Kärnkraften var oönskad redan innan den blev olönsam

- Men det har de flesta glömt.

2026-01-19

Tomas Kåberger
professor Chalmers tekniska högskola
Executive Board Chair of Renewable Energy Institute, Tokyo
Ledamot IVA och Sveriges EnergiEkonomers Förening

Kärnkraftens politiska frågor:

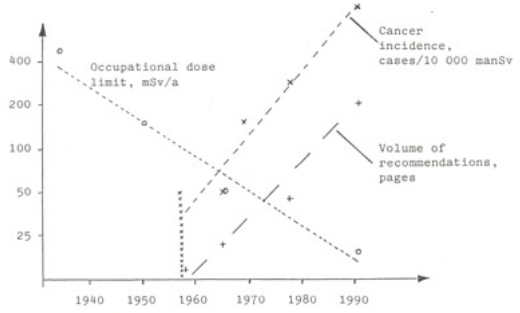
1. **Rutinutsläpp: - Hur många skall tillåtas dö?**
2. **Reaktorhaverier: - Vem skall betala?**
3. **Avfallshantering: - Vad skall tillåtas och vem betalar?**
4. **Kärnvapenspridning: - Hur spridda förutsättningar kan vi överleva med?**
5. **Direkta kostnader: - Skall bolag subventioneras räddas?**

Kärnkraftens politiska frågor:

1. **Rutinutsläpp: - Hur många skall tillåtas dö?**

Mer kunskap och större risker

(enligt Bengtsson 1991)



1. Development with time of ICRP recommendations

The data are not strictly comparable from time to time since they are differently expressed by the ICRP. Occupational dose limits have been given since 1934 although with varying motives. The first authoritative risk estimate was given by UNSCEAR in 1958 in cooperation with ICRP.

Cancer av radioaktiva föroreningar

- Dickinson, H.O. & Parker, L. 2002: Leukemia and non-hodgkin's lymphoma in children of male Sellafield radiation workers. International Journal of Cancer, vol. 99 pp. 437-444.
- Dubrova, Y.E. et al. 1996: Human minisatellite mutation rate after the Chernobyl accident. Nature vol. 380, pp. 683-686.
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- Guizard, A-V, et al. 2001: The incidence of childhood leukaemia around the La Hague nuclear waste reprocessing plant (France): a survey for the years 1978-1998. Journal of Epidemiological Community Health, vol. 55 pp. 469-474.
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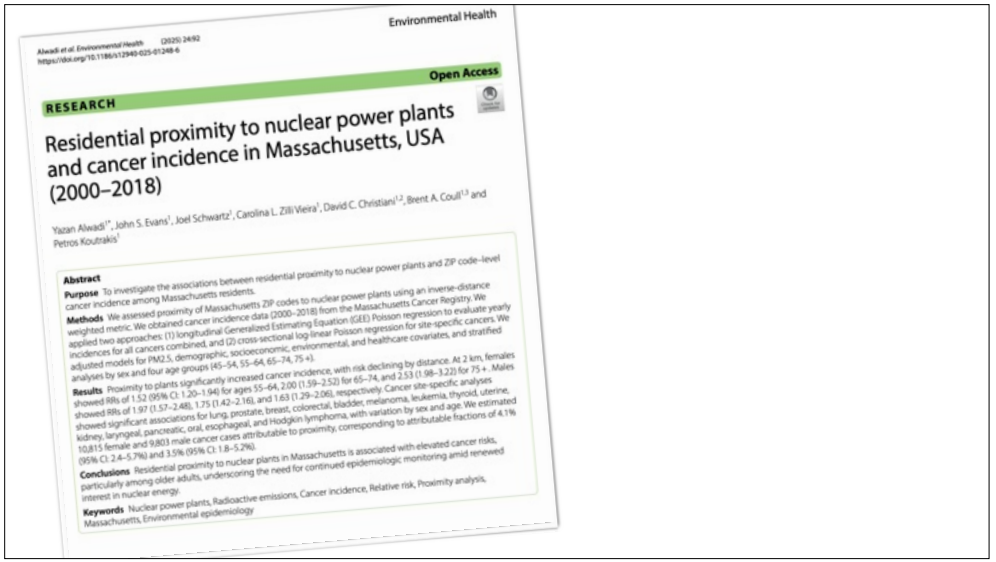


Environmental Health

RESEARCH

Open Access

Residential proximity to nuclear power plants and cancer incidence in Massachusetts, USA (2000–2018)

Yazan Alwadi[1*], John S. Evans[1], Joel Schwartz[1], Carolina L. Zilli Vieira[1], David C. Christiani[1,2], Brent A. Coull[1,3] and Petros Koutrakis[1]

