

Internal distribution code:

- (A) [] Publication in OJ
(B) [] To Chairmen and Members
(C) [X] To Chairmen
(D) [] No distribution

D E C I S I O N
of 18 November 2004

Case Number: T 0370/03 - 3.4.1

Application Number: 96934265.8

Publication Number: 0858663

IPC: G21C 9/06

Language of the proceedings: EN

Title of invention:

Passive emergency hydrogen mitigation system for water-cooled nuclear reactors

Patentee:

ATOMIC ENERGY OF CANADA LIMITED

Opponent:

Framatome ANP GmbH

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (no)"

"Admissibility of late-filed request (no)"

Decisions cited:

-

Catchword:

-



Case Number: T 0370/03 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 18 November 2004

Appellant: Framatome ANP GmbH
(Opponent) Freyeslebenstrasse 1
D-91058 Erlangen (DE)

Representative: Walkenhorst, Andreas
Tergau & Pohl
Eschersheimer Landstrasse 26
D-60322 Frankfurt am Main (DE)

Respondent: ATOMIC ENERGY OF CANADA LIMITED
(Proprietor of the patent) 344 Slater Street
Ottawa
Ontario K1A 0S4 (CA)

Representative: Senior, Alan Murray
J.A. KEMP & CO.,
14 South Square
Gray's Inn
London WC1R 5JJ (GB)

Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 18 December 2002
rejecting the opposition filed against European
patent No. 0858663 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: G. Davies
Members: M. G. L. Rognoni
G. Assi

Summary of Facts and Submissions

- I. The appellant (opponent) lodged an appeal, received on 18 February 2003, against the decision of the opposition division, dispatched on 18 December 2002 rejecting the opposition against European patent No. 0 858 663. The fee for the appeal was paid on 18 February 2003 and the statement setting out the grounds of appeal was received on 17 April 2003.
- II. The opposition had been filed against the patent as a whole, based on Article 100(a) EPC, in particular on the grounds that the subject-matter of claim 1 of the patent as granted lacked novelty within the meaning of Article 54 EPC and did not involve an inventive step within the meaning of Article 56 EPC.
- III. In the decision under appeal, the opposition division held that the grounds for opposition did not prejudice the maintenance of the patent as granted, having regard, *inter alia*, to the following documents:
- D2: DE-A-28 05 476
- D4: DE-A-40 15 228
- D8: K. Petersen *et al.* "Wasserstoff-Durchmischung durch Naturkonvektion in DWR-Containments", Atomwirtschaft, November 1994, pages 758 to 761.
- IV. Oral Proceedings were held on 18 November 2004.
- V. The appellant requested that the decision under appeal be set aside and the patent be revoked.

VI. The respondent (patentee) requested that the appeal be dismissed and the patent maintained as granted (Main Request), or that the patent be maintained on the basis of the following documents:

First Auxiliary Request: claims 1 to 6 filed on 31 October 2002;

Second Auxiliary Request: claims 1 to 5 filed on 31 October 2002.

At the oral proceedings, the respondent further requested permission to file an additional auxiliary request that was not formulated but would have introduced a feature from the description into claim 1 of the second auxiliary request.

VII. Claim 1 according to the patent as granted (main request) reads as follows:

"A system, for use in a water cooled nuclear reactor (10) having within its containment wall (12,40) a reactor core (42) and coolant lines associated therewith, said system being for removing hydrogen from containment atmosphere generated in the event of a loss of coolant accident occasioned by a break in said coolant lines, said system comprising:

means for establishing within containment an air upflow path and an air downflow path in convective exchange, said air upflow path disposed in the area of said coolant lines and effective to entrain hydrogen from

said break and said air downflow path in the area adjacent said containment wall (12); means for ducting said air upflow path downstream of said coolant lines effective to confine said entrained hydrogen to the ducted air upflow path; and a catalytic hydrogen recombiner (70) located in said ducted air upflow path for recombining said entrained hydrogen with oxygen in said ducted air upflow."

