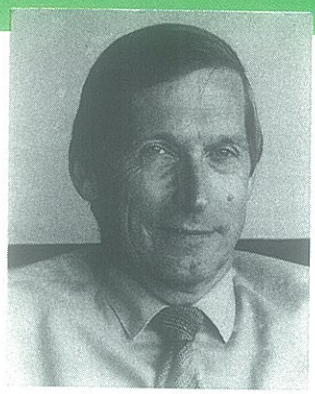

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OPERATIONAL SAFETY: A PLANT MANAGERS POINT OF VIEW

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"Safety, reliability, availability and economy are strictly related. Reactor safety and reliability are inseparable because the failure of a component or system could lead to an accident". This statement is, in different versions, repeatedly mentioned during this conference.
The yearly higher than 80% capacity factors of all five swiss nuclear units are well above the world average. Does this imply that they are also safer? Notwithstanding this fact of high capacity factors, and independent of the relationship between the difficult to assess and measure quantity called "safety" and the measurable quantity called "availability", we, the operators of nuclear power plants, are very interested to further improve safety *and* availability. At the some time, we know that we have reached a point where the availability may increase only a little and the economics not at all by adding additional technical safety measures.
Lets look at the last five years of Swiss Nuclear Plant performance. It represents the last third of more than 70 successful years of NPP-Operation.

- Load-Factors (F I). 1986 KKM: Recirc-Pipe Exchange.
- Nonavailability 1986 (F II). Small fraction of unplanned unavailability.
- Nonavailability 1988 (F III).

More safety related performance factors are:

- Total Man-Rem Dosis (F IV). Inpo-Goal: BWR's 469; BWR's: 288. (Note: Beznau, KKB 1 + 2).
- Unplanned Automatic SCRAM's (F V). The figure shows all the unplanned scrams, not only the on-line scrams. (We meet the Inpo-Goal of 1.5/unit in the average.)
- Radioactivity Release.
- Iodine Release. Normally in the range of a few percents.

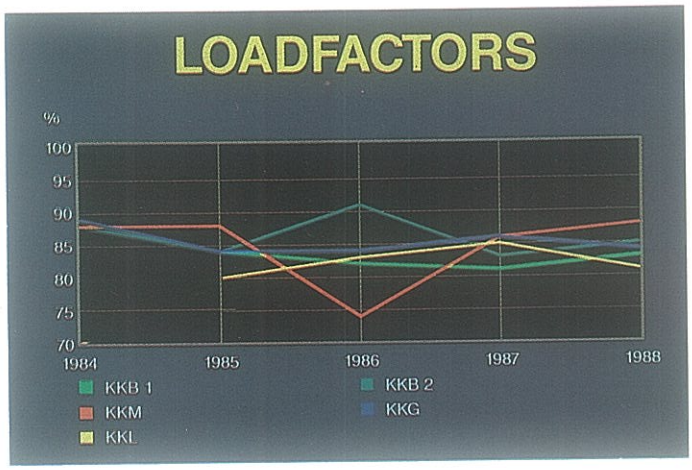
In the following presentation, I will discus mainly the role of the operation team.

SAFETY GOALS

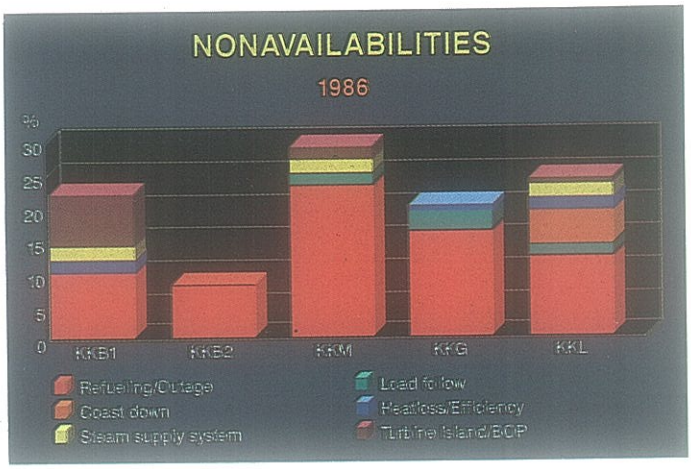
The draft for a new "Atomic Law" in Switzerland postulates:
(On the basis of discussions in the Swiss Parlament following the TMI accident, a draft was worked out which contained qualitative and specific goals for the assurance of the safety of the populations):