Abstract

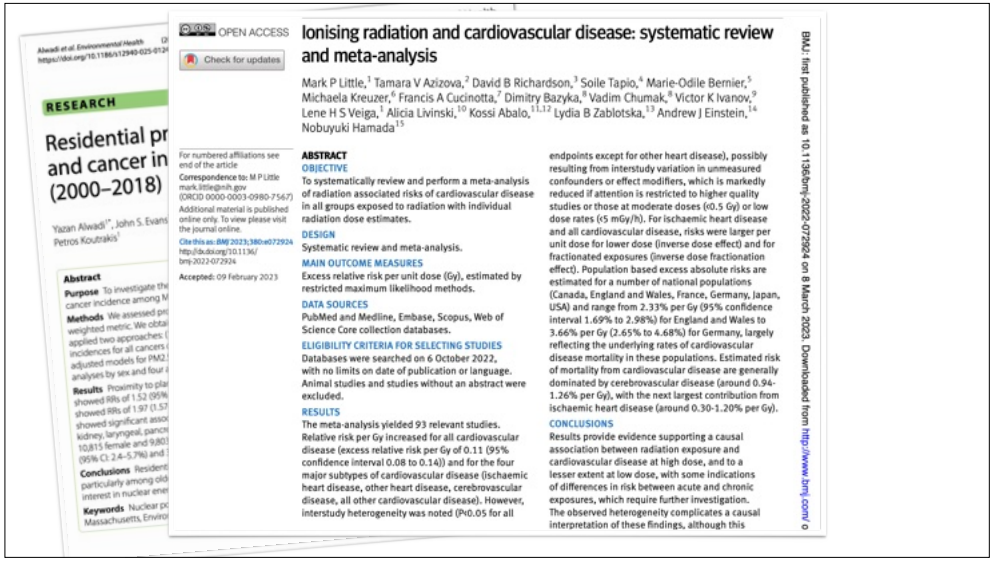
Purpose To investigate the associations between residential proximity to nuclear power plants and ZIP code–level cancer incidence among Massachusetts residents.

Methods We assessed proximity of Massachusetts ZIP codes to nuclear power plants using an inverse-distance weighted metric. We obtained cancer incidence data (2000–2018) from the Massachusetts Cancer Registry. We applied two approaches: (1) longitudinal Generalized Estimating Equation (GEE) Poisson regression to evaluate yearly incidences for all cancers combined, and (2) cross-sectional log-linear Poisson regression for site-specific cancers. We adjusted models for PM2.5, demographic, socioeconomic, environmental, and healthcare covariates, and stratified analyses by sex and four age groups (45–54, 55–64, 65–74, 75 +).

Results Proximity to plants significantly increased cancer incidence, with risk declining by distance. At 2 km, females showed RRs of 1.52 (95% CI: 1.20–1.94) for ages 55–64, 2.00 (1.59–2.52) for 65–74, and 2.53 (1.98–3.22) for 75 +. Males showed RRs of 1.97 (1.57–2.48), 1.75 (1.42–2.16), and 1.63 (1.29–2.06), respectively. Cancer site-specific analyses showed significant associations for lung, prostate, breast, colorectal, bladder, melanoma, leukemia, thyroid, uterine, kidney, laryngeal, pancreatic, oral, esophageal, and Hodgkin lymphoma, with variation by sex and age. We estimated 10,815 female and 9,803 male cancer cases attributable to proximity, corresponding to attributable fractions of 4.1% (95% CI: 2.4–5.7%) and 3.5% (95% CI: 1.8–5.2%).

Conclusions Residential proximity to nuclear plants in Massachusetts is associated with elevated cancer risks, particularly among older adults, underscoring the need for continued epidemiologic monitoring amid renewed interest in nuclear energy.

Keywords Nuclear power plants, Radioactive emissions, Cancer incidence, Relative risk, Proximity analysis, Massachusetts, Environmental epidemiology



OPEN ACCESS

Check for updates

Ionising radiation and cardiovascular disease: systematic review and meta-analysis

Mark P Little,[1] Tamara V Azizova,[2] David B Richardson,[3] Soile Tapio,[4] Marie-Odile Bernier,[5] Michaela Kreuzer,[6] Francis A Cucinotta,[7] Dimitry Bazyka,[8] Vadim Chumak,[8] Victor K Ivanov,[9] Lene H S Veiga,[1] Alicia Livinski,[10] Kossi Abalo,[11,12] Lydia B Zablotska,[13] Andrew J Einstein,[14] Nobuyuki Hamada[15]

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Additional material is published online only. To view please visit the journal online.

Cite this as: *BMJ* 2023;380:e072924 http://dx.doi.org/10.1136/bmj-2022-072924

Accepted: 09 February 2023

ABSTRACT

OBJECTIVE
To systematically review and perform a meta-analysis of radiation associated risks of cardiovascular disease in all groups exposed to radiation with individual radiation dose estimates.

DESIGN
Systematic review and meta-analysis.

