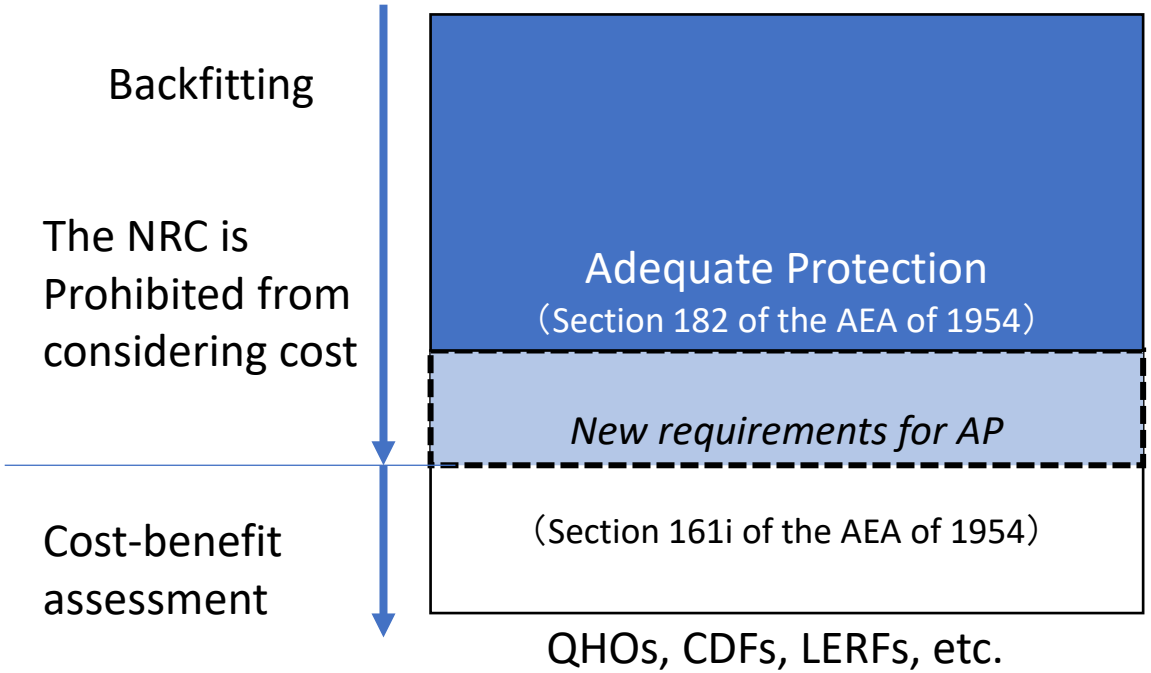
安全目標と安全性向上

鄭　嘯宇
日本原子力研究開発機構
2024年11月7日（木）

Backfitルールによる「安全性向上」の2階層構造

Congressional legislation (The Atomic Energy Act of 1954) commands the NRC to ensure that nuclear power plant operation provides adequate protection. In defining, redefining, or enforcing this statutory standard of adequate protection, the NRC is prohibited from considering, and does not consider, economic costs. However, safety improvements beyond the minimum needed for adequate protection are possible through optimization. For such backfits beyond the minimum needed for adequate protection, the Commission's backfitting rule requires that backfits be imposed only upon a finding that they provide a substantial increase in the overall protection of the public health and safety or the common defense and security and that the direct and indirect costs of implementation for the facility are justified in view of this increased protection.

- Adequate protection満足した（規制を超えた）安全性向上の場合、safety enhancementに修飾する用語（substantial, cost-justified等）が必要
- Safety enhancement 「安全性向上」を理解するのは、contextに依存してしまう



POST-FUKUSHIMA SAFETY ENHANCEMENTS RESOURCES

NRC Order on Mitigation Strategies (EA-12-049)
(https://www.nrc.gov/docs/L1205/ML12054A735.pdf)

NRC Order on Spent Fuel Pool Instrumentation (EA-12-051)
(https://www.nrc.gov/docs/ML1205/ML12056A044.pdf)

NRC Order for Containment Venting Systems (EA-13-109)
(https://www.nrc.gov/docs/ML1314/ML13143A321.pdf)

NRC Request for Information letter related to seismic, flooding and emergency preparedness
(https://www.nrc.gov/docs/ML1205/ML12053A340.pdf)

Post-Fukushima Safety Enhancements Resources
(https://www.nrc.gov/reactors/operating/ops-experience/japan-dashboard.html)

Recommendations for Enhancing U.S. Reactor Safety in the 21st Century: The Near-Term Task-Force Review of Insights from the Fukushima Dai-ichi Accident
(https://www.nrc.gov/docs/ML1118/ML111861807.pdf)

Resolution of Post Fukushima Tier 2, Tier 3, and Non Tiered Activities
(https://www.nrc.gov/docs/ML1810/ML18101B396.pdf)

安全性向上に関する米国NRCの用語について

- そのままのSafety enhancement/improvementとの表現があるが、条件付きの場合もある。例えば、
  - Post-Fukushima safety enhancements（“条件無し”）
  - 他に、Cost-justified substantial safety enhancement（“条件付き”）

- Backfits are expected to occur as part of the regulatory process to ensure the safety of power reactors and radioactive materials. It is important for sound and effective regulation, however, that backfitting be conducted by a controlled and defined process. The NRC backfitting process is intended to provide for a formal, systematic, and disciplined review of new or changed positions before imposing them. The backfit process enhances regulatory stability by ensuring that changes in regulatory staff positions are justified and suitably defined.