1. The use of nuclear power may not increase the existing danger to man and environment.
2. While using nuclear power, particular care must be taken to prevent an inadmissible release of radioactive material, as well as to prevent inadmissible irradiation of individuals in normal conditions and *during technical and/or human failures.*
3. At the same time all measures are to be taken which:
   a) for the protection of man and the environment are *necessary* accordng to the latest state of science (knowledge) and technology.
   b) will lead with reasonable expenditures to a further reduction of risk.

Paragraph 1 and 2 are certainly already fullfilled, our plants meet this goal.
Also 3a, we can agree, that we take all measures which are *necessary.*
Paragraph 3b is more questionable! It asks for measures, even if they are not proven to be necessary, as long as it is not prohibitively expensive. Here certainly we reach the limit, from where on incresing safety does not increase the availability any more.
If technical measures of this class can not be avoided and have to be introduced at a plant, then, from operations point of

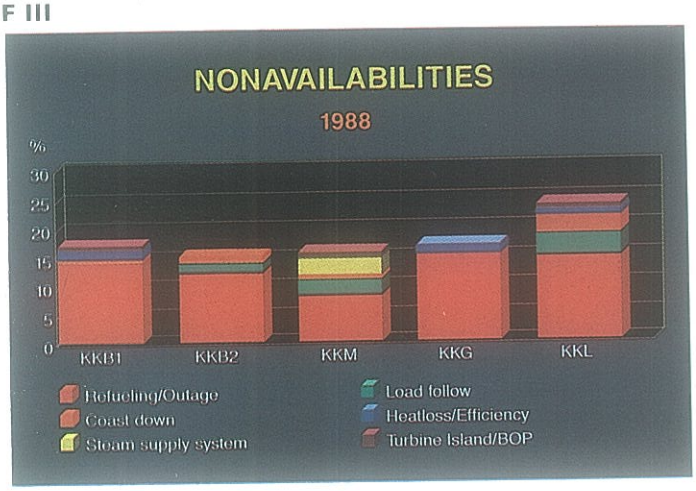


F I

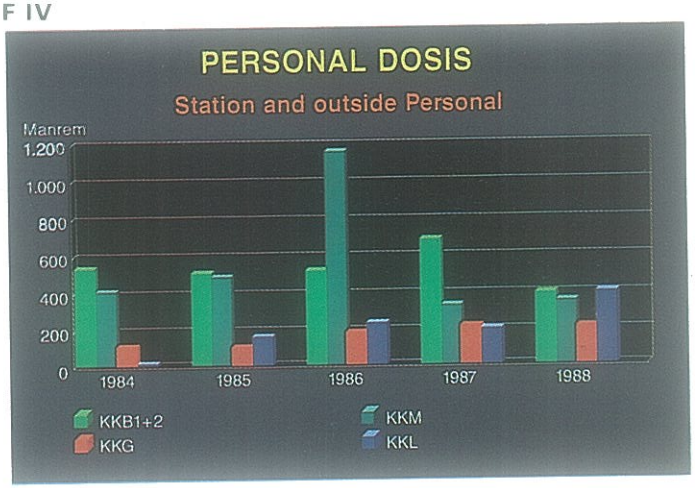


F II

F III



F IV



view, they have to be designed and built so as *not to interfere at all,* with *normal* operation and maintenance. To this category belong in my view Containment Venting Systems, Hydrogen Igniters or Inerting Systems, etc.

