending of the Swedish nuclear power program in the first half of the 21st century), the engineering group expected this to happen about 200 years later. As many as 40% of the engineering students expected this never to happen.

Table 1. Geometric mean of years into the future for energy related events in Study 1. Never answers were excluded from the computations and reported separately in the footnote.

| No. | Question | Psychology group | Engineering group |
|---|---|---|---|
| 47. | Solar energy profitable | 27 | 41 |
| 48. | Coal reserves depleted | 151 | 137 |
| 49. | Last river used for electric power | 78 | 301 |
| 50. | Oil reserves depleted | 282 | 121 |
| 51. | Uranium reserves depleted | 355 | 507 |
| 58. | Next Swedish reactor | 26[6] | 15[7] |
| 59. | First Swedish core melt down | 24[3] | 259[2] |
| 36. | Completely safe method nuclear waste deposit | 360[4] | 242[5] |
| 51. | Groundwater in fuel storage | 183 | 1498 |
| 52. | Leakage of spent fuel storage | 108 | 1556 |
| 53. | Radiation of spent fuel halved | 253 | 1905 |
| 54. | Stored fuel no longer dangerous | 4613 | 17140 |

Note - (1) 30% indicated "never" (2) 40% "never"
(3) 5% "never", (4) 14% "never", and (5) 50% "never"
(6) 14% "never", (7) 25% "never"

Neither group was willing to accept the notion of a completely safe method for nuclear waste disposal. This was reflected in the time perspectives of about 250 to 350 years into the future and as many as 50 % of the engineers believing that this could never happen concerning associated hazards. Both groups believed that a leakage would occur before the radiation of the fuel was halved but their time horizons were quite different in magnitudes.

Product-moment correlations were computed between answer to planning questions and responses to the spent nuclear fuel questions. In general more significant (alpha=0,05) correlations could be found for the psychology group than for the engineers. Not surprisingly, both groups gave significant positive relations between societal planning and the answers to the questions of when the radiation of the fuel would be halved and no longer dangerous respectively.

The results from Study 1 have indicated ways in which planning horizons may be studied and related to other subjective concepts in the past and into the future. This leads into the next study in which a greater number of subjects and questions were used to further elucidate how people perceive planning in the long perspective and in particular in relation to nuclear waste management.

## Study 2

### Procedure

#### Subjects

Four different groups of subjects participated. The first group comprised of newly retired persons (group R), the second group of students in the Swedish gymnasium (high school) taking the social science curriculum (group G), the third group was university students of engineering (group E) recruited from the chemistry branch to ensure about equal numbers of male and female subjects. The fourth group was persons employed by the Swedish Nuclear Fuel and Management Company (group NF). The number of subjects in the groups were 32(R), 40(G), 40(E) and 9(NF). Men and women were distributed as follows in the four groups 19 men, 12 women (R), 19 men, 21 women (G), 24 men 16 women (E) and 8 men, 1 women (NF). The mean ages were 72(R), 17(G), 21(E) and 41(NF) in the groups respectively.

#### Questionnaire

The questionnaire was a thoroughly revised and enlarged version of that used in Study 1 and comprised the following sections of questions (a) past events, (b) future events, (c) societal planning, (d) personal planning and (e) risk perceptions. There were many questions related to energy and nuclear power energy and in all 90 questions (two of these with subquestions) were asked. When the subjects were asked about when an event had happened or was expected to happen the answer was to be given in number of years from now in the past or into the future or the word "never" could be entered if found appropriate.

## Results

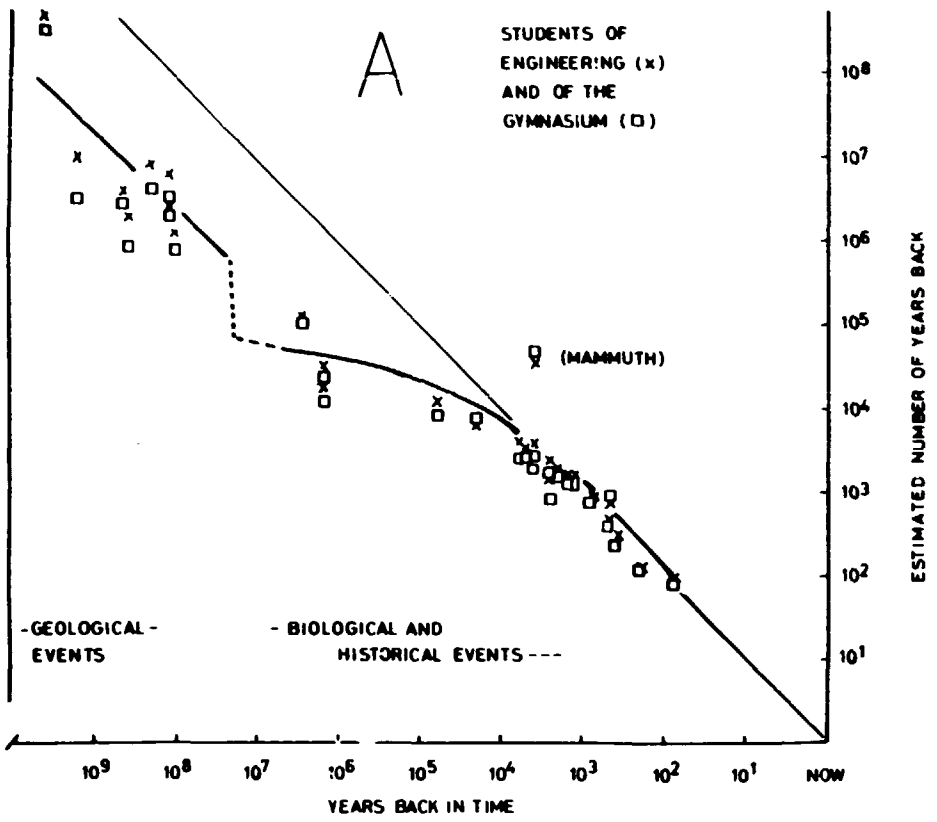
The results will be presented in the form of geometric means or means of logarithms if nothing else is specified. As mentioned above this is because of the positively squewed distributions. Note that the nuclear fuel experts group consisted of only 9 persons. Therefore all differences between this group and the others must be regarded illustrative but cannot be given the same significance as other differences.

The answers to the very first question which was "We would like you to write down a year that is very far into the future. Make your choice of a year spontaneously and do not spend much effort on this task" was correlated with the answers of all other questions in the different groups (with exception for the expert group which was too small). This was done in order to find out whether differences in the size of the estimates of time could be explained partly by subjects having formed habits of using different numerical ranges.

The retired group (R) had 5 questions of 99 correlating significantly (alpha=0.05) with the first question (nos. 14, 34, 35, 69 and 86). The students of the gymnasium had 2 significant (alpha=0.05) correlations (nos. 45 and 46). Finally, the engineering students had 4 significant (alpha=0.05) correlations (nos. 36, 40, 55 and 72). As these numbers closely correspond to what would be expected in a random process and no question appeared twice or more it seems safe to conclude that no great effect of the habits of using numbers could explain the variability within groups.

### Events in the past

Figure 4 shows the relation between subjective estimates of time in the past and scientific estimates.



