Boiling of the coolant in the sodium-cooled fast reactions

http://bibliothek.fzk.de/zb/kfk-berichte/KFK1020.pdf

Die Lösung lautet allgemein

$$T_j^* = B_{1j}^* e^{\sqrt{\psi/a_j}\, x_j} + B_{2j}^* e^{-\sqrt{\psi/a_j}\, x_j} + \frac{T_{oj}}{\psi} \qquad (24)$$

Mit den Randbedingungen ergibt sich

$$T_j^* = \left(T_B^* - \frac{T_{oj}}{\psi}\right) e^{-\sqrt{\psi/a_j}\, x_j} + \frac{T_{oj}}{\psi} \qquad (25)$$

Vernachlässigt man gemäß 5) die Wärmekapazität der Blase, dann gilt ferner die Ernergiebilanz

$$\sum_{j=1,n} \Omega_j k_j \frac{\partial T_j}{\partial x_j} = 0 \qquad \text{für } x_j = 0 \qquad (26)$$

bzw. mit (22) und (25)

$$-\sum_j \Omega_j k_j \sqrt{\frac{\psi}{a_j}} \left(T_B^* - \frac{T_{oj}}{\psi}\right) e^{-\sqrt{\psi/a_j}\, x_j} = 0 \; ; \; x_j = 0 \qquad (27)$$

Hieraus wird

$$T_B^* \sum_{j=1,n} \Omega_j k_j \sqrt{\frac{\psi}{a_j}} = \sum_{j=1,n} \Omega_j k_j \sqrt{\frac{\psi}{a_j}} \; \frac{T_{oj}}{\psi} \qquad (28)$$

ACCIDENT **described on page 2:**

Failure of the fuel rods by
Over temperature (melting of the shell) after 0.3 to 0.5 sec

Während in der Rechnung erst im Zeitbereich von 3 bis 4 sec eine Austrocknung zu verzeichnen ist, muß gemäß der Abschätzung zu Beginn dieses Kapitels schon kurz nach der ersten Blasenbildung mit lokal begrenzten Trockenflecken gerechnet werden, die über mehrere Sekunden hinweg nicht mehr benetzt werden. Hieraus folgt:

Few tenths of a second after drying of the residual film is at the Dry the spot Shell wall temperature heated up to failure point.

- Unmittelbare Folge des Siedens ist ein Versagen der Brennstäbe durch Übertemperatur (Schmelzen der Hülle) bereits nach 0.3 bis 0.5 sec.
- Frühestens etwa 3 sec nach Austrocknung (an der Stelle größter Leistungsdichte) tritt Brennstoffschmelzen ein. Da die Rechnung zeigt, daß durchaus auch über längere Zeiten hinweg das Kühlmittel durch die Dampfblase von zentralen Teilen des Brennelementes ferngehalten werden kann, muß in Bereichen hoher Leistung eine beträchtliche Zerstörung der Brennelementstruktur erwartet werden, sofern nicht rechtzeitig (d.h. nach etwa 1 bis 2 sec) die Leistung abgeschaltet wird.
- Die Behandlung des Siedevorganges, wie sie in dieser Arbeit entwickelt wurde, kann sich sinnvoll nur über die ersten Sekunden erstrecken. Anschließend ist die Problematik der zerstörten Geometrie und der Brennstoff-Kühlmittel-Wechselwirkung einzubeziehen.

Abb. 24 bis 28 zeigen den entsprechenden Vorgang bei Ausfall der Pumpe.

Als Ort des Blasenursprungs wurde ein Ort 20 cm über der Corehöhe gewählt.
Die gesamte Corehöhe beträgt 93 cm.

After drying out no earlier than about 3 sec (at the largest point Power density occurs), a fuel melting. (...) Destruction of the fuel assembly structure can be expected if power is not switched (ie after about 1 to 2 sec).

Das Ergebnis dieser Rechnungen läßt sich wie folgt zusammenfassen:

- In einem siedenden Brennelement treten einzelne Dampfblasen auf, deren Volumen mit einer Grundfrequenz von etwa 2 bis 3 Hz oszilliert.
- Im Maximum des Blasenvolumens ist nahezu das ganze Brennelement mit Dampf gefüllt. Im Minimum bleibt in den meisten Fällen eine Restblase erhalten, die nicht vollständig kollabiert. Hohe Druckspitzen durch vollständige Kondensation treten nur bei den ersten Oszillationen auf.

