

in an essentially airtight concrete vault so that there are many feet of concrete between it and the workers, certainly the risk to workers is quite different, if you use the word "safety" in that sense. Again, what safety factor should be used if the boiler contains highly radioactive material where consequences of a failure would be very severe? I mention these things to point out that one cannot blindly adopt, for nuclear energy application, safety codes developed for conventional equipment until you know a great deal more about it.

Where circumstances are not normal—and they are certainly not normal in this case—an applicant would submit detailed argument or experimental proof that the proposed relaxation would not cause an unacceptable hazard, or else be expected to show that equivalent protection would be obtained by other means.

The applicants of the NPD-2 project did submit such argument and evidence to both the boiler inspection branch of Ontario, and the board through the reactor safety advisory committee. I understand a copy of their submission to the boiler inspection branch has been tabled with your committee. Briefly, this submission proposed the use of tubes of a certain thickness at an operating pressure of approximately 1200 p.s.i. and a temperature of around 525 degrees.

These tubes are made of zircaloy. Zircaloy used in our pressure tubes is a relatively new material and I understand the A.S.M.E. has not adopted a figure for its ultimate strength, and nothing in the code refers to this new material.

However, the A.E.C. have published some data, which C.G.E. engineers assumed correctly were very conservative. They realized that the tests for the particular tubes would be much more extensive, and they said "we think a factor of safety on the figures published of three to one would be satisfactory".

Now, this matter was discussed at very great length, and the consideration was this: that the normal tests that would have been made on material for pressure tubes was not what was proposed. The tests proposed to us were extremely extensive and unusual, as well as the inspection procedure. The proposal was that these should be tested by all the methods I have indicated, and also that they would finally be broken, and Mr. McRae, I think, reported to you the results of the tests, which means that the actual individual tests were all higher than the original test. Therefore, if you apply this factor of safety you actually have something that would have met your figures. If you are really concerned with the actual safety of this reactor, you have to follow these procedures we are talking about.

Another point, as we are interested in the safety of the reactor and the safety of the people, is that the reactor safety advisory committee, in addition, approached this problem from another direction. It required the applicants to submit detailed assessment of the possible consequences, if such an unlikely failure occurred. On the basis of its review of this assessment the committee concluded that there would be no hazard to workers or the general public from the release of radioactive material or from escaping steam in the event of such an accident.

This was the position which was before our board when we gave the permit. The boiler inspection branch of Ontario considered this reasonable. I think they may or may not give an approval. I cannot tell you what happens in the provincial government body. Anyway, we understand it was reasonable. The so-called safety factors on these tubes, as determined by experiment rather than calculated from published values, is at least four. So that to say that this particular thing is unsafe is absurd. No one can guarantee that failure of some tubes will not occur whether safety factors of three, four or five and so on, are used, but even in the unlikely event of a break in one or more tubes, our expert advisors, as the result of careful investigation, are of the opinion that no injury to workmen or to the general public would result.