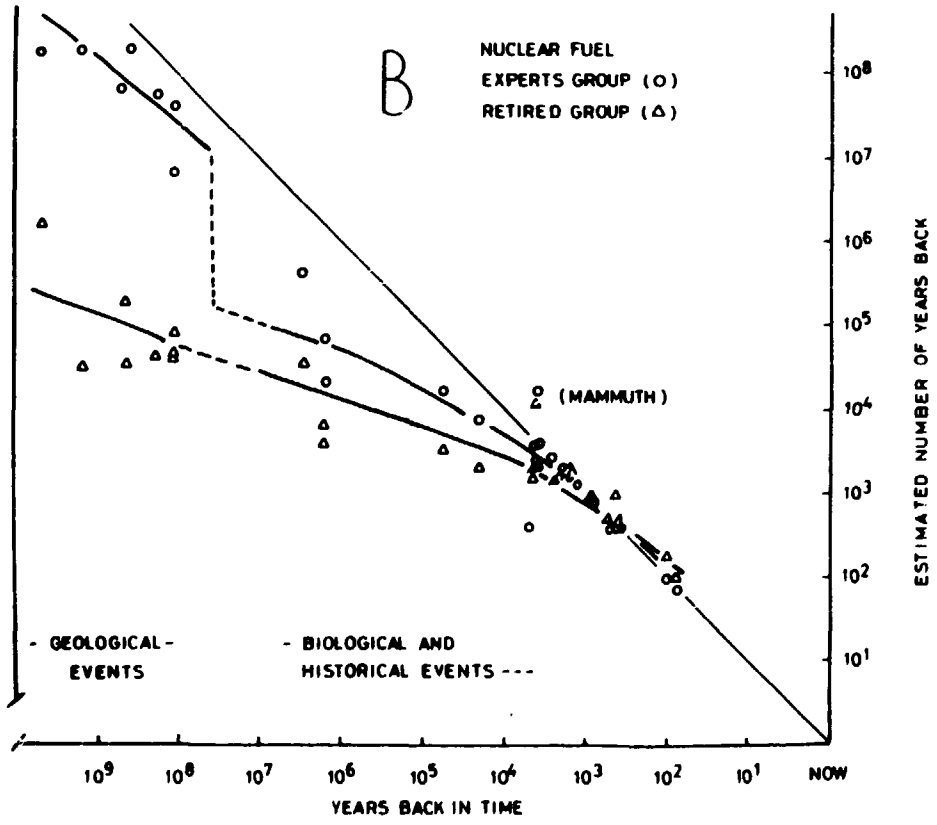




Figure 4. Relation between estimated location of an event in in the past and its actual location. Data from Study 2 with four different groups. See text for identification of groups.

The two student groups showed results that were quite similar to those reported in study 1. In Figure 4 a difference was noted between the geological and the other closer in time located events. In general the notion of the past was quite accurate to about $10^{3.5}$ years from now. The estimated time intervals further into the past tended to be shorter than estimated by science. The retired group (panel B) shows the same tendency as the two student groups but without any discontinuity and the geological events were closer in time than for other groups.

The nuclear fuel experts show a clear discontinuity in their curve which depends on the very close to accurate estimates of the geological events. For biological and historical events far into the future they expose the same tendency of underestimation as the students did in panel A. One single event, that of the death of the last mammuth, is for all groups located further back into the past than science does. Overall, subjects tend to underestimate time intervals into the past for events that have occured more than about 3000 years ago.

Events in the future

Table 2 lists a number of events and their predicted locations in the future. The numbers in the table may be used as reference points in the following. Most of the differences between the groups are related to nuclear power (e.g., questions 52, 54, 45, 46, 48 and 49). In the following, some of the results in the table will be treated in more detail.

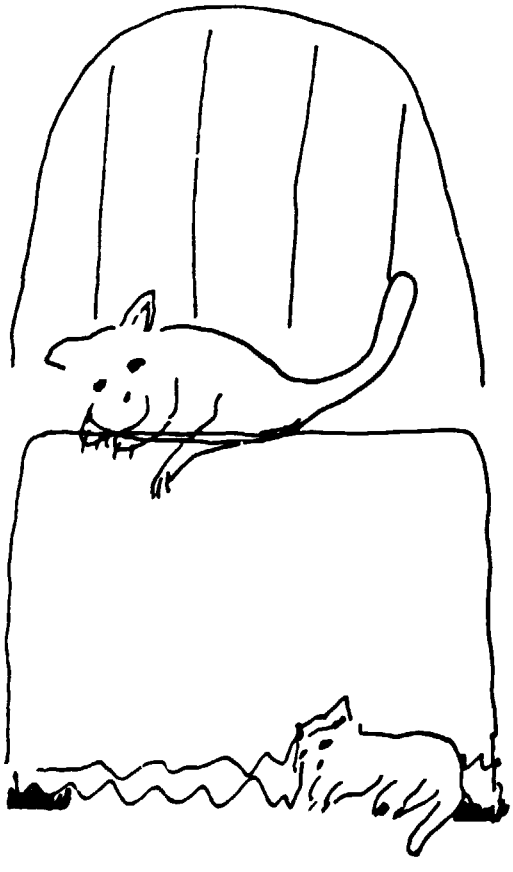


Table 2. Geometric means of years of future events in Study 2. Retired subjects were denoted R, highschool students G, University students of engineering E and specialists in nuclear fuel management NF. Percent "never happen" answers in paranthesis following mean. When never answers exceeded 60% no means were computed from the remaining answers.

| No. | Question | Group R N=32 | G N=40 | E N=40 | NF N=9 |
|---|---|---|---|---|---|
| 30 | Most cancers cured | 31(6) | 36(5) | 15(0) | 62(22) |
| 31 | Speeding up decay of spent fuel | 35(13) | 76(15) | 121(18) | - (78) |
| 35 | Vaccine against cancer | 29(6) | 41(15) | 56(18) | 29(11) |
| 37 | Next iceage | 1109(3) | 5623(15) | 5572(10) | 10000(0) |
| 40 | Sweden ends as State | 248(19) | 248(30) | 392(25) | 266(11) |
| 42 | Coal 90% used reserves | 376(0) | 217(8) | 262(0) | 361(22) |
| 43 | Last river for power | 24(3) | 27(28) | 32(33) | 33(22) |
| 44 | Oil 90% used | 135(3) | 108(5) | 114(3) | 126(11) |
| 52 | Uranium depleted | 251(9) | 406(5) | 1614(5) | 1656(44) |
| 53 | Next Swedish reactor | 16(38) | 14(45) | 16(45) | 30(55) |
| 54 | First core melt | 12(34) | 25(45) | 26(58) | 65(44) |
| 55 | Closing last Sw reactor | 62(9) | 53(23) | 67(13) | 76(0) |
| 56 | Safe method for storage of spent nuclear fuel | 55(34) | 72(40) | 31(38) | - |
| | Exists already (%) | 0 | 0 | 0 | 78 |
| 45 | Ground water in storage | 434(16) | 940(13) | 1285(18) | 26303(0) |
| 46 | Leakage from storage | 388(16) | 403(13) | 1303(13) | 166724(0) |
| 47 | Radiation halved | 275(3) | 1135(5) | 9550(0) | 77(0) |
| 48 | Stored fuel no longer dangerous | 1675(13) | 5781(28) | 58076(20) | 31623(33) |
| 49 | Sweden starts storing fuel in bedrock | 18(0) | 21(15) | 19(8) | 58(0) |
| 51 | Sweden starts storing fuel under ocean | 63(19) | 69(40) | 52(50) | - (88) |

A set of questions asked about what should be planned by others and covered personal economy through parents for their children (10 years old today) to nuclear waste management planning (by the government). Figure 5 gives the results in logarithms of the geometric means. The student data are similar differing from the expert and retired groups.