The maximum of the bladder volume is nearly the entire fuel assembly with Steam filled.

- Wenige Zehntel Sekunden nach Austrocknung des Restfilmes ist an der Trockenstelle die Hüllwandtemperatur bis zum Versagenspunkt aufgeheizt.

In a boiling fuel vapor bubbles occur on individual,
their volume with a fundamental frequency of about 2 to 3 Hz oscillates.

Während die hier detailliert behandelten Fälle mit einem für den Reaktor

The end of the fast breeder program:
http://www.chernobylcongress.org/fileadmin/user_upload/pdfs/Baverstock_How_the_UN_works.pdf

> In about 1980 Gian-Carlo Pinchera, an Italian nuclear physicist, showed that fast reactors were inherently unsafe. That single conference paper led to the almost total abandonment of the fast breeder programme. (...) he warned "beware the dying kick of the nuclear advocates." This is what we see today but maybe they are not dying! quote by Keith Baverstock.

Mikkai

http://life-upgrade.com/DATA/Artikel%20zu%20Tschernobyl%20in%20Nuclear%20Technology%20Vol%2090.pdf

Light water reactors are designed to be undermoderated, which is a guarantee of stability. The total water voidage leads the reactor to a very subcritical state (it is converted into a very poor fast assembly) where the main concern is the decay heat cooling. A pressurized water reactor can become overmoderated if very large soluble boron concentrations are used. This phenomenon is well known and can be avoided by the use of solid absorbers. Nevertheless, it must be taken into account in the design and licensing of each burnup cycle.

Boiling water reactors present a very strong coupling between hydraulics and neutronics, but they are perfectly stable at nominal conditions. Reactivity perturbations (originating from hydraulic perturbations, for instance) can induce power transients that can become important in some regimes that are very far from the permitted one.[44] In any case, a dry reactor (as a consequence of a steam explosion, for instance) is very subcritical.

Gas-cooled reactors can have a positive graphite temperature reactivity coefficient, but the evolution of this variable is much slower than the fuel temperature evolution. The coolant does not have any neutronic significance.

Heavy water reactors and LMFBRs deserve a deep analysis that lies beyond the scope of this paper, because the first is a channel-type reactor where the coolant and the moderator are different fluids and the second can present coolant voidages configurations that lead to supercritical states.

Comparison of RBMK features with those of Western reactors has been the subject of several works.[15,45,46] All of them point out the different neutronic behavior of RBMK due to its overmoderated characteristic. A general conclusion of those works is the lack of need to change any design or operational specification in Western reactors as a consequence of the Chernobyl accident. However, all the works underline the importance of abiding by the rules established to properly operate nuclear reactors.

In the Western nuclear community, much attention has been paid to decay heat removal systems and loss-of-coolant accidents, *radioactivity* being the major concern of nuclear safety because *reactivity* accidents are considered virtually impossible in the very stable Western reactors. The prototype of a *decay heat* accident is Three Mile Island Unit 2, which was orders of magnitude more benign than Chernobyl Unit 4, the prototype of a reactivity accident. This can be considered as an indication that a reactivity accident cannot happen in Western reactors.

ACKNOWLEDGMENTS

The late Counsellor Prof. F. Goded is particularly acknowledged.

This work was performed under a research contract with the Spanish Nuclear Safety Council.

REFERENCES

1. "The Accident at the Chernobyl Nuclear Power Plant and Its Consequences," information compiled for the Experts' Mtg., August 25–29, 1986, Vienna, Austria, INIS-mf-10523, International Atomic Energy Agency (1986).

2. I. YA. EMEL'YANOV, B. P. BASILIEVISKII, B. P. VOLKOV, P. A. GABRILOV, A. YA. KRAMEROV, S. P. KLUZNETZOV, E. P. KUNEGIN, and N. Z. RIVAKOV, "The Safety Problems of Nuclear Power Plants with Channel-Type, Graphite, Boiling-Water-Reactors," *Proc. Int. Conf. Nuclear Power and Its Fuel Cycles*, Salzburg, Austria, May 2–13, 1977, Vol. 5, paper CN-36/341, International Atomic Energy Agency (1977).