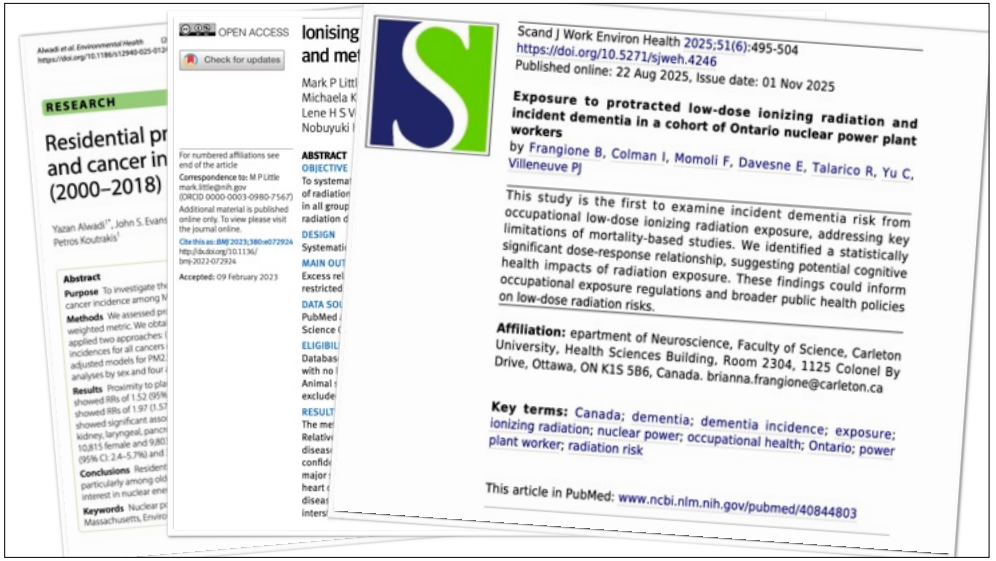
MAIN OUTCOME MEASURES
Excess relative risk per unit dose (Gy), estimated by restricted maximum likelihood methods.

DATA SOURCES
PubMed and Medline, Embase, Scopus, Web of Science Core collection databases.

ELIGIBILITY CRITERIA FOR SELECTING STUDIES
Databases were searched on 6 October 2022, with no limits on date of publication or language. Animal studies and studies without an abstract were excluded.

RESULTS
The meta-analysis yielded 93 relevant studies. Relative risk per Gy increased for all cardiovascular disease (excess relative risk per Gy of 0.11 (95% confidence interval 0.08 to 0.14)) and for the four major subtypes of cardiovascular disease (ischaemic heart disease, other heart disease, cerebrovascular disease, all other cardiovascular disease). However, interstudy heterogeneity was noted (P<0.05 for all endpoints except for other heart disease), possibly resulting from interstudy variation in unmeasured confounders or effect modifiers, which is markedly reduced if attention is restricted to higher quality studies or those at moderate doses (<0.5 Gy) or low dose rates (<5 mGy/h). For ischaemic heart disease and all cardiovascular disease, risks were larger per unit dose for lower dose (inverse dose effect) and for fractionated exposures (inverse dose fractionation effect). Population based excess absolute risks are estimated for a number of national populations (Canada, England and Wales, France, Germany, Japan, USA) and range from 2.33% per Gy (95% confidence interval 1.69% to 2.98%) for England and Wales to 3.66% per Gy (2.65% to 4.68%) for Germany, largely reflecting the underlying rates of cardiovascular disease mortality in these populations. Estimated risk of mortality from cardiovascular disease are generally dominated by cerebrovascular disease (around 0.94-1.26% per Gy), with the next largest contribution from ischaemic heart disease (around 0.30-1.20% per Gy).

CONCLUSIONS
Results provide evidence supporting a causal association between radiation exposure and cardiovascular disease at high dose, and to a lesser extent at low dose, with some indications of differences in risk between acute and chronic exposures, which require further investigation. The observed heterogeneity complicates a causal interpretation of these findings, although this



OPEN ACCESS

Check for updates

Ionising and mef

Mark P Litt
Michaela K
Lene H S V
Nobuyuki

Scand J Work Environ Health 2025;51(6):495-504
https://doi.org/10.5271/sjweh.4246
Published online: 22 Aug 2025, Issue date: 01 Nov 2025

Exposure to protracted low-dose ionizing radiation and incident dementia in a cohort of Ontario nuclear power plant workers

by Frangione B, Colman I, Momoli F, Davesne E, Talarico R, Yu C, Villeneuve PJ

This study is the first to examine incident dementia risk from occupational low-dose ionizing radiation exposure, addressing key limitations of mortality-based studies. We identified a statistically significant dose-response relationship, suggesting potential cognitive health impacts of radiation exposure. These findings could inform occupational exposure regulations and broader public health policies on low-dose radiation risks.

Affiliation: epartment of Neuroscience, Faculty of Science, Carleton University, Health Sciences Building, Room 2304, 1125 Colonel By Drive, Ottawa, ON K1S 5B6, Canada. brianna.frangione@carleton.ca

Key terms: Canada; dementia; dementia incidence; exposure; ionizing radiation; nuclear power; occupational health; Ontario; power plant worker; radiation risk

This article in PubMed: www.ncbi.nlm.nih.gov/pubmed/40844803

Kärnkraftens politiska frågor:

2. **Reaktorhaverier: - Vem skall betala?**

SOU 1959:34 Om Atomansvarighet

- ”Världens förråd av fossila bränslen kan beräknas börja sina vid sekelskiftet. Redan tidigare kommer förmodligen knappheten på fossila bränslen för köparländerna göra sig märkbar genom stigande priser. För vårt land, som i stort saknar tillgångar på fossila bränslen, innebär det att utvecklingstakten måste avtaga, om ej atomenergin eller någon annan ny kraftkälla kan tagas i bruk. (sid. 19)”
- ”Det är inte sannolikt att någon – bortsett möjligen från staten – skulle vilja utan ansvarighets-begränsning satsa kapital på en atomanläggning.” (sid 28)”
- ”Såsom framgår av det ovan (sid.19) sagda blir vi nödgade att ta atomkraften i anspråk – kosta vad det kosta vill – om vi inte vill acceptera en standardsänkning.”