RISK ANALYSIS

PSA/PRA is certainly a valuable tool to evaluate the safety of a plant. It can examine the suitability and comprehensiveness of the deterministic design and can point out possible deficiencies.
The plant specific PRA helps to:

- Detect weak points in the plant and to find remedy.
- Recognize (and eliminate) dominant accident sequences.
- Develop plant specific source terms.
- Allow a comparison with the safety goals and therefore, last but not least, it helps to find out where to get the most benefit out of the money spent.

However, I would be reluctant to compare the safety of different plants on the basis of PRA's, because of the differences of the safety philosophies of different individual plants and of the difference of the PRA's. Maybe not everybody in the audience agrees with this opinion.

THE ROLE OF THE OPERATING TEAM

The operating team I am talking about includes everybody who takes part and contributes in some way to the operation of a plan.
I would to give some thoughts to three keywords:

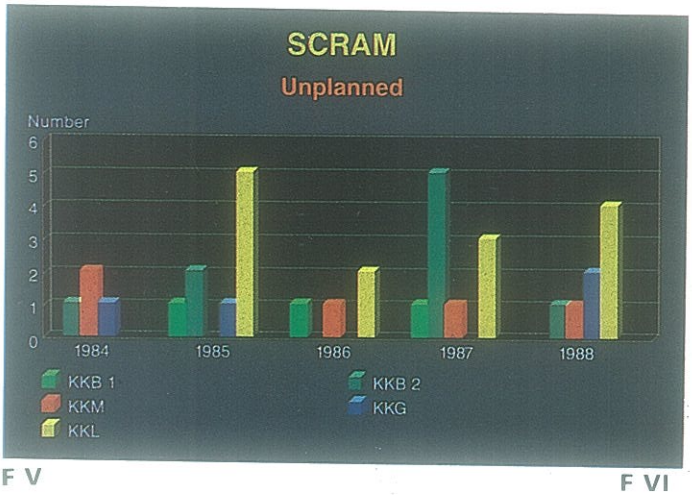
- Operating Crew (what in the plant organization is called "Operation").
- Maintenance.
- Management.

OPERATING (CREW)

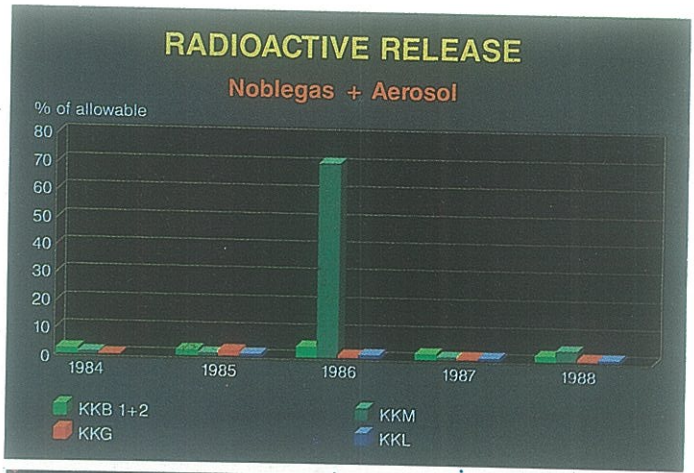
Well trained, responsible and experienced operators are a key factor for safe operation and to prevent severe accidents.
Inspite the increased application of automatic safety systems, the ability of the operating crew will continue to be the deciding factor. The overall goal in this field is not to exclude or bypass thee shift personnel in case of an incident, but to provide support, to provide clear information and give them time to respond.
This is mainly achieved by:

- Automatic safety measures, which gives the operator sufficient time for his decisions and intervention.
- Electronic data acquisition and data processing equipments which rapidly and comprehensively inform the operating personnel and provide them with documentation on which to base their decisions.
- Systematic training of shift supervisors and shift technical advisors to diagnose incidents and to take measures to control them.