3. V. P. ANDREEV, A. V. BONDARENKO, V. K. VIKULOV, V. D. KOZYREV, F. M. KRASNOGOROV, V. F. LYUBCHENKO, V. V. MAL'TSEV, YU. I. MITYAEV, A. S. OVESHKOV, E. I. SNITKO, A. G. SHEINKMAN, and S. V. SHIROKOV, "Steam Effects and Reactivity Coefficients of the Beloyarsk Nuclear Power Station Reactors," *At. Energ.*, 50, 381 (1981).

4. V. I. PUSHKAREV, A. D. ZHIRNOV, and A. P. SIROTKIN, "Way of Altering the Coefficients of Reactivity in RBMK Reactors," *At. Energ.*, 46, 386 (1979).

5. V. S. ROMANENKO and A. V. KRAYUSKHIN, "Physical Characteristics of an RBMK Reactor in the Transitional Period," *At. Energy*, 53, 367 (1982).

6. I. YA. EMEL'YANOV, L. N. PODLAZOV, A. N. ALEKSAKOV, V. M. PANIN, and B. V. PARAEV, "Effect of the Shape of the Height Distribution of Neutrons on the Stability of a Reactor to Xenon Oscillations," *At. Energ.*, 50, 385 (1981).

7. A. N. ALEKSAKOV, B. A. VORONTSOV, I. YA. EMEL'YANOV, L. N. PODLAZOV, V. I. RYABOV, and B. M. SVECHAREVSKII, "Deformation of an Energy Release Field in a High-Powered-Water-Cooled Channel Reactor (RBMK)," *At. Energy.*, 46, 227 (1979).

8. S. V. BRYUIN, A. I. GORELOV, V. YA. NOVIKOV, I. K. PAVLOV, and V. V. POSTINOV, "Optimization of the Safety Margin to the Critical Load of the Heat-Releasing Assemblies in a RBMK," *At. Energ.*, 46, 222 (1979).

9. K. YOSHIDA, F. TANABE, M. HIRANO, and A. KOHSAKA, "Analyses of Power Excursion in Chernobyl Accident with RETRAN Code," *J. Nucl. Sci. Technol.*, 23, 1107 (1986).

10. "Summary Report on the Post-Accident Review Meeting on the Chernobyl Accident," IAEA Safety Series No. 75-INSAG-A, International Atomic Energy Agency (1986).

11. "Report on the Accident at the Chernobyl Nuclear Power Plant," NUREG-1250, U.S. Nuclear Regulatory Commission (1986).

LMFBR Fast breeder Reactor = CHERNOBYL

Mikkai

More of Häfele: "Technischer und wirtschaftlicher Stand sowie Aussichten der Kernenergie in der Kraftwirtschaft der BRD" http://bibliothek.fzk.de/zb/kfk-berichte/KFK1430.pdf PAGE 50:

translation on page 3

"In the early American development of fast breeders (1945 - 1959) considerations **reactor neutrons with short lifetime (10 ^ 7 sec)** played a large role (Bethe, Fermi, Teller), because with such rapid neutron lifetime, steep reactor excursions are possible, then **because of its steepness in Principle for the release of large quantities suitable for mechanical destruction are likel**y"

"The set configuration of a fast reactor cores of principle neutron-physical reasons, not the configuration of highest criticality. Rather, **a down or molten core, a core, whose center is emptied of sodium**
is to be well above critical. Then it could lead **to the release of large amounts of energy**, which of course come from the negative double coefficient itself clearly.

MORE: http://www.sciencedirect.com/science/article/pii/0017931069901148

AND: http://bibliothek.fzk.de/zb/kfk-berichte/KFK1020.pdf page 59: **"Boiling of the coolant in the sodium-cooled fast reactions"**