Claim 1 according to the first auxiliary request differs from the granted claim 1 in that it further comprises the following features recited in dependent claim 2:

"wherein said means for establishing an air upflow path and said air downflow path comprises a baffle wall (62) disposed between the area of said coolant lines and the outer containment wall (12,40) and having a lower (64) and an upper aperture (66), said baffle wall (62) defining an air upflow path from said lower aperture (64) to said upper aperture (66) through the area of said coolant lines and an air downflow path from said upper aperture (66) to said lower aperture (64) in the area between said baffle wall (62) and the outer containment wall (12,40);"

Claim 1 according to the second auxiliary request adds to the independent claim of the first auxiliary request the following feature recited in dependent claim 3 of the patent as granted:

"wherein a steam generator enclosure (52) is present inside containment and said ducted air upflow path is through said steam generator enclosure (52)."

VIII. The appellant's arguments may be summarised as follows:

The system according to claim 1 of the **main request** relied on a combination of known measures to control the concentration of hydrogen generated by a break in the coolant lines of a water-cooled nuclear reactor. Document D8, for instance, related to a pressurised water reactor comprising a missile protection wall and showed that the reactor's internal structure established an air upflow path and an air downflow path in convective exchange in the event of a loss of coolant accident. Document D4 was concerned with catalytic hydrogen recombiners as a standard means for removing hydrogen from the containment atmosphere. Furthermore, document D2 hinted at the possibility of combining a convective air exchange to disperse hydrogen with the use of hydrogen recombiners. As it would have been obvious to a person skilled in the art, wishing to increase the safety of a nuclear power plant, to arrive at the claimed combination of features, the subject-matter of claim 1 of the granted patent lacked an inventive step.

Claims 1 of the **first and second auxiliary requests** specified further features of the alleged invention which were already known from D8 and which therefore could not contribute to the inventive step of the claimed subject-matter.

IX. The respondent argued essentially as follows:

D8 related to a particular kind of nuclear reactor and did not imply that its findings could be extended to

any reactor. Moreover, this document showed that the convective air flows which would be established in the case of a loss of coolant accident were sufficient to keep hydrogen concentration below safe limits. A person skilled in the art starting from D8 would have assumed that means for diluting and dispersing hydrogen within the containment wall provided a complete solution to the problem of keeping the hydrogen concentration under control. Thus, D8 would not have given the skilled person any incentive to look for different and more complex solutions.

Document D2 merely hinted at the possibility of adding recombiners to a nuclear reactor where a convective air exchange was triggered by specific means and did not occur spontaneously in the case of a loss of coolant accident. Furthermore, it showed that recombiners could be arranged either outside or inside the nuclear reactor and, thus, that the choice of a suitable location for a recombiner was not based on obvious and straightforward considerations.

Document D4 taught explicitly to distribute recombiners in netlike fashion over the wall and/or bottom region of the containment building or shell.

As there was no indication in the prior art that the problem addressed in the contested patent could be solved by combining hydrogen dispersion and dilution through convective air exchange and hydrogen removal by means of a catalytic hydrogen recombiner located in a ducted air upflow path, the subject-matter of claim 1 of the contested patent involved an inventive step.

The independent claims of the **first and second auxiliary requests** comprised specific structural details of the means for establishing an air upflow

path and an air downflow path and therefore added features which contributed to the inventive step of the claimed subject-matter.

The filing of a further request was justified by the fact that, in the oral proceedings, the appellant relied essentially on a document (D8) which the appellant's previous submissions had not presented as particularly relevant. The respondent should be given the opportunity to react to a new, unforeseeable situation by proposing a further amendment to the independent claim of the second auxiliary request.

Reasons for the Decision

1. The appeal is admissible.

Main request

2. Both parties agree that none of the cited prior art documents shows a system comprising all the features recited in claim 1 of the patent as granted. Hence, novelty is no longer in dispute.
 - 3.1 Document D8 is concerned with the evaluation of the natural convective air circulation which starts within the containment wall of a typical pressurised water reactor (PWR) after a loss of coolant due to a break in the coolant lines. As shown in Figure 1, an air upflow path is established in the enclosure, delimited by a missile protection shield ("Trümmerschutzzylinder") and the wall surrounding the reactor core, where the steam generators and the coolant lines are located. Openings

at the bottom of the missile protection shield and at the top of said enclosure allow the air upflow to remain in convective exchange with an air downflow which follows a path adjacent to the containment wall. As pointed out in D8 (page 758, left-hand column, last paragraph), this convective air circulation triggered by a loss of coolant is an inherent feature of the structure of a typical PWR. It entrains hydrogen from the areas where the latter is generated, *i.e.* where coolant lines are located, along the air upflow path within the steam generator enclosure and mixes it with the containment atmosphere (cf. Figure 1).