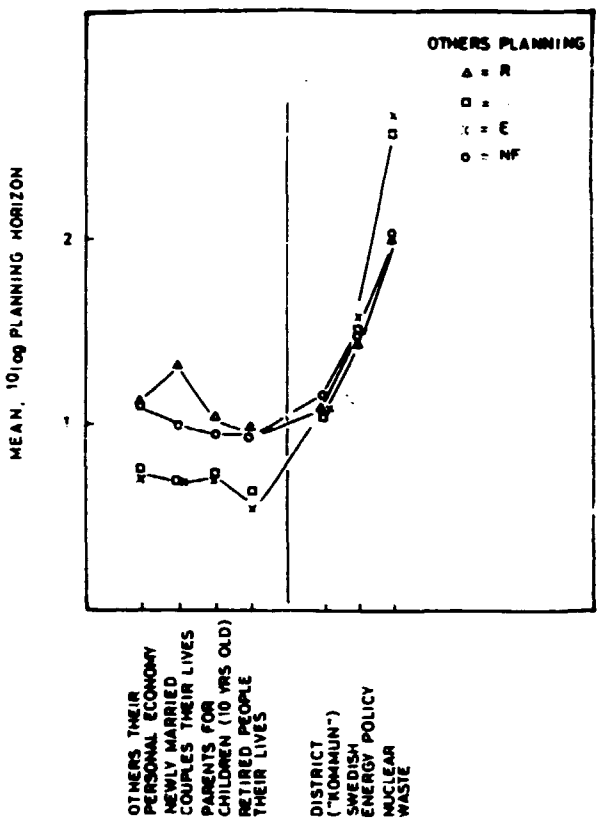



Figure 5. Logarithmic means of adequate planning horizons for other people. The two student groups were both described by one curve. See text for explanation of groups.

Although the questions were not all the same as in study 1, the general picture is very similar to the one reported in figure 3. The student groups in study 2 thought less planning of personal affairs was needed than the university students in study 1. In general, the students did not find it as needed to plan into the future as the other two groups when the planning is restricted to the personal level. For societal planning there is no difference with the exception for the planning of nuclear waste management. Comparing the pooled student groups with the other two groups yields a significant t-value ($t=2.13$, $df=104$, $p<0.05$) for this question.

Another question indicated that the responsibility of today's planners reached between geometric means of 3.4 (group E) to 5.9 (group G) generations into the future. The subjects' estimated remaining life length varied across groups as could be expected. Adding this number to the actual age of the respondents yielded shorter expected life lengths

for the younger groups 55 and 56 years for groups E and G respectively - and for the R group 75 and NF group 72 years). This may reflect a fact that 30-40 more years of life is perceived as a maximum estimate and hence personal planning for a life beyond that time period is not realistic or at least motivated by other reasons.

Figure 6 gives a graphical representation of the planning horizons indicated as adequate by the different groups. Energy policy planning horizons (top) and planning horizons for nuclear waste (bottom) are indicated for the four groups.

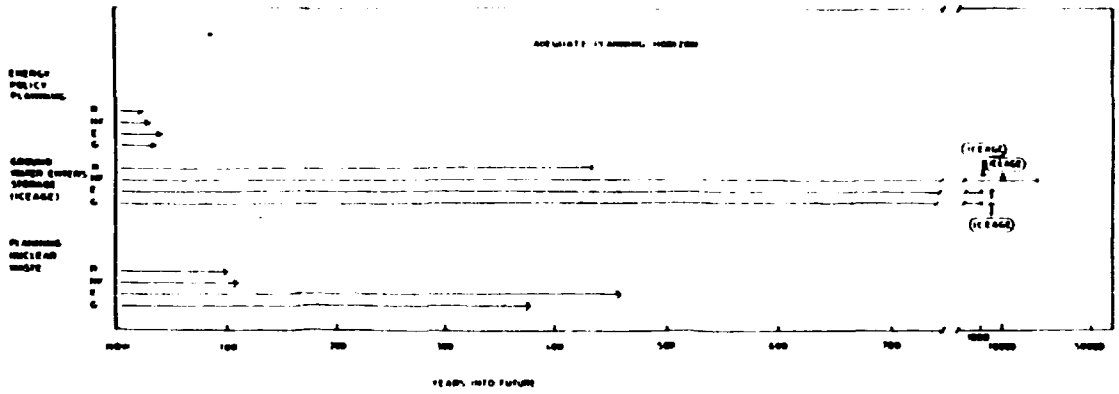


Figure 6. Adequate planning horizons in three different areas and estimated time for the arrival of the next ice age.

The planning horizons needed for energy policy planning range between 26 (group R) to 38 years (group E) and do not differ much. Although the rank order between the planning horizons remain the same the drastic gap is shown between the young and older subjects with regard to nuclear waste planning. The planning horizons for the former are 376 and 458 years while they are around 100 years for the latter groups.

Two nuclear waste related events are also indicated in Figure 6 namely the time when groundwater is estimated to enter the storage and when the next iceage arrives. Both these events are far beyond the planning horizons for all groups and for the expert group further away than for the others. Actually, the expert group is the only group that estimates the ground water to enter later than the next iceage occurs.

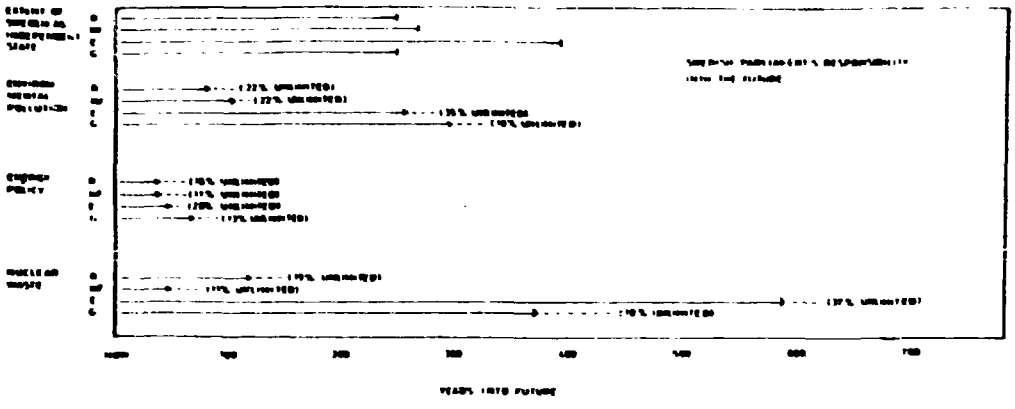


Figure 7. Judged responsibility into the future of today's parliament for energy-related areas. The estimated life length of Sweden as an independent nation is indicated at the top.

The Swedish parliament's perceived responsibility for energy related questions is described in Figure 7 which also gives the percentages of respondents indicating unlimited responsibility. On top in the figure has the life length of Sweden as an independent state been indicated. Another 250 up to almost 400 years seem to be the estimated future for Sweden. The time horizons for responcibility for environmental pollution are located between about 100 and 300 years for those not indicating unlimited responsibility. In those cases it is possible that the question is regarded as an ethic issue or that the responsibility is unlimited in time because the outcome should have marginal effect on the ongoing natural changes on earth. Energy policy planning need not be very far reaching into the future but planning for nuclear waste is so for the younger groups who want the responsibility of the parliament to reach beyond the perceived end of Sweden as a state.

To conclude, energy policy planning of about 40-75 years is found adequate, while planning for nuclear waste disposal may vary between about 45 and 600 years into the future. This huge difference may depend on different perspectives. To examplify, some subject may believe that a leakage should be managed and others that is is a natural consequence in the future and not dangerous or anything that one should take responsibility for.