Japan's minister Hosono has announced his opinion concerning Abolition of Fast Breeder reactor "MONJU": http://mainichi.jp/select/wadai/news/20111127ddm003040168000c.html

mainichi.jp/select/wadai/news/20111127ddm003040168000c.html

事件・事故・裁判 | 話題 | 経済 | IT | 海外 | 政治 | サイエンス | 気象・地震 | 人事・訃報 | 社説・解説・コラム

トップ > ニュースセレクト > 話題 > 記事

[PR] エッ？ 女性ウケ 抜群のモテる香りはコレだった！

毎日jpユーザーアンケートご協力ください（抽選で全国共通商品券2000円分進呈）

話題　文字サイズ変更 小 中 大

ツイートする 80　Empfehlen 23　チェック　この記事を印刷

もんじゅ：廃炉検討　基軸失う核燃サイクル　政策転換必至

細野事志原発事故担当相が26日、検討を表明した高速増殖原型炉「もんじゅ」の廃炉は、高速増殖炉技術の開発断念を意味し、原子力政策を大きく転換させることになる。政府は、原発発電で生じた使用済み核燃料を再利用し、そこから取り出したプルトニウムを原発で再び使う「核燃料サイクル」をエネルギー政策の基本と位置づけ、その中核が「もんじゅ」の行方にかかっているためだ。【野田武】

高速増殖炉は、燃やしたプルトニウム以上にプルトニウムを増やせるため、資源の乏しい日本にとって「夢の原子炉」と言われたが、95年12月、もんじゅで火災事故が発生、運転を停止した。

再開見通しが立たない中で始まったのが、プルトニウムを既存の原発でウラン燃料と合わせて燃やす「プルサーマル」。97年に計画が認められ、2010年までに16～18基の原発で実施する計画だったが、立地自治体の了解を得るのに難航した。

高速増殖原型炉もんじゅを視察する細野原発事故担当相（中央）＝福井県敦賀市で2011年11月26日（共同）

火災事故以降、政府はプルサーマルを高速増殖炉と並ぶ核燃料サイクルの基軸と位置づけた。高速増殖炉を断念しても、片方の軸のプルサーマルを使っての核燃料サイクルは可能だ。しかし、東京電力福島第1原発事故後、既存の原発の再稼働すら見通しが立たない。また今後、新たな原発を造らず、寿命の原発を廃炉にする「脱原発依存」政策を進めれば、核燃料サイクルは成立しない。そうなれば使用済み核燃料は、再利用せずそのまま処分する道しかなくなる。

もんじゅを廃炉にするならば、使用済み核燃料の処分方法や、日本が保有しているプルトニウムの扱いなど、解決の難しい問題にも、道筋を付ける必要がある。もんじゅを含めた日本の原子力政策の全体像は、政府のエネルギー・環境会議が来夏までに決めるが、課題は山積している。

◇地元、慎重論と歓迎が交錯

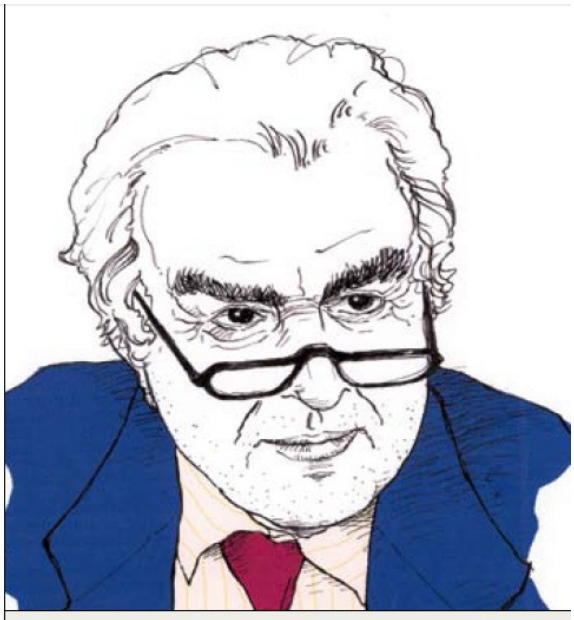
地元関係者からはさまざまな反応があった。もんじゅが立地する福井県敦賀市の河瀬一治市長は毎日新聞の取材に対し26日、「継続、廃止など、もんじゅにはたくさんの選択肢があるということだろう。今後についてはエネルギー政策全体を考えて冷静な議論をしてほしい」と注文をつけた。一方、福井県の市民団体「サヨナラ原発福井ネットワーク」の山崎隆敏代表（62）は「もんじゅを止めることになれば、核燃料サイクルの破綻が明確になり、国は結論を出しにくいかもしれない。しかし、脱原発は早急に進めるべきで、早期に廃炉の結論を出すべきだ」と話した。【柳楽未来、安藤大介】