3.2 In other words, the water-cooled nuclear reactor shown in Figure 1 of D8 involves a system comprising the following features recited in claim 1 of the patent as granted:

- means for establishing within containment an air upflow path and an air downflow path in convective exchange, said air upflow path disposed in the area of said coolant lines and effective to entrain hydrogen from said break and said air downflow path in the area adjacent said containment wall;
- means for ducting said air upflow path downstream of said coolant lines effective to confine said entrained hydrogen to the ducted air upflow path.

3.3 Hence, the subject matter of claim 1 of the main request differs from the system according to D8 in that it further comprises the following feature:

"a catalytic hydrogen recombiner (70) located in said ducted air upflow path for recombining said entrained hydrogen with oxygen in said ducted air upflow".

- 4.1 The essential question to be considered in the present appeal is whether it would be obvious to a person skilled in the art to add a catalytic hydrogen recombiner to the PWR shown in Figure 1 of D8 and whether such skilled person would choose to locate it within the air upflow path, as specified in claim 1 of the granted patent.
- 4.2 According to the respondent, D8 presented a complete solution to the problem of keeping the concentration of hydrogen below dangerous levels in case of a loss of coolant accident by dispersing it within the containment atmosphere. A person skilled in the art would not have had any incentive to add a catalytic hydrogen recombiner to the system referred to in D8. Moreover, a recombiner would have obstructed the convective air circulation and thus would not have been compatible with the approach suggested in D8 which required free air upflow and downflow paths.
- 4.3 In the appellant's view, however, dispersing or diluting hydrogen within the containment atmosphere by means of convective air circulation and recombining hydrogen were simply two complementary aspects of the solution to the problem of reducing hydrogen concentration to acceptable levels in case of a loss of coolant accident. Furthermore, the use of catalytic hydrogen recombiners was a common safety measure in water-cooled nuclear reactors and the skilled person, who was primarily concerned with the safe operation of

a nuclear power plant, would not have been prejudiced against using them in a PWR with a missile protection wall where, as shown in D8, a convective air exchange spontaneously occurred.

5.1 Indeed D8 (see page 758, left-hand column, first paragraph) comes to the conclusion that the convective air exchange started by a loss of coolant accident in a PWR would be sufficient to keep the hydrogen concentration below self-ignition limits up to one hundred days after the occurrence of a break in the coolant lines. However, the Board considers that the skilled person would not have interpreted the content of D8 as a teaching excluding the combination of different safety measures for keeping hydrogen concentration under control. Moreover, such combinations are reported in the prior art. For instance, document D2, which deals with the problem of starting convective air flows within the containment atmosphere of a water-cooled reactor, explicitly suggests that, if desired, a system for establishing a convective air exchange may be combined with hydrogen recombiners and that, in this case, hydrogen would be entrained to the recombiners (D2, handwritten page No. 13, third paragraph).

5.2 As to the question of whether the skilled person would place a recombiner in the air upflow path, the respondent has stressed that this was by no means an obvious choice. For instance, D2 hinted at the possibility of having recombiners outside or inside the reactor and D4, which had been cited by the appellant to show that catalytic hydrogen recombiners were commonly known in the art, taught to locate them over

the wall and/or bottom region of the containment building or shell (D4, column 9, lines 5 to 11).

- 5.3 The Board agrees with the respondent that document D2 does not give the skilled person any clear hint as to where to locate the recombiners. As to D4, this document relates to a hydrogen recombiner comprising catalyst bodies and a casing, surrounding and retaining the catalyst bodies, which has a gas inlet aperture and a gas outlet aperture so as to establish a gas **upflow path** through the catalyst bodies (D4, Figure 1). Thus, the suggestion in D4, that an advantageous system of recombiners inside a nuclear power plant may be obtained by mounting a plurality of such recombiners at a corresponding number of fastening sites distributed in netlike fashion over the wall and/or bottom region of the containment building, is directed to a particular kind of recombiners comprising means (a casing with suitable openings) for establishing and ducting an air upflow.