Subjects were asked to indicate (on an 11 category scale: 0 = "no risk at all" to 10 = "very great risk") how great risks for humans they considered associated with each of a number of actions or events in the future. Figure 8 exposes the resulting risk profiles. The student groups were considered so similar that one curve describe both groups. This curve is similar to that of the retired group's with the exception of the consequences if no Aids vaccine can be

invented. Incidentially, the retired group expects a vaccine to be invented in 14 years from now which is quicker than the younger groups (22 and 23 years for groups G and E respectively). So, the group of retired people believe Aids to be significantly ($t=3.91$, $p<0.01$, $df=119$) more dangerous than the other groups pooled into one but is more optimistic about the invention of a vaccine. The expert group expects an Aids vaccine to appear in 10 years.

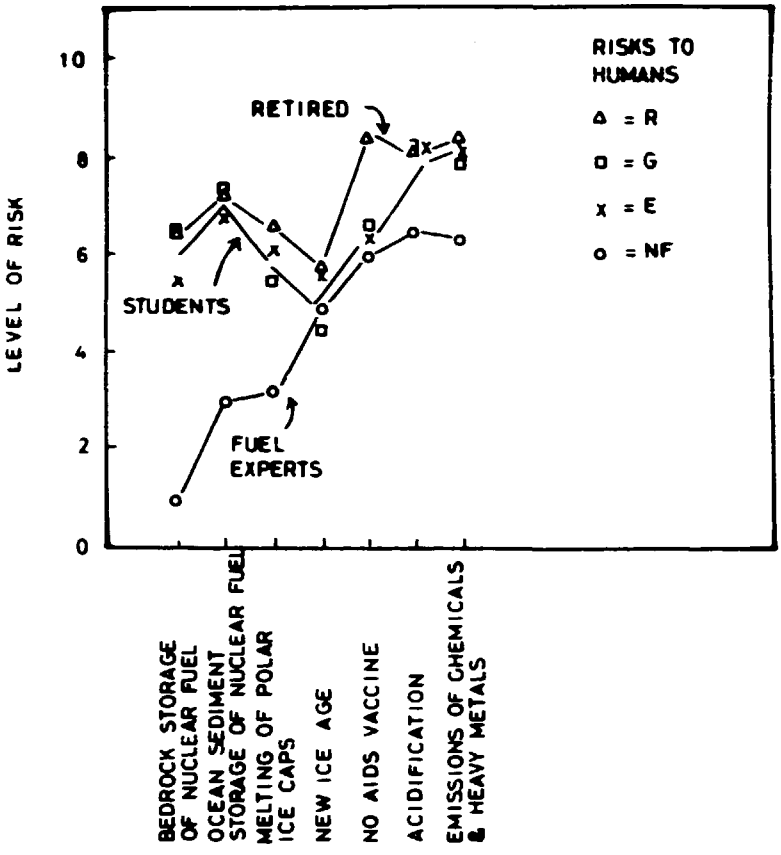



Figure 8. Levels of perceived risks associated with different activities and groups.

One interesting difference is the experts' generally lower risk estimates which are particularily evident for the questions concerning storage of nuclear waste in bedrock or in ocean sediments.

Sex differences

Means for two planning and three responsibility questions were computed and shown in Figure 9. For the retired group the men indicated longer planning and responsibility into the future than the women. Exactly the opposite tendency was exposed in the younger student groups. The latter result seems congruent with the consistently greater worry expressed by women than men in many studies of riskperception. The retired groups reversed result is surprising. There may be an effect of age interacting with sex on perceived degree of risk which has not been detected in earlier research.

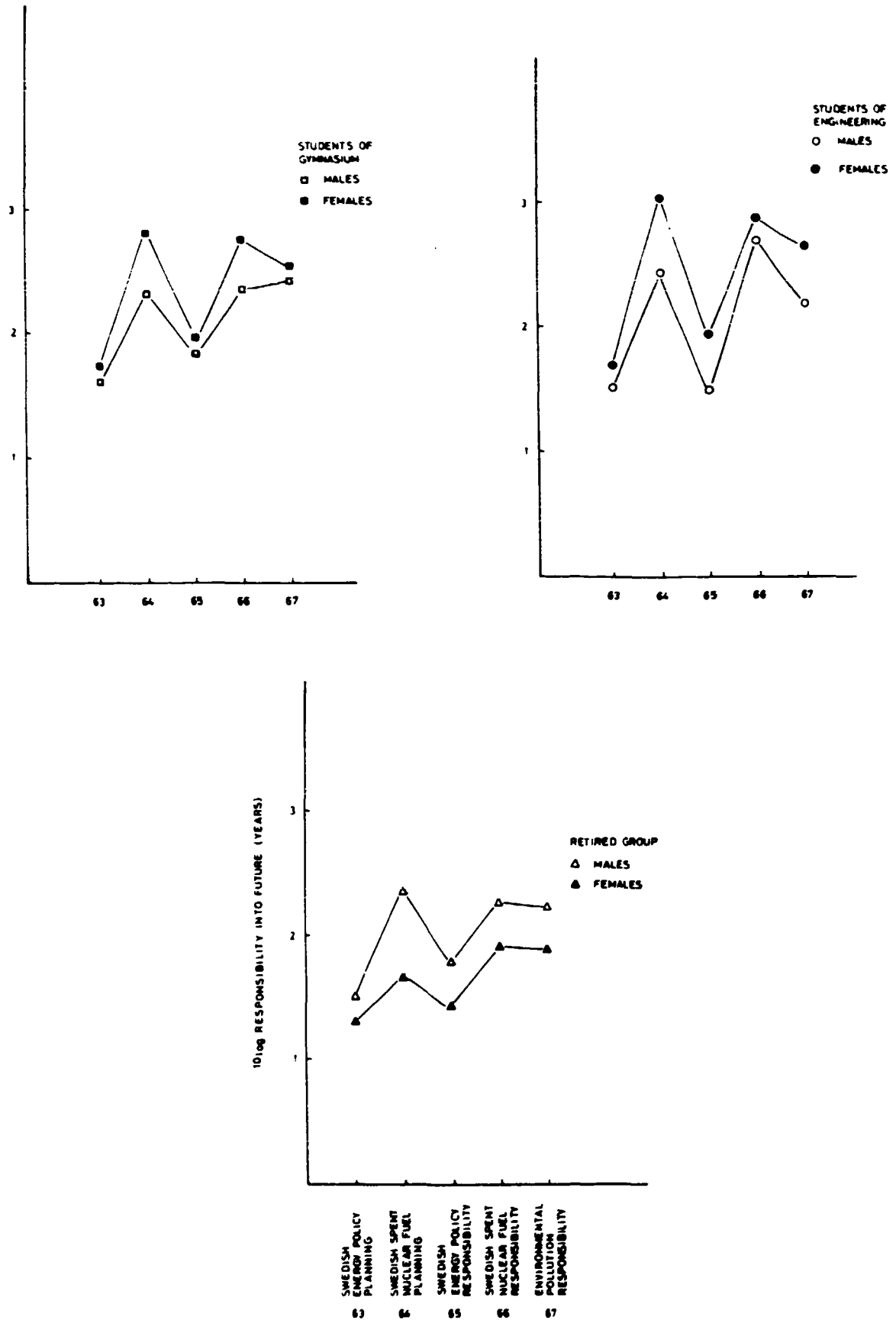



Figure 9. Planning and responsibility horizons for men and women of three groups.

Interrelations between perceived aspects of the future

Questions in the same domain were regarded as one unit and the answers added to form a new variable which was correlated with other clusters. The clusters concerned questions about (1) own personal planning (2) others planning (3) societal planning of energy policy and nuclear waste, (4) the government's responsibility for energy planning and related issues, (5) risks of acidification and pollution with heavy metals, (6) risks of storage of nuclear waste in bedrock and under the ocean, (7) outcome horizons for hazards (e.g., leakage from a nuclear waste storage and the death of the trees in a given area from acidification) and (8) location in the past of historical events.