Fukushima Dai Ichi 15 mars 2011:

Tre härdsmältor

Tre reaktorbyggnader exploderat

Fukushima nuclear disaster: PM at the time feared Japan would collapse

Naoto Kan said that Tepco had considered abandoning the plant after it was hit by the 11 March tsunami

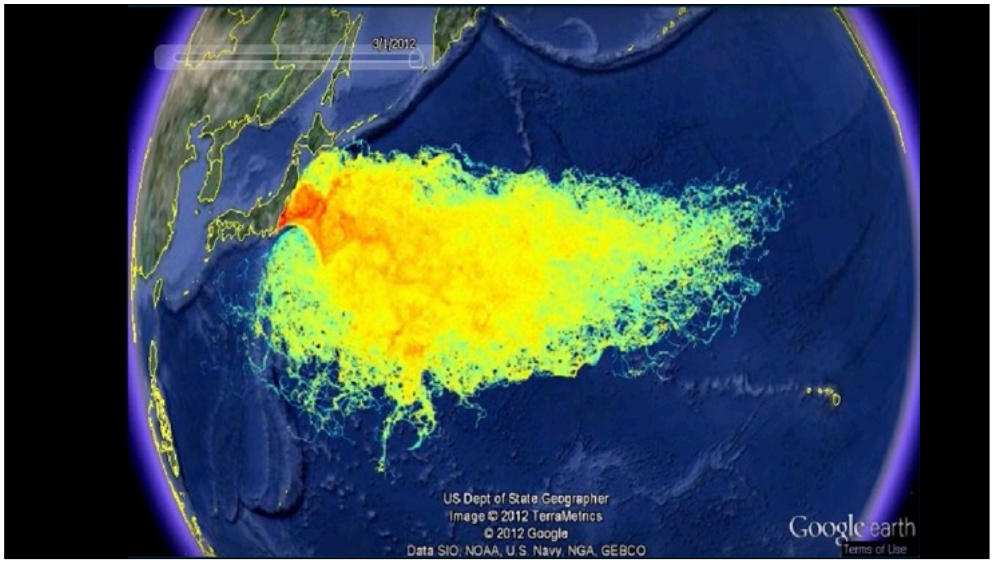
Justin McCurry
guardian.co.uk, Thursday 8 September 2011 20.26 BST

A

An aerial view of the Fukushima Daiichi nuclear power, two weeks after the tsunami struck Japan. Illustration: Reuters

Japan's prime minister at the height of the nuclear crisis has said he feared the country would collapse, and revealed that Tepco had considered abandoning the Fukushima Daiichi power plant after it was hit by the 11 March tsunami.

"It was truly a spine-chilling thought," he told the Tokyo Shimbun, adding that he foresaw a situation in which greater Tokyo's 30 million people would have to be evacuated, a move that would "compromise the very existence of the Japanese nation".




Risky business?: U.S. Navy crew members clean the flight deck to remove radiation from the USS Ronald Reagan aircraft carrier on March 23, 2011. | AP

Economic Management of Future Nuclear Accidents

Tomas Kåberger[1]

Abstract

Nuclear core melts with large emissions of radioactive substances are not paid for by nuclear power companies but by the victims and by taxpayers. This subsidy is often the result of legislation with that purpose.

Experience shows that the relative frequency of such accidents is several orders of magnitude larger that the risk estimates publicised by the nuclear industry and nuclear proponents.

This chapter describes the how the problem was created in order to make the nuclear development economically possible. In the end, it is described how a market may be created based on compulsory paying capacity, possibly provided via catastrophe bonds that would internalise many costs of accidents. At the same time, such regulations would provide a market evaluation, by responsible actors, of the nuclear risk costs.

1 Tomas Kåberger, Chalmers University of Technology, Göteborg, Sweden, tomas.kaberger@chalmers.se

R. Haas et al. (Eds.), *The Technological and Economic Future of Nuclear Power*, Energiepolitik und Klimaschutz. Energy Policy and Climate Protection, https://doi.org/10.1007/978-3-658-25987-7_9

Economic Management of Future Nuclear Accidents

Using experience to get a possible order of magnitude of the real risk cost of nuclear reactors, we may combine 100 billion -1 trillion US dollar per accident with a relative frequency of one in 5 000 reactor-years which would give an average risk cost of 20–200 million dollar per reactor-year. With reactors producing 5–10 TWh/year this would provide a range from 0.2-4 cent/kWh. Despite enormous uncertainties the accumulated experience suffices to dismiss the idea that the risk costs are "clearly negligible".

The argument that externalising the costs of accident risks is acceptable because the risk costs are negligible is not consistent with experience.

The question is instead how to manage this risk costs in a rational way.