On the other hand, the teaching of D4 clearly implies that, in order to be effective, the air upflow path should pass through the catalyst bodies. As pointed out by the appellant, the catalytic recombination of hydrogen with oxygen is an exothermic reaction which also creates an air upflow path through the recombiners (cf. D4, column 1, lines 17 to 19). It would therefore be obvious to a skilled person to locate a recombiner in the path of an existing convective air upflow in order to increase the intrinsic upflow of air sustained by the catalytic reaction.

It should also be noted, as suggested by the appellant, that the upflow path is necessarily close to the area where the loss of coolant occurs and that a location for the recombiners where hydrogen concentration is likely to be higher is an obvious choice for the person skilled in the art.

Finally, the Board wishes to point out that claim 1 simply specifies that "*a catalytic hydrogen recombiner*" is located in the ducted air upflow path, but it does not exclude the possibility that other recombiners may be distributed within the containment building.

- 5.4 In summary, the Board finds that it would be obvious to a person skilled in the art, starting from a nuclear reactor as shown in D8 where natural convection takes place in case of a loss of coolant accident, to consider the possibility of adding catalytic hydrogen recombiners in order to keep the concentration of hydrogen below self-ignition levels. As to their possible location, it would also be an obvious choice for the skilled person to place at least one recombiner where hydrogen is likely to be present in high concentrations and where there is a favourable convective airflow through the catalyst body, *i.e.* in the steam generator enclosure. By doing so, such a skilled person would arrive at the claimed system without exercising any inventive activity.

Thus, the subject matter of claim 1 according to the **main request** does not involve an inventive step within the meaning of Article 56 EPC.

First and second auxiliary requests

6.1 Claim 1 according to the **first auxiliary request** differs from claim 1 as granted in that it comprises features of the "*means for establishing an air upflow path and an air downflow path in convective exchange*". Claim 1 of the **second auxiliary** request further specifies that a steam generator enclosure is present inside containment and that the ducted air upflow path is through the steam generator enclosure.

Figure 1 of D8 shows a missile protection wall which defines a first enclosure adjacent to the reactor core and a second enclosure adjacent to the outer containment wall. A steam generator and associated coolant lines are located in the first enclosure. A lower and an upper aperture in the missile protection wall allow a convective exchange between an air upflow path and an air downflow path which are established in the event of a loss of coolant accident in the first and in the second enclosure, respectively. In other words, the PWR referred to in D8 comprises also all the additional features of the independent claims according to the first and second auxiliary requests and, thus, also the subject-matters of these claims differ from D8 by the same feature (*i.e.* "*a catalytic hydrogen recombiner located in said ducted air upflow path for recombining said entrained hydrogen with oxygen in said ducted air upflow*") which makes claim 1 of the main request novel over the prior art.

As the same objections raised above against the patentability of the main request apply also to the first and second auxiliary requests, the subject-

matters of their corresponding independent claims do not involve an inventive step within the meaning of Article 56 EPC.

Admissibility of the respondent's further request

7. As to the respondent's request to file a new amended claim by adding some features taken from the description, the Board takes the view that such a request is not admissible, because it comes at a very late stage in the appeal proceedings and involves an amendment which neither the appellant nor the Board could have expected. The respondent's justification for the lateness of this request rests on the fact that, in the oral proceedings before the Board, the appellant used a different document, D8, as a starting point for an argument against the patentability of the claimed invention. In the respondent's view, this had created a new situation to which the respondent should be given the possibility to react, for instance, by presenting a new request.

However, the Board observes that the appellant's arguments in the oral proceedings were not essentially different from those submitted in writing and that D8 had already been filed during the opposition proceedings and dealt with in the impugned decision. The respondent did not have to face a completely new situation in the oral proceedings and, thus, should not have been taken by surprise by the appellant's submissions.

8. As none of the respondent's requests is allowable, the patent must be revoked.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:

A. Vottner

G. Davies