

Nuclear safety rules – are they killing nuclear power?

David Toke SPRU seminar November
13th 2019

Are regulations killing nuclear?

Rodney Adams, nuclear engineer: 'The problem in the US is many organisations there are regulated by the NRC, are unwilling to publicly criticise the NRC and make them look bad. The NRC has almost total control over their life. Different regulators can take offence. They can start making things harder, all of the approvals they have to give can be withdrawn.There is a real reluctance to go out and say NRC, 'you killed us here'. That is part of what has driven the cost, in my view, without really affecting safety at all' (interview 9/09/2018)

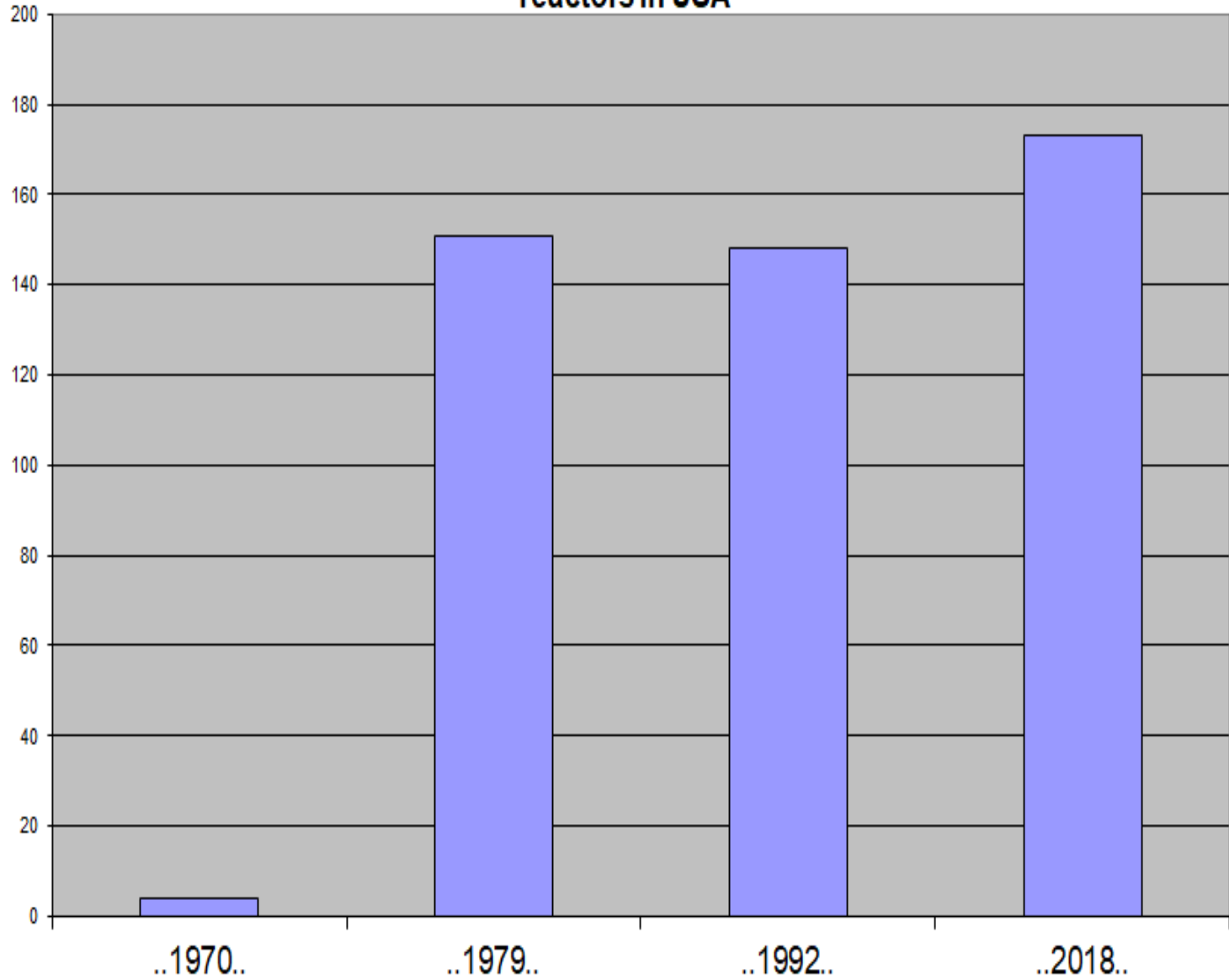
Safety regulations are not to blame for nuclear failure?