R. Haas et al. (Eds.), *The Technological and Economic Future of Nuclear Power*, Energiepolitik und Klimaschutz. Energy Policy and Climate Protection, https://doi.org/10.1007/978-3-658-25987-7_9
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Kärnkraftens politiska frågor:

3. **Avfallshantering: - Vad skall tillåtas och vem betalar?**

Asse-Bergung kostet ???? Milliarden

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The Nuclear Decommissioning Authority's management of the Magnox contract Contents

Summary

The cost of the long-term liability to decommission the UK's civil nuclear sites now stands at £132 billion, though by its nature this estimate is inherently uncertain. Even the cost to take the Magnox sites to the care and maintenance stage of the decommissioning process is highly uncertain, with the Nuclear Decommissioning Authority (NDA) currently estimating that it will cost anything from £6.9 billion to £8.7 billion. The timetable for completing this work is similarly uncertain, with a current estimate of anything from 12 to 15 years. Past experience tells us that these estimates could increase further. Efforts to produce a reliable estimate are made more difficult by the historical legacy of decommissioning being an afterthought when the nuclear industry was established, and poor records of what hazardous materials are on the sites. In this context, the NDA faces a considerable challenge to produce a reliable cost estimate. However, lack of knowledge about the sites was a significant factor in the failure of the Magnox procurement and original contract, which seriously damaged the NDA's reputation and has now cost the taxpayer in excess of £140 million, and it continues to be a major barrier to making progress. A further barrier is developing sufficient skills and capacity to decommission sites efficiently. That said, the UK nuclear industry possesses valuable technical skills and new technologies that could be better exploited to the benefit of the UK economy. The NDA also holds substantial assets in terms of land and employment opportunities that could be used to serve local communities.

Published: 27 November 2020

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UK's civil nuclear sites now stands at £132 billion,

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Published: 27 November 2020

Motsvarar 1 600 miljarder SEK
8 SEK/årskWh ≈>200 TWh/år!
Kärnkraften har givit ca 100 TWh som bäst

Germany approves disputed nuclear waste deal

Photo: DPA

AFP
news@thelocal.de

19 October 2016 | 14:46 CEST+02:00

Germany on Wednesday paved the way for nuclear power plant operators to pay €23.5 billion towards managing atomic waste, in a deal critics say lets firms get off too lightly.

Germany approves disputed

"The companies made high profits for years and shouldn't be released from overall responsibility," energy policy expert Claudia Kemfert of the DIW economic think-tank said.

She added that the financially struggling energy companies may be unable to cover the costs of dismantling nuclear plants.

"With this pact only a fraction of the true costs will be covered, society will have to bear the rest," she said.

Lawmakers in the German parliament still have to approve the law, which must also pass a European Commission check against state aid rules before coming into force.

atomic waste, in a deal critics say lets firms get off too lightly.

”Katastrofalt” – koppar för kärnavfall korroderar

Katastrofalt. Det säger KTH-forskaren Peter Szakalos om de kopparprover som Svensk kärnbränslehantering plockat upp från sin försöksanläggning. Korrosion kommer att göra att de kapslar som ska användas vid slutförvar av kärnavfall kanske inte ens håller i hundra år. Och då är ändå strålningen inte med i beräkningarna, konstaterar professor Christofer Leygraf.

Nu har Svensk kärnbränslehantering presenterat resultat från sina långtidsförsök av det som behövs för slutförvar av kärnbränsle. Efter 20 år i berggrunden i närheten av kärnkraftverket i Oskarshamn har kopparbitar plockats upp som nu analyserats.

Professor Christofer Leygraf och forskaren Peter Szakalos, båda vid Kungliga tekniska högskolan i Stockholm, KTH, har sett delar av materialet. De har bland annat studerat foton av några av de kopparbitar som plockats upp från marken under småländska Åspö, en plats som liknar dendär slutförvaret i Forsmark planeras.

LÄS MER: Strålsäkerhetsmyndigheten mörkade risker med slutförvaret

Något kanske fungerar…

Statens Kärnkraftsinspektions expertgrupp av geologer konstaterade att den inte hade hittat något tillräckligt bra berg. Inspektionens ledning och styrelse valde emellertid en annan ståndpunkt: Svaret på frågan om det fanns tillräckligt sprickfritt berg blev att *”betydelsen av de krav som ställs på den geologiska barriären inte bör överdrivas och att de mycket långsiktiga förloppen i berggrunden har föga praktisk betydelse om övriga barriärer fungerar tillfredställande”.*

Istället för att svara på om kapseln är säker skriver myndigheten:
”SSM anser dock att de kvarvarande osäkerheterna är mycket små i förhållande till slutförvarets samlade skyddsförmåga.”

Kärnkraftens politiska frågor:

1. **Rutinutsläpp: - Hur många skall tillåtas dö?**
2. **Reaktorhaverier: - Vem skall betala?**
3. **Avfallshantering: - Vad skall tillåtas och vem betalar?**
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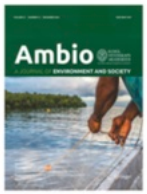
Kärnkraftens politiska frågor:

4. **Kärnvapenspridning: - Hur spridda förutsättningar**

Ambio / Vol. 11, No. 2/...



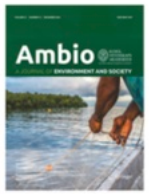
Vol. 11, No. 2/3, 1982, Nuclear War: The Aftermath

Ambio

Published by: Springer Nature on behalf of Royal Swedish Academy of Sciences

https://www.jstor.org/stable/i398478

Ambio / Vol. 11, No. 2/...



Vol. 11, No. 2/3, 1982, Nuclear War: The Aftermath

Ambio

Published by: Springer Nature on behalf of Royal Swedish Academy of Sciences

https://www.jstor.org/stable/i398478

FINALLY...