毎日新聞　2011年11月27日　東京朝刊

・もんじゅ：廃炉含め検討…細野原発事故担当相「来年判断」
・提言型政策仕分け：スタート　もんじゅ「抜本見直し」
・事業仕分け：原子力関連「予算縮減」　除染・廃炉へ予算を
・もんじゅ関連施設：10年以上利用なく放置…検査院指摘

Mikkai

From http://www.life-upgrade.com/DATA/Superphenix-GianCarlo-Pinchera.pdf – PAGE 49:



I MAESTRI

Giancarlo Pinchera

Ingegnere chimico, comunista, si specializza negli Usa in Ingegneria nucleare, frequentando i laboratori di Los Alamos che, in piena guerra fredda, gli sarebbero preclusi. Il decennio 1965-75 lavora come ricercatore nel Cnen, il neocostituito Comitato nazionale per l'energia nucleare. In questi anni si occupa della sicurezza al centro ricerche della Casaccia, del progetto *Superphénix* in Francia e diventa responsabile Energia del Pci. Entra in contatto con la letteratura ecologista, dai rapporti del Club di Roma ai testi di Barry Commoner e Amory Lovins. Nascono i primi dubbi sul nucleare, con una riflessione su rischi e costi dell'atomo, e sulla cronica inefficienza italiana. La svolta sarà l'abbandono della posizione favorevole al nucleare e la trasformazione in uno dei tecnici ambientali più stimati in Italia e all'estero fino alla morte avvenuta il 2 settembre 1995.

TRANSLATION (Véronique G.): „The masters : Giancarlo Pinchera"

Chemistry engineer, communist, he specialized in nuclear engineering in the USA , frequenting the Los Alamos laboratories which closed their doors to him in the middle of the Cold War. Between 1965 and 75, he worked as a researcher at Cnen, the newly instituted National Committee for Nuclear Energy.

During these years he is in charge of security at the Casaccia Research center, at Superphénix project in France, and becomes responsible for Energy matters at PCI [probably Italian Communist Party]. He gets to know ecology litterature, from the Club de Rome reports to texts by Barry Commoner et Amory Lovins. Then arrise his first doubts about nuclear energy, with his thoughts about risks and costs linked to the atom policy and about the recurring Italian inefficiency. Then he drops his positions favorable to nuclear energy, which becomes one of the most discredited environmental techniques in Italy and abroad, until his death on 9/2/1995.

Mikkai

Japan's Monju nuclear accident parts 1-3 A Coverup Revealed By Wikileaks Pre Fukushima

vidsupquick 30 Videos Abonnieren

Mag ich + Hinzufügen zu Weiterleiten

Hochgeladen von vidsupquick am 28.09.2011

Named after the Buddhist divinity of wisdom, Monju, located in Japan's Fukui prefecture, is Japan's only fast-breeder reactor. Unlike conventional reactors, fast-breeder reactors, which "breed" plutonium, use sodium rather than water as a coolant. This type of coolant creates a potentially hazardous situation as sodium is highly corrosive and reacts violently with both water and air.

On December 8th, 1995, 700 kg of molten sodium leaked from the secondary cooling circuit of the Monju reactor, resulting in a fire that made headlines across the country. Although the accident itself did not result in a radiation leak, many argue that the fire came close to breaching Monju, a catastrophe which would have spilled plutonium into the environment.

Following the fire, officials at the government-owned Power Reactor and Nuclear Fuel Development Corporation (PNC), operators of Monju, first played down the extent of damage at the reactor and denied the existence of a videotape showing the sodium spill. Later, they released still shots only, showing things like intact pipes and clean floors and claiming that there had only been "a minor leakage in the secondary sodium loop [that had] caused some fumes". While short videos were released, these were edited to hide the full extent of the damage. Further complicating the story, the deputy general manager of the general affairs department at the PNC, Shigeo Nishimura, 49, jumped to his death the day after a news conference where he and other officials revealed the extent of the cover-up.

Starting from September of 2007, Nishimura's family brought the story back to light in a trial against the PNC at Japan's High Court.

LINK:

http://www.youtube.com/watch?v=axWudT8eEYk