Figure 10 provides a general picture describing the intercorrelations between clusters of questions. When a correlation was non-significant (alpha=0.05) this was denoted n.s. It is clear that location in the past has a relation only with the perception of risk of nuclear fuel storage and others planning horizons (for the retired group R, only). The further back in time one places past events the less serious are the perceived risks of spent nuclear fuel disposal. The planning horizons that others should use correlate with desired societal planning horizons and responsibility. The fact that only two questions represent each of the risk measures may weaken the links to the government's responsibility. It was not possible to link the future time perspective of outcome of expected hazards to any of the other clusters.

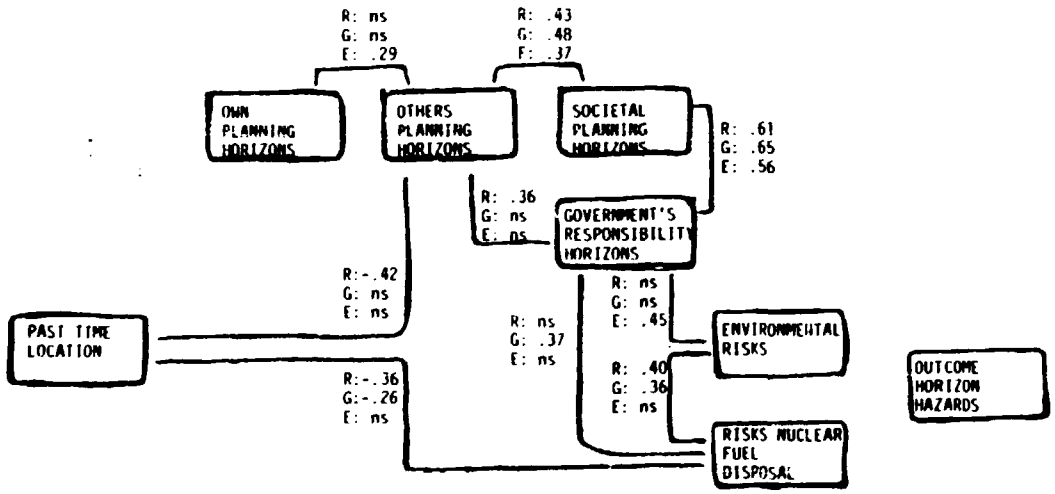



Figure 10. Interrelations between clusters of questions. All clusters except "Own planning activity", "Environmental risks" and "Risks of nuclear fuel disposal" include responses on the time scale. The exceptions consisted of four degree scales for the first cluster and 0 to 10 degree scales for the second two clusters. Insignificant correlations were denoted n.s.

Looking into more detail there were rather few significant correlations between individual questions as mentioned above. One exception was the very strong interrelation between the questions concerning planning (no. 63 and 64) and responsibility (no. 65 and 66) shown in Table 3. The table also gives typical correlations between

Table 3. Correlations between required planning horizons, the Swedish parliament's responsibility into the future and perception of risk questions. See text for identification of groups.

| No. | Question | | Question no. 63 | 64 | 65 | 66 |
|---|---|---|---|---|---|---|
| 63 | Planning Swedish energy policy | R | | | | |
| | | G | | | | |
| | | E | | | | |
| 64 | Planning spent fuel management | R | .32 | | | |
| | | G | .34 | | | |
| | | E | .36 | | | |
| 65 | Responsibility for energy policy | R | .43 | .48 | | |
| | | G | .63 | .51 | | |
| | | E | .41 | .14 | | |
| 66 | Responsibility for fuel management | R | .42 | .68 | .60 | |
| | | G | .39 | .54 | .55 | |
| | | E | .24 | .93 | .12 | |
| 83 | Risks ot bedrock deposit of fuel | R | .04 | -.16 | .07 | .05 |
| | | G | .01 | .44 | .31 | .29 |
| | | E | .09 | -.08 | .30 | -.09 |
| 84 | Risks of ocean deposit of fuel | R | .15 | -.02 | .10 | .07 |
| | | G | .02 | .34 | .25 | .22 |
| | | E | .35 | .05 | .40 | .09 |

Note. - Underlined correlations are significant at the 5% level.

individual questions in related areas. Because of the small number of people in the NF group, these data were not included in Table 3 (but they were present in the earlier discussion based on data aggregated over questions). It seems natural and clear that length of adequate planning horizons and responsibility are very strongly related for most of the subjects in this study.

## Discussion

Man's orientation in time and his concern for the future is an interesting and thought provoking question to study. Because it is reasonable to assume that there are many different ways of relating to time and the future (cf. Ainsley, 1975; Svenson, 1984; Jungerman & Fleischer, 1985) it is hard to know how each individual interprets the questions. The present investigation may be used to exemplify this. How do the different respondents interpret the questions of for example responsibility for storage of nuclear waste? For those familiar with the issues there are questions such as responsibility for retrievability of storage, for the time period before expected leakage from storage, formal responsibility and so on. For the person not familiar with the issues more global ideas of responsibility and moral may be triggered by the same question. Therefore, it is important to interpret the results of this study with an open mind. They do reflect how the respondents reacted to the questions presented but the results give us only vague details about what mental model generated the answers.

Summarizing the insights gained through this investigation, the subjects were quite knowledge about past time back to about 3000 years ago. Further back most people compressed the time scalle and there was a leap for most of them when switching from estimates of biological and historical time to geological time. When asked about outcome horizons those analyzed here covered an approximate maximum of 10000 years into the future but most judgments were well below a 1000 years.

Planning horizons for nuclear waste ranged from 100 to 460 years. The entrance of ground water into a bedrock deposit was expected to occur between $10^{2.6}$ (retired group) and $10^{4.4}$ years (experts group) into the future.

Today's generation's responsibility in general for consequences into the future extended 3.4 to 5.9 generations ahead. Translating this into years indicates that general responsibility may be assumed to reach 80-150 years into the future. Some planning is noticably shorter (e.g. society's planning of energy policy need not be longer than 25 to 40 years) and some longer. Nuclear fuel requires planning considerably further into the future. Here, experts and the retired group suggest 100 years while younger people require about 400 years planning into the future. The politician's responsibility for what is happening in the future is seen as limited to a shorter period of time by the experts (about 50 years) and extended over a longer period by the younger respondents (about 400 to 600 years and indefinitely for 27% of these subjects).

The results indicate that there are different planning horizons for different types of activities. A set of such horizons have been called a planning horizon profile. Different groups may have different profiles and feel that responsilibty for what is planned today reaches differently far into the future.

Conflicts over future plans may arise due to at least the following factors: different planning and responsibility profiles, different perceived allocations of the same events into the future and different evaluations of the same set of activities and events.

Demands on personal planning and societal planning were not related within groups; across groups they were, if anything, negatively related. Likewise, a person's own planning was not found to be related to demands on societal planning. The relatively small groups used in the study was associated with a low power to detect low correlations between individual questions within groups but the significant relations between clusters of items gave promising insights like the ones just mentioned.

The framework introduced in Figure 1 summarizes time horizons from a decision theoretic point of view. An alternative and complimentary way of understanding how future events are perceived is to assume a subjective causal representation in which acts and events are perceived to cause certain consequences (cf. Svenson & Nilsson, 1986) in scenarios into the future. The case of nuclear power and long-term storage of spent nuclear fuel is an interesting area of study in this context. Another interesting and related topic is the discounting of consequences over time often characterizing human behavior (cf. Jungerman & Fleisher, 1985).