Although the impact of the nuclear war described in this issue would be widespread and terrible, there would probably be survivors. Their fate, however, is extremely uncertain. The human and social environment in which they will have to live will be changed far beyond our comprehension. In addition to wartime destruction and poisoning, the natural environment might suffer such grave long-term changes as to severely threaten the survivors' fight for recovery. In any case societies as we know them today will most certainly cease to exist.

President Emmanuel Macron on December 8, 2020:

"Without civilian nuclear power, no military nuclear. Without military nuclear, civilian nuclear power."

(Sans nucléaire civil, pas de nucléaire militaire, sans nucléaire militaire, pas de nucléaire civil.)

President Macron 8 DÉCEMBRE 2020
https://www.elysee.fr/front/pdf/elysee-module-16825-fr.pdf

Även Sverige…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INSIGHT

SVENSKA KÄRNVAPEN

SVENSKA KÄRNVAPEN UTVECKLADES FRAM TILL 1972!

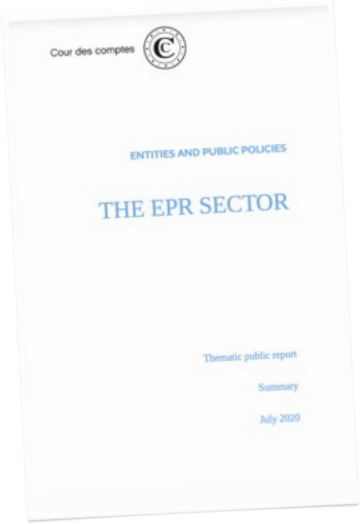
Försvarsmakten/FOA, collage Ny Teknik

Ny Tekniks granskning från 1985: Historien om en svensk atombomb

Socialdemokraternas partistyrelse 21 februari 1956 när Sköld enligt protokoll, citerat i Lindströms avhandling, säger att: "Däremot är det säkert, att något vapenplutonium kan man inte få på snabbare väg än genom utvecklingen av atomenergi för fredliga ändamål."

Kärnkraftens politiska frågor:

5. **Direkta kostnader: - Skall bolag subventioneras**


Cour des comptes

ENTITIES AND PUBLIC POLICIES

THE EPR SECTOR

Thematic public report

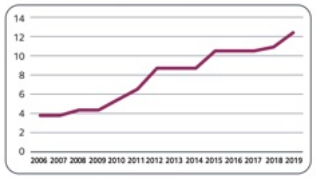
Summary

July 2020

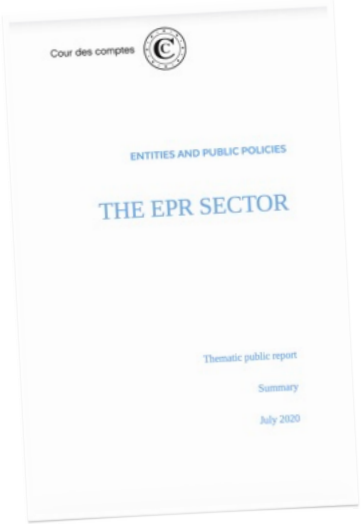
Serious consequences for the entire sector

The consequences of these deviations obviously impact the costs and profitability of the Flamanville EPR. Its construction cost is estimated by EDF at €12.4 billion2015, to which additional costs will be added which could reach nearly €6.7 billion2015 on the commissioning of the reactor, still being scheduled for mid 2023, including around €4.2 billion in financial costs. Under these conditions, it is regrettable that neither EDF nor the public authorities concerned calculated the profitability forecast of the Flamanville 3 EPR, apparently considering it normal that it should be absorbed into the average profitability of all electronuclear reactors. In the absence of data produced by the company, the Cour has estimated, based on hypotheses set out in the report, that the cost of the electricity produced by the Flamanville EPR could be between €110 and €120 / MWh.

Evolution of the building cost of Flamanville 3 between 2006 and 2019 (billions of €2015)