Peter Bradford (former NRC Commissioner) 'The experience of the 1970s and 1980s was repeated at Vogtle and Summer. For reasons having nothing to do with environmental opposition or regulatory excess these plants and several others now cancelled experienced major cost overruns that they were unable to manage. Ultimately Westinghouse, which had no experience as a constructor despite its storied history as a reactor designer was driven into bankruptcy by the interplay between the cost overruns and its fixed price contracts.' (interview 4th June 2018)

Testing a hypothesis

- null hypothesis: i.e. relative strength of western based nuclear safety regulations have no major impact on commercial viability of nuclear power plant
- Method: compare safety regulations in France and USA and then commercial nuclear power outcomes. (UK safety regulation comparison included for interest)

Cumulative number of safety rules issued by NRC for nuclear power reactors in USA



Source: author's analysis of NRC safety rule archives

US nuclear safety principles

- New plant: rules based on the notion of 'adequate' safety
- License conditions can only be changed on the basis of 'cost benefit' calculations that measures must not be more expensive than the benefit in avoiding radioactive discharges

EU nuclear safety Directive 2014

1. Member States shall ensure that the national nuclear safety framework requires that nuclear installations are designed, sited, constructed, commissioned, operated and decommissioned with the objective of preventing accidents and, should an accident occur, mitigating its consequences and avoiding:
 - (a) early radioactive releases that would require off-site emergency measures but with insufficient time to implement them;
 - (b) large radioactive releases that would require protective measures that could not be limited in area or time.
2. Member States shall ensure that the national framework requires that the objective set out in paragraph 1:
 - (a) applies to nuclear installations for which a construction licence is granted for the first time after 14 August 2014;
 - (b) is used as a reference for the timely implementation of reasonably practicable safety improvements to existing nuclear installations, including in the framework of the periodic safety reviews as defined in Article 8c(b). (EUR LEX 2014)

Nuclear power safety regulations for existing reactors compared in USA, UK and France (selected measures)

country	US	UK	France
discourse	Cost-benefit	safety preferred over cost (until 'grossly disproportional')	Safety regardless of cost (but according to priorities)
Post-Fukushima action	Task force recommendations only partly accepted by NRC after industry lobbying	Task force established with recommendations accepted by ONR, mainly implemented	Stress tests ordered and analysed leading to 'hardened core' concept implemented for existing plant
PAR	Not required by NRC for PWRs	Fitted	Fitted
FCVS	Not required by NRC for PWRs	Recommended by ONR but not (yet) fitted	Fitted
Independent power generation	Vague requirement by NRC: some guaranteed availability no longer than 6 hours	Minimum 48 hour guarantee	Available on a permanent basis
Post Fukushima 'beyond design' technical measures	Not required by NRC	Recommended by ONR	Recommended by ASN

Nuclear power safety regulations for new reactors compared in USA, UK and France (selected measures)

Safety measure	Indefinite guaranteed power after accident	Passive Autocatalytic Recombiners (H2 removal)	Additional cooling systems for reactor core and spent fuel sites	Double containment	Core catcher
USA	Not required	Not required	Not required	Not required	Not required
France	required	required	required	required	required
UK	required	required	required	Not required	Not required

Sources: interviews, regulatory documents, UCS and OECD analysis

Comparison of outcomes for nuclear power in France and USA 1

Existing reactors

- USA: 96 reactors in operation (64 PWRs)
- France: 58 reactors in operation (58 PWRs)
- PWRs: 14 PWRs closed down in USA compared to 1 PWR closure in France to date.

Comparison of outcomes for nuclear power in France and USA 2

New reactors:

- USA: Double AP1000 projects at Vogtle and V.C. Summer (Georgia and South Carolina) both heavily delayed and costs spiralling (V.C. Summer abandoned)
- France: Flamanville EPR: heavily delayed and costs spiralling

Conclusion of hypothesis test

- The null hypothesis is accepted i.e. relative strength of western based nuclear safety regulations have no major impact on commercial viability of nuclear power plant

Have French nuclear safety standards increased?

- Yes and No
- Yes in the sense that the regulators now expect reactors to prevent radioactive fallout from events that were previously said to be beyond design basis (note: not accepted in USA)
- But No in the sense that the same quality standards are applied to achieve engineering outcomes (eg problems with RPV and weldings on steam pipes)

Why is nuclear doing badly? – some guesses

- Partly because of safety reasons nuclear requires highly specialised parts and labour skills
- Lack of capacity for such specialisation leads to quality problems eg weldings for EPR
- New ‘safety’ designs (Gen III passive safety) introduced new problems, not cost reductions
- Efforts to increase size to contain new safety measures leads to new engineering problems (eg EPR RPV)