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I det här frågeformuläret kommer vi att ställa en rad frågor som alla har det gemensamt att de handlar om tid. Vi vill att du skall ange för hur länge sedan du tror att vissa händelser ägde rum (vet du exakt skriver du det men för det mesta blir det nog fråga om uppskattningar). Om du anser att en händelse aldrig inträffat skriver du "aldrig".

Vi kommer också att fråga om hur långt in i framtiden du tror en rad andra händelser kommer att inträffa.

Frågorna är så konstruerade att det skall vara svårt att veta svaren exakt och ändå vill vi att du ger din egen mest troliga uppskattning av för hur länge sedan de olika händelserna ägde rum eller hur långt fram i tiden de kommer att inträffa. Det första avsnittet är svårast och tar mer tid än de andra.

Fundera inte alltför länge på varje fråga utan ge ett spontant svar.

Fråga försöksledaren om någonting är oklart.

Välkommen till det här försöket! Först skall vi be dig att skriva ner ett årtal som du tycker ligger mycket långt fram i tiden. Välj spontant ett årtal och fördjupa dig inte i denna uppgift. Jag tycker ..... år ligger mycket långt in i framtiden.

Vi ber dig nu vända blad och börja på nästa avsnitt.

1. När flög man för första gången i ett flygplan? år_____ bakåt i tiden

2. När uppstod det första skriftspråket? år_____ bakåt i tiden

3. När uppfanns tryckkonsten i Europa? år_____ bakåt i tiden

4. När började människan använda hjulet i t ex kärror? år_____ bakåt i tiden

5. När bildades vår planet Jorden? år_____ bakåt i tiden

6. När började människan använda elden? år_____ bakåt i tiden

7. När började de första vattenledningarna användas? år_____ bakåt i tiden

8. När började människan begrava sina döda? år_____ bakåt i tiden

9. När avsattes siste kejsaren i det enade Romarriket? år_____ bakåt i tiden

10. När föll Inkariket i Sydamerika sönder? år_____ bakåt i tiden

11. När föddes Mohammed, Islams grundare? år_____ bakåt i tiden

12. När byggdes Colosseum i Rom? år_____ bakåt i tiden

13. När stod den minoiska kulturen på Kreta på sin höjdpunkt? år_____ bakåt i tiden

14. När byggdes Cheops pyramid i Egypten? år_____ bakåt i tiden

15. När utfördes grottmålningarna i Alta Mira i Spanien? år_____ bakåt i tiden

16. När hade oraklet i Delfi i Grekland sin största betydelse? år_____ bakåt i tiden

17. När uppfanns glödlampan? år_____ bakåt i tiden

18. När uppfanns kikaren? år_____ bakåt i tiden

19. När började människan använda stenredskap? år_____ bakåt i tiden

20. När uppträder de första människorna? år_____ bakåt i tiden

21. När uppträder de första fiskarna? år_____ bakåt i tiden

22. När dog mammuten ut? år_____ bakåt i tiden

23. När bildades kalkberget på Gotland? år_____ bakåt i tiden

24. När uppträder de första däggdjuren? år_____ bakåt i tiden

25. När skapades Alperna? år_____ bakåt i tiden

26. När byggdes Visby ringmur? år_____ bakåt i tiden

27. När skapades de svenska fjällen? år_____ bakåt i tiden

28. När dog de sista dinosaurierna ut? år_____ bakåt i tiden

29. När skapades Anderna i Sydamerika? år_____ bakåt i tiden

30. När har de flesta cancerformer fått ett botemedel? _____ år framåt i tiden

31. När har mänskligheten hittat en metod som kan öka hastigheten hos radioaktiva sönderfallsprocesser (t ex för använt kärnbränsle)? _____ år framåt i tiden

32. När har största delen av träden i Småland dött av försurning? _____ år framåt i tiden

33. När inträffar ett kärnvapenkrig i Europa? _____ år framåt i tiden

34. När inträffar nästa jordbävning med dödsfall i Californien? _____ år framåt i tiden

35. När har man utvecklat ett vaccin mot cancer _____ år framåt i tiden

36. När börjar polarisarna smälta så att världshavets yta höjs minst 1 meter? _____ år framåt i tiden

37. När inträffar nästa istid i Sverige? _____ år framåt i tiden

38. När har man utvecklat ett vaccin mot AIDS? _____ år framåt i tiden

39. När gör man rutinmässiga hjärttransplantationer som är lyckade (minst 10 års överlevnadstid)? _____ år framåt i tiden

40. När upphör Sverige som nationalstat? _____ år framåt i tiden

41. När slutar solen lysa? _____ år framåt i tiden

42. När har 90% av de kolreserver man nu känner till i världen tagit slut? _____ år framåt i tiden

43. När byggs den sista av de fyra stora ej utbyggda älvarna ut för vattenkraft? _____ år framåt i tiden

44. När har 90% av världens oljereserver tagit slut? _____ år framåt i tiden

45. När börjar grundvatten komma i kontakt med det utbrända kärnbränslet som slutlagrats i berg? _____ år framåt i tiden

46. När börjar radioaktiva ämnen från utbränt kärnbränsle lagrat i berg läcka ut i naturen? _____ år framåt i tiden

47. När har den radioaktiva strålningen från det utbrända kärnbränslet som producerats idag halverats? _____ år framåt i tiden

48. När slutar utbränt kärnbränsle som deponerats i berg att vara farligt för människan? _____ år framåt i tiden

49. När börjar man lagra utbränt kärnbränsle i svenskt urberg? _____ år framåt i tiden

50. När har det kvicksilver som släppts ut och nu finns i Östersjön blivit hälften så farligt som nu? _____ år framåt i tiden

51. När kommer Sverige att lagra utbränt kärnbränsle under havsbotten i sediment? _____ år framåt i tiden

52. När är världens uranreserver slut? _____ år framåt i tiden

53. När startar man upp nästa kärnkraftreaktor i Sverige? _____ år framåt i tiden

54. När inträffar den första olyckan i ett svenskt kärnkraftverk med s k härdsmälta som följd? _____ år framåt i tiden

55. När stängs det sista kärnkraftverket i Sverige? _____ år framåt i tiden

OBS! Dessa två frågor kan vara såväl förfluten som framtid!

56. När finner/fann man enligt din uppfattning en helt säker metod för förvaring av använt kärnbränsle? _____ år sedan/framåt i tiden (Ringa in det lämpliga)

57. När utgör/utgjorde vindgenererad elkraft 1% av Sveriges eleffektkapacitet? _____ år sedan/framåt i tiden (Ringa in det lämpliga)

58. Hur långt in i framtiden tycker du att människor skall planera sin ekonomi? år _____ framåt i tiden

59. Hur långt in i framtiden tycker du att ett nygift par (25 år) skall planera sina liv? år _____ framåt i tiden

60. Hur långt in i framtiden tycker du att föräldrar i allmänhet skall planera för sina barn (antag att barnet är 10 år idag)? år _____ framåt i tiden

61. Hur långt in i framtiden tycker du att en nybliven frisk pensionär skall planera sitt liv? år _____ framåt i tiden

62. Hur långt in i framtiden tycker du att en kommun skall planera för sin verksamhet? år _____ framåt i tiden

63. Hur långt in i framtiden tycker du att svensk energipolitik skall planeras? år _____ framåt i tiden

64. Hur långt in i framtiden tycker du att hanteringen av utbränt kärnbränsle skall planeras? år _____ framåt i tiden

65. Hur långt in i framtiden tycker du att den svenska riksdagen bör ta ansvar för svensk energipolitik?

_____ år framåt i tiden

66. Hur långt in i framtiden tycker du att den svenska riksdagen bör ta ansvar för hanteringen av använt kärnbränsle?

_____ år framåt i tiden

67. Hur långt in i framtiden tycker du att den svenska riksdagen bör ta ansvar för utsläpp av miljögifter i naturen?

_____ år framåt i tiden

68. Hur långt in i framtiden tycker du att den svenska riksdagen bör ta ansvar för den svenska samhällsekonomin?

_____ år framåt i tiden

69. För hur många generationer fram i tiden tycker du att vi allmänt kan ta ansvar för konsekvenser av beslut som fattas i vår generation?