Source: Cour des comptes based on EDF data


Cour des comptes

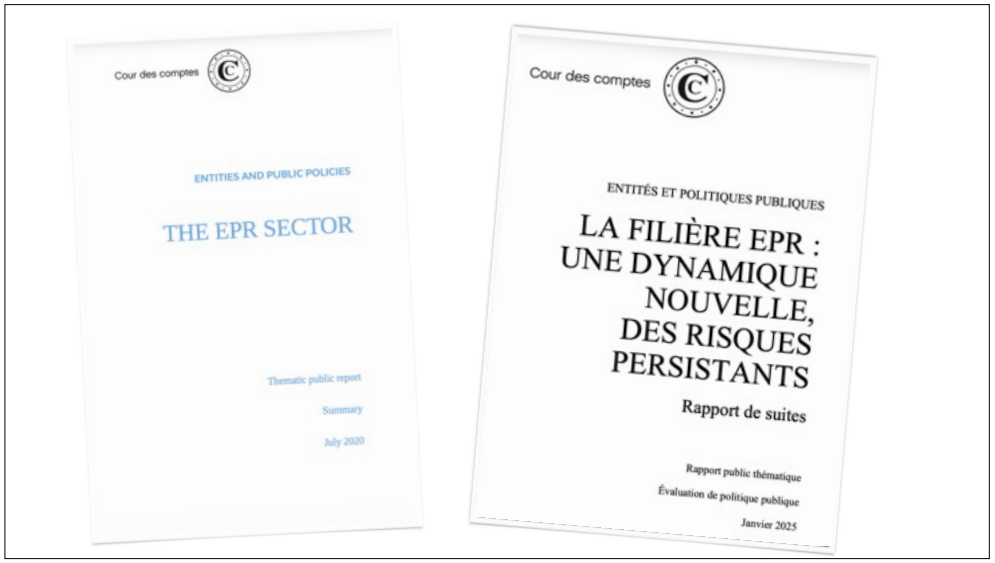
ENTITIES AND PUBLIC POLICIES

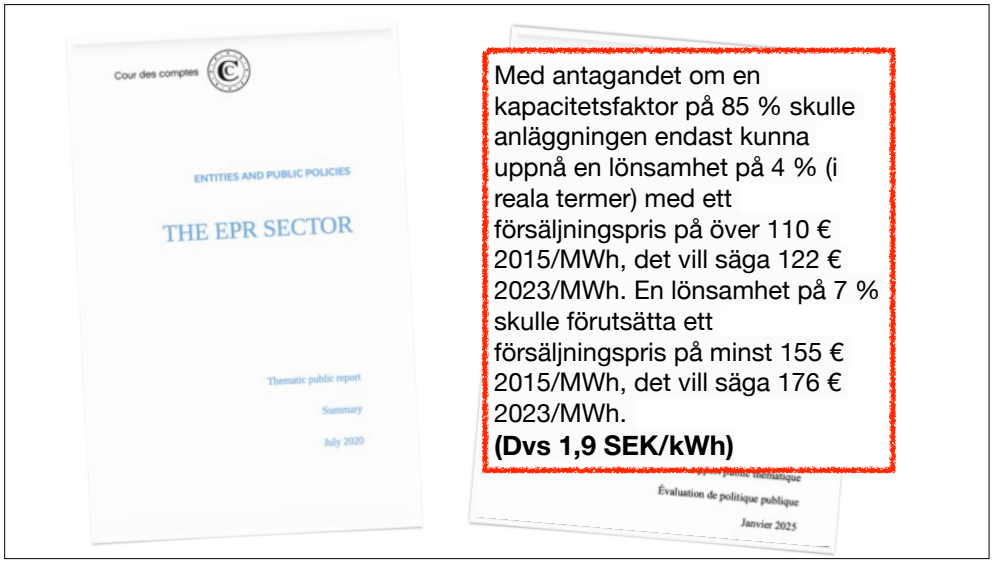
THE EPR SECTOR

Thematic public report

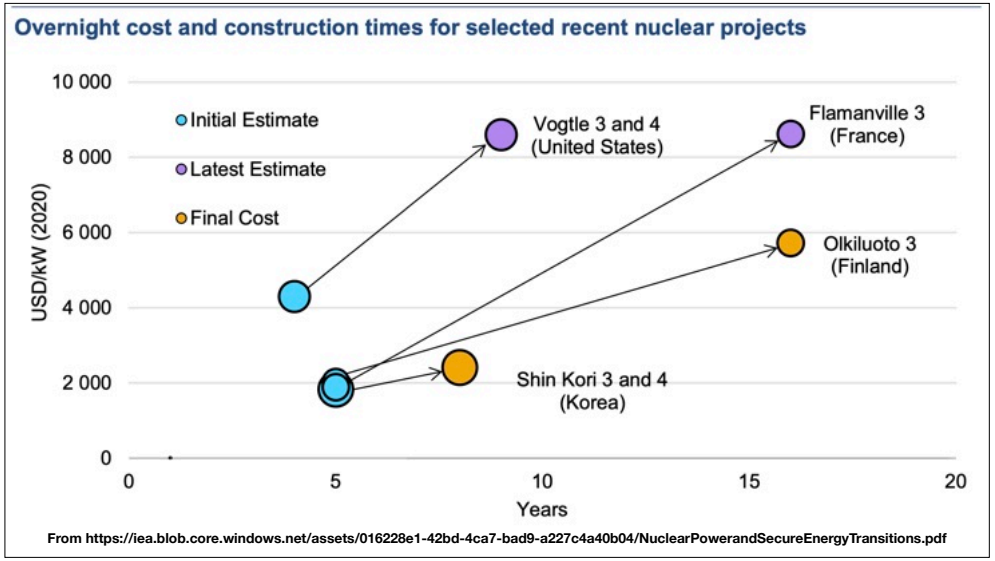
Summary

July 2020





Med antagandet om en kapacitetsfaktor på 85 % skulle anläggningen endast kunna uppnå en lönsamhet på 4 % (i reala termer) med ett försäljningspris på över 110 € 2015/MWh, det vill säga 122 € 2023/MWh. En lönsamhet på 7 % skulle förutsätta ett försäljningspris på minst 155 € 2015/MWh, det vill säga 176 € 2023/MWh.
(Dvs 1,9 SEK/kWh)



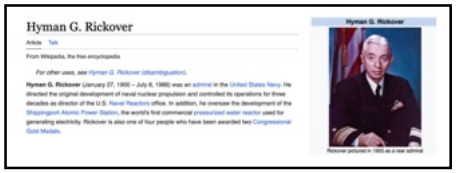
From https://iea.blob.core.windows.net/assets/016228e1-42bd-4ca7-bad9-a227c4a40b04/NuclearPowerandSecureEnergyTransitions.pdf