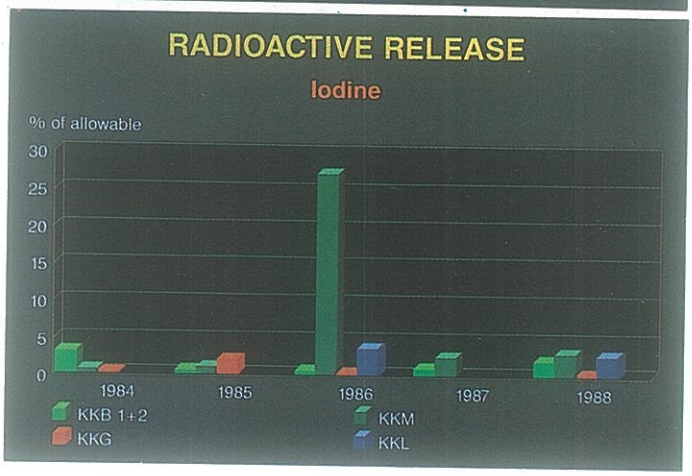
I don't want to elaborate on keywords like "Training" or "Human Factors" because there importance is well recognized and quite a number of technical sessions at this conference are dedicated to these subjects. I only want to give an impressive



F V



F VI



F VII

example to demonstrate the importance of procedures and training.
Edward R. Frederick, GPUN, the control board operator during the first part of the TMI accident said:
I am often asked the question, "If you were back in the control room faced with the same circumstance - and allowed to use only one of the innovations installed or created since the accident - which change or improvement would you choose and would that prevent the incident?" "If I must choose *only one,* then the training on the symptom based emergency procedures is all that I would need".
(Extracted from a paper presented to *the IAEA simposium on severe accidents,* Sorrento, Italy, 21-25 March 1988).

MAINTENANCE

Safety and availability are heavily depending on an excellent maintenance. Preventive maintenance can drastically reduce remedial actions.
With the modern tools of monitoring and detecting of abnormalities the maintenance strategy can be based on the condition of the component.
We hare heard here, and I can agree with it, that "hands on" monitoring does not get obsolete despite the new technical, computer-aided systems.
Refuelling and maintenance *outage* plays a dominant role as you can hear from special technical sessions.
To guarantee perfect maintenance service, the yearly outage should not be as short as possible. On the contrary, the outage should be as long as necessary to provide high quality work. Besides, one should only hire as many contractor personnel as is absolutely necessary and only the best qualified personnel with as much continuity as possible. The management of his personnel should be in the hands of the plant staff.
The outage should not be longer than necessary even when —as in our country—, there is no strong economical incentive to shorten it to an absolut minimum. Why? In central Europe, in summer we produce more electricity than we need, therefore replacement electric energy is —for the near future— very cheap.
Despite of this economic situation I postulate: Outages have to be not longer as absolutely necessary. Then: If you allow for a job, which can be done properly in five weeks, six weeks, I bet, you will not only increase the cost, but also —what is even more important— the man-rems accumulated more or less by 20% for having this job done.
Whatever maintenance strategy you choose, finally the result will depend on the quality of the work to be done *in the* plant, *on the* component. Again, this is a matter of reliability of the person doing the job, of this dedication to his job.
If you look at a component in a Swiss NPP, its appearance reflects the pride of the individual responsible for maintaining this component and the pride in his work.
In this room, I said at another meeting a few years ago in this context:
"Plant cleanliness is also a kind of preventive measure. It is not just pedantry or an expression of perfectionism; Plant cleanliness is part of a philosophy".

MANAGEMENT

Highly qualified and well trained personnel can only do their best and make optimal use of the high quality equipment if they get strong support from the management.
Also here dedication and obligation are important keywords.
A clear organization with clear allocation of responsabilities are a prerequisite for a safe and reliable NPP operation. That means, defining the responsibilities at each level and to allocate the responsibility to the lowest level that is best suited to take it.
Corbin Mc Neill, Executive Vice President of Philadelphia Electric said:
"Critical is developing an organization in which management of day-to-day operations and short-term decision-making are pushed to *as low a level as possible in the organization,* leaving top management free to concentrate on long-term needs".
That's more than true, because manage-

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