_____ (obs!) generationer framåt i tiden

Till sist några frågor om dig själv.

70. Har du planerat vad du ska göra ikväll?

(Ringa in lämpligt alternativ)

| Inte alls tänkt på planeringen | Tänkt litet på planeringen | Planerat i stort | Planerat färdigt |
|---|---|---|---|
| 1 | 2 | 3 | 4 |

71. Har du planerat vad du ska göra på din semester?

(Ringa in lämpligt alternativ)

| Inte alls tänkt på planeringen | Tänkt litet på planeringen | Planerat i stort | Planerat färdigt |
|---|---|---|---|
| 1 | 2 | 3 | 4 |

72. Har du planerat vad du ska arbeta med om 5 år?

(Ringa in lämpligt alternativ)

| Inte alls tänkt på planeringen | Tänkt litet på planeringen | Planerat i stort | Planerat färdigt |
|---|---|---|---|
| 1 | 2 | 3 | 4 |

73. Har du planerat vad du ska göra veckoslutet efter nästa veckoslut?

(Ringa in lämpligt alternativ)

| Inte alls tänkt på planeringen | Tänkt litet på planeringen | Planerat i stort | Planerat färdigt |
|---|---|---|---|
| 1 | 2 | 3 | 4 |

74. Har du planerat för din framtida yrkesverksamhet?

(Ringa in lämpligt alternativ)

| Inte alls tänkt på planeringen | Tänkt litet på planeringen | Planerat i stort | Planerat färdigt |
|---|---|---|---|
| 1 | 2 | 3 | 4 |

75. Har du tänkt på hur du ska bo om 5 år?

(Ringa in lämpligt alternativ)

| Inte alls tänkt på planeringen | Tänkt litet på planeringen | Planerat i stort | Planerat färdigt |
|---|---|---|---|
| 1 | 2 | 3 | 4 |

76. Har du tänkt på vad du ska göra när du blir pensionär?

(Ringa in lämpligt alternativ)

| Inte alls tänkt på planeringen | Tänkt litet på planeringen | Planerat i stort | Planerat färdigt |
|---|---|---|---|
| 1 | 2 | 3 | 4 |

77. Har du tänkt på var du vill bli begravd?

(Ringa in lämpligt alternativ)

| Inte alls tänkt på planeringen | Tänkt litet på planeringen | Planerat i stort | Planerat färdigt |
|---|---|---|---|
| 1 | 2 | 3 | 4 |

78. Hur långt fram i tiden tror du att du själv kommer att leva? _____ år framåt i tiden

79. Har du i din ägo någonting som dina far-morföräldrar använt när de var i din ålder? Ja Nej

80. Planerar du att spara något åt dina barnbarn?

(Ringa in lämpligt alternativ)

| Inte alls tänkt på planeringen | Tänkt litet på planeringen | Planerat i stort | Planerat färdigt |
|---|---|---|---|
| 1 | 2 | 3 | 4 |

81. Hur gammal är du? _____ år

82. man / kvinna (ringa in tillämpligt svar)

83. Hur stora risker för människor anser du vara förknippade med lagring av utbränt kärnbränsle i urberg? (Ringa in tillämpligt svar.)

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| ingen risk alls | | | | | | | | | | mycket stor risk |

84. Hur stora risker för människor anser du vara förknippade med lagring av utbränt kärnbränsle i sediment på havsbotten? (Ringa in tillämpligt svar.)

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| ingen risk alls | | | | | | | | | | mycket stor risk |

85. Hur stora risker för människor anser du vara förknippade med en smältning av polarisarna som följd av förbränning av olja, gas och kol? (Ringa in tillämpligt svar.)

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| ingen risk alls | | | | | | | | | | mycket stor risk |

86. Hur stora risker för människor anser du vara förknippade med en ny istid på jorden? (Ringa in tillämpligt svar.)

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| ingen risk alls | | | | | | | | | | mycket stor risk |

87. Hur stora risker för människor anser du vara förknippade med om inget vaccin skulle kunna skapas mot AIDS? (Ringa in tillämpligt svar.)

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| ingen risk alls | | | | | | | | | | mycket stor risk |

88. Hur stora risker för människor anser du vara förknippade med en fortsatt försurning av jorden i nuvarande takt? (Ringa in tillämpligt svar.)

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| ingen risk alls | | | | | | | | | | mycket stor risk |

89. Hur stora risker för människor anser du vara förknippade med utsläpp av kemikalier och tungmetaller i luft och vatten.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| ingen risk alls | | | | | | | | | | mycket stor risk |

90. Radioaktiva läckage från ett lager av använt kärnbränsle kan ha negativa konsekvenser. Beroende på läckagets storlek och när det inträffar är konsekvenserna mer eller mindre allvarliga. Låt oss säga att allvaret i konsekvenserna av ett stort läckage mellan år 2000 och 2100 svarar mot 1000, hur skulle du bedöma konsekvenserna av samma händelse längre fram i tiden?

| Om läckaget sker mellan | bedömer jag konsekvensernas allvar vara |
|---|---|
| år 2000 och 2100 | 1000 |
| år 3000 och 3100 | _____ |
| år 4000 och 4100 | _____ |
| år 10000 och 10100 | _____ |
| år 100000 och 100100 | _____ |
| år 1000000 och 1000100 | _____ |
| år 2000000 och 2000100 | _____ |

91. När man bygger ett lager för permanent lagring av utbränt kärnbränsle kan det byggas så att man under en viss tid kan gå in i lagret igen och rätta till eventuella fel som kan uppstå. Detta är förknippat med vissa risker som man undgår om man slutgiltigt förseglar lagret då man bygger det. Å andra sidan skulle då något hända i lagret är det svårare att rätta till detta än då lagret är byggt så att man kan öppna det igen.

Hur skulle du vilja väga risken av att ha ett åtkomligt lager med större risk för omgivningen mot ett förseglat lager med mindre risk (och oåtkomlighet om något skulle hända)? (Kryssa för ett tillämpligt alternativ och ange i förekommande fall tiden.)