SMRs' basic economics are worse than meets the eye, because their goalposts keep receding. Reactors are built big because, for physics reasons, they don't scale down well. Small reactors, say their more thoughtful advocates, will produce electricity initially about twice as costly as today's big ones, which in turn, as noted earlier, are ~3–13× costlier per MWh than modern renewables (let alone efficiency). But those renewables will get another ~2× cheaper (say BNEF and NREL) by the time SMRs could be tested and start to scale toward the mass production that's supposed to cut their costs. High volume cannot possibly cut SMRs' costs by 2 × (3 to 13) × 2-fold, or ~12× to ~52×. Indeed, SMRs couldn't compete even if the steam they produce to turn the turbine were *free*. Why not? In big light-water reactors, ~78–87% of the prohibitive capital cost buys *non*-nuclear components like the turbine, generator, heat sink, switchyard, and controls. Thus even if the nuclear island were *free* and a shared non-nuclear remainder were still at GW scale so it didn't cost more per unit[182], the whole SMR complex would still be manyfold out of the money.

https://www.sciencedirect.com/science/article/pii/S1040619022000483

The academic reactor designer is a dilettante. He has not yet had to assume any real responsibility in connection with his projects. He is free to luxuriate in elegant ideas, the practical shortcomings of which can be relegated to the category of "mere technical details." The practical reactor designer must live with these same technical details. Although recalcitrant and awkward, they must be solved and cannot be put off until tomorrow. Their solutions require manpower, time, and money.

Unfortunately for those who must make far-reaching decisions without the benefit of an intimate knowledge of reactor technology, and unfortunately for the interested public, it is much easier to get the academic side of an issue than the practical side.



An academic reactor or reactor plant almost always has the following basic characteristics:

(1) It is simple.
(2) It is small.
(3) It is cheap.
(4) It is light.
(5) It can be built very quickly.
(6) It is very flexible in purpose ("omnibus reactor").
(7) Very little development is required. It will use mostly "off-the-shelf" components.
(8) The reactor is in the study phase. It is not being built now.

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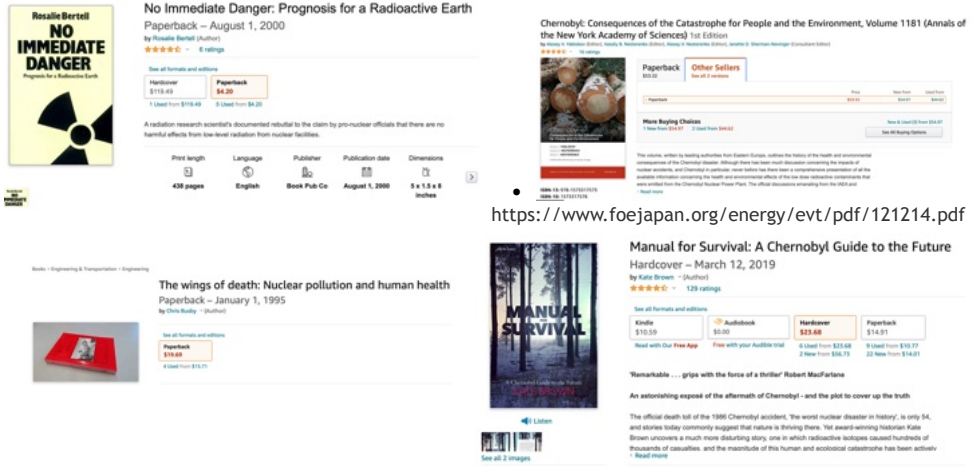
On the other hand, a practical reactor plant can be distinguished by the following characteristics.

(1) It is being built now.
(2) It is behind schedule.
(3) It is requiring an immense amount of development on apparently trivial items. Corrosion, in particular, is a problem.
(4) It is very expensive.
(5) It takes a long time to build because of the engineering-development problems.
(6) It is large.
(7) It is heavy.
(8) It is complicated.

Kärnkraftens politiska frågor:

1. **Rutinutsläpp: - Hur många skall tillåtas dö?**
2. **Reaktorhaverier: - Vem skall betala?**
3. **Avfallshantering: - Vad skall tillåtas och vem betalar?**
4. **Kärnvapenspridning: - Hur spridda förutsättningar kan vi överleva med?**
5. **Direkta kostnader: - Skall bolag subventioneras räddas?**

Några böcker



- https://www.foejapan.org/energy/evt/pdf/121214.pdf

Lite att lyssna på

- Rosalie Bertell
  - https://www.youtube.com/watch?v=8BVH3XN7NX0
  - https://www.youtube.com/watch?v=uSS7T33pLk8
- Fairewinds
  - https://www.fairewinds.org/
- Gordon Edwards
  - https://www.youtube.com/watch?v=-YzHT4c4WCc

Mina sammanfattningar

- https://www.etc.se/analys/det-haer-ska-du-kaenna-till-om-kaernkraft
- https://www.airclim.org/sites/default/files/2025-05/nuclear-power-was-unwanted-even-when-it-was-cheaper_0.pdf
- Föreläsningen om batterier och beredskap finns här:
- https://campustotalforsvar.se/forskning/oppna-forelasningar-inom-totalforsvaret

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Kärnkraften var oönskad redan innan den blev olönsam

- Men det har de flesta glömt.

2026-01-19

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