__ (a) förseglat lager

__ (b) åtkomligt lager till och med _____ år framåt i tiden och därefter förseglat.

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NAK Report 1

SAMMANSTÄLLNING AV NUKLEÄRA KÄLLDATA FÖR ANVÄNT KÄRNBRÄNSLE

(Compilation of Nuclear Source Data for Spent Nuclear Fuel)

Göran Olsson
Studsvik Energiteknik AB
April 1983

(19 pages of tables and diagrams, Swedish text)

NAK Report 2

MATERIAL OCH PROCESSUTVECKLING FÖR DIREKT SLUTFÖRVARING AV ANVÄNT KÄRNBRÄNSLE

(Material - and Process Development of Ceramic Encapsulation of Spent Nuclear Fuel for Disposal)

Caj Airola
Studsvik Energiteknik AB
November 1983

(119 pages mainly on engineering aspects of ceramic encapsulation, in Swedish)

NAK Report 3

ENCAPSULATION OF SPENT NUCLEAR FUEL IN CERAMIC MATERIALS AN INTRODUCTORY STUDY

S Forsberg
T Westermark
Department of Nuclear Chemistry
The Royal Institute of Technology
Stockholm, Sweden
March 1983

(37 pages mainly on material properties, in Enlish)

NAK Report 4

INTERNATIONELL UTVECKLING FÖR KOMMERSIELL UPPARBETNING AV KÄRNBRÄNSLE, BEHANDLING AV UPPARBETNINGSAVFALL OCH ÅTERANVÄNDNING AV PLUTONIUM

(International Development of Commercial Reprocessing of Spent Nuclear Fuel, Treatment of Reprocessing Wastes and Recycling of Plutonium)

Göran Carleson
Åke Hultgren
Studsvik Energiteknik AB
Mars 1983

(44 pages in Swedish)

NAK Report 5

SAMMANSTÄLLNING OCH VÄRDERING AV UTLÄNDSKA SÄKERHETSSTUDIER ÖVER SLUTFÖRVARING AV KÄRNBRÄNSLEAVFALL

(Review of Foreign Safety Studies on Disposal of Spent Nuclear Fuel Waste)

Ragnar Gelin
Studsvik Energiteknik AB
April 1983

(109 pages in Swedish)

NAK Report 6

NÅGRA HUVUDRIKTNINGAR INOM MODERN RISKTEORI

(Som Main Trends in Recent Development of Risk Theory)

Nils-Eric Sahlin
AB Episteme
Lund
Juli 1983

(23 pages in Swedish)

NAK Report 7

RISK PÅ LÅNG SIKT OCH DISKONTERING AV RISK

(Risk in the Long Term and Discounting of Risk)

Bengt Hansson
AB Episteme
Juli 1983

(17 pages in Swedish)

NAK Report 8

RISK PÅ LÅNG SIKT OCH DISKONTERING AV RISK I SAMBAND MED FÖRVARING AV RADIOAKTIVT MATERIAL

(Long Term Risk and Discounting of Risk in Relation to Disposal of Radioactive Materials)

Ola Svensson
Gunnar Karlsson
Department of Psychology,
University of Stockholm
September 1983

(43 pages in Swedish)

NAK Report 9

UPPFÖLJNING AV UTLÄNDSKA SÄKERHETS-STUDIER ÖVER SLUTFÖRVARING AV KÄRNBRÄNSLEAVFALL

(Review of Foregin Safety Studies on Disposal of Spent Nuclear Fuel Waste)

Ragnar Gelin
Studsvik Energiteknik AB
June 1984

(40 pages in Swedish)

NAK Report 10

INTERNATIONELL UTVECKLING AV MELLANLAGRING OCH UPPARBETNING AV ANVÄNT KÄRNBRÄNSLE SAMT PLUTONIUMÅTERFÖRING

(International Development of Intermediate Storage and Reprocessing of Spent Nuclear Fuel and on Recycling of Plutonium)

G Carleson
Å Hultgren
Studsvik Energiteknik AB
August 1984

(56 pages in Swedish)

NAK Report 11

THE DISPOSAL OF HIGH-LEVEL RADIOACTIVE WASTE 1984
Volume I and II

Frank L Parker
Robert E Broshears
Janos Pasztor
The Beijer Institute of the Royal Swedish Academy of Sciences
October 1984

(Vol I 116 pages, Vol II 209 pages, in English)

NAK Report 12

KÄRNBRÄNSLENÄMNDENS FORSKNINGSINVENTERING 1983-1984

DEL I SLUTRAPPORT

DEL II FORSKARUTLÅTANDEN

(An inventory of research needs)

Vol I Summary and Conclusions
30 pages)

Vol II Research proposals 196 pages)

Clas-Otto Wene et al
December 1984

The report identifies knowledge gaps and presents proposals on itmes which ought to be addressed in the on-going Swedish research programme on disposal of spent nuclear fuel (in Swedish).

NAK Report 13

RISKFORSKNING OCH BESLUT OM RISKER

(Risk Research and Decisions about Risks)

Sven Ove Hansson
Februari 1985

(14 pages in Swedish)

NAK Report 14

UPPFÖLJNING AV UTLÄNDSKA SÄKERHETSSTUDIER ÖVER SLUTFÖRVARING AV KÄRNBRÄNSLEAVFALL

(Review of Foreign Safety Studies on Disposal of Spent Nuclear Fuel Waste)

Ragnar Gelin
Studsvik Energiteknik AB
April 1985

(37 pages in Swedish)

NAK Report 15

UPPFÖLJNING AV DEN INTERNATIONELLA UTVECKLINGEN AV MELLANLAGRING OCH UPPARBETNING AV ANVÄNT KÄRNBRÄNSLE

(International Development of Intermediate Storage and Reprocessing of Spent Nuclear Fuel and on Recycling of Plutonium)

Göran Carleson
Studsvik Energiteknik AB
June 1985
(39 pages in Swedish)

SKN Report 16

NAK WP-CAVE PROJECT - REPORT ON THE RESEARCH AND DEVELOPMENT STAGE, MAY 1984 TO OCTOBER 1985

Boliden WP-Contech AB
November 1985

(129 pages in English)

SKN Report 17

TECHNICAL AND SOCIO-POLITICAL ISSUES IN RADIOACTIVE WASTE DISPOSAL 1986

Vol I Safety, Siting and Interim Storage (184 pages)
Vol IA Appendices (197 pages)
Vol II Subseabed Disposal (95 pages)

Frank L Parker
Roger E Kasperson
Tor Leif Andersson
Stephan A Parker
The Beijer Institute of the Royal Swedish Academy of Sciences

November 1987

SKN Report 18

INTERNATIONELL UTVECKLING INOM KÄRNBRÄNSLECYKELN MED TYNGDPUNKT PÅ TRANSPORTER OCH SAFEGUARDS

(International Development within the Spent Nuclear Fuel Cycle with Emphasis on Transports and Safeguards)

Karin Brodén
Göran Carleson
Åke Hultgren
Studsvik Energiteknik AB
November 1987

(52 pages in Swedish)

SKN Report 19

RISK DECISIONS AND NUCLEAR WASTE

Sven Ove Hansson
The National Board for Spent Nuclear Fuel
November 1987
(38 pages in English)

SKN Report 20

TIME ORIENTATION, PLANNING HORIZONS AND RESPONSIBILITY INTO THE FUTURE

Ola Svensson
Göran Nilsson
University of Stockholm
January 1988

(40 pages in English)

SKN Report 21

PSYCHOLOGICAL ASPECTS OF NUCLEAR WASTE DISPOSAL: Long time perception and the question of discounting of risks

Gunnar Karlsson
Ola Svensson
University of Stockholm
January 1988

(40 pages in English)

SKN Rapport 22

KÄRNKRAFT OCH RADIOAKTIVT AVFALL: Riskperception och attityder hos gymnasieelever i Stockholm

(Nuclear Power and Radioactive Waste: Risk perceptions and Attitudes of High-school Students in Stockholm, Sweden)

Britt-Marie Drottz
Lennart Sjöberg
Psykologisk Metod AB, Stockholm
Januari 1988

(150 pages in Swedish)

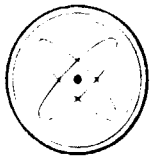
SKN Rapport 23

ATTITYDER TILL RADIOAKTIVT AVFALL

(Attitudes to Radioactive Waste)

Lennart Sjöberg
Britt-Marie Drottz
Psykologisk Metod AB, Stockholm
Januari 1988

(160 pages in Swedish)



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