NUREG/BR-0058, Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission, Revision 5 (2017)

Backfitting is defined in 10 CFR 50.109 as the modification of or addition to SSCs, or the design of a facility; or the design approval or manufacturing license for a facility; or the procedures or organization required to design, construct, or operate a facility; any of which may result from a new or amended provision in Commission rules or the imposition of a regulatory staff position that is either new or different from a previously applicable staff position and effective after specific dates described in the backfit rule.

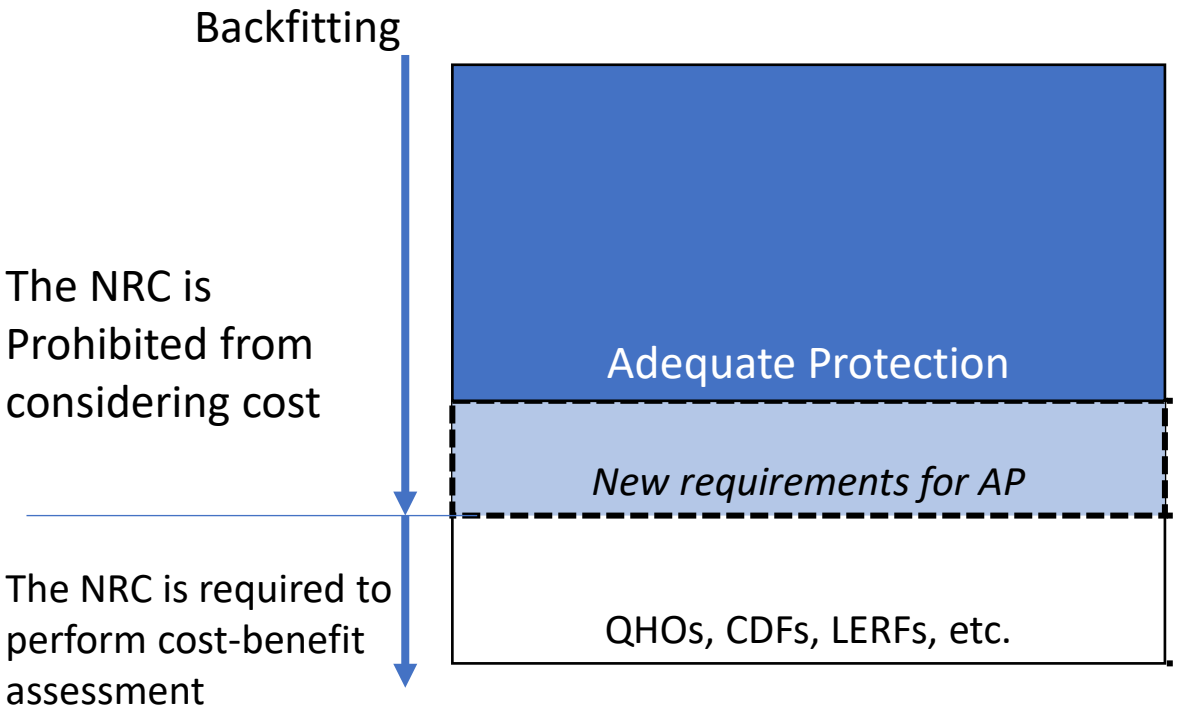
The term "backfit" is not normally used in discussions relevant to new power reactors; the concept of "issue finality" is used rather than “backfit.” In this guidance, the NRC uses the terms “backfit” and “backfitting” to mean backfits as defined in 10 CFR 50.109, 10 CFR 70.76, 10 CFR 72.62, and 10 CFR 76.76 and issue finality matters under 10 CFR Part 52.

NUREG/BR-0058, Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission, Revision 5 (2017)

- 10 CFR Part 50, backfitting
  - § 50.109, ‘‘Backfitting,’’ (the Backfit Rule)
- 10 CFR Part 52, issue finality
  - § 52.98, ‘‘Finality of combined licenses; information requests,’’
- 10 CFR Part 53 (draft)
  - § 53.1590 Backfitting.
- The NRC Management Directive 8.4, “Management of Backfitting, Forward Fitting, Issue Finality, and Information Requests,”

The Backfit Rule (USNRC)と日本の新規制基準を比較してみると

- 設置許可された原発に対してさかのぼって適用する（「バックフィット」といわれる）法的仕組みは何もなかった。（国会事故調）
- 新規制基準の前提となる法改正 (平成24年6月公布)：既に許可を得た原子力施設に対しても最新の規制基準への適合を義務づける、「バックフィット制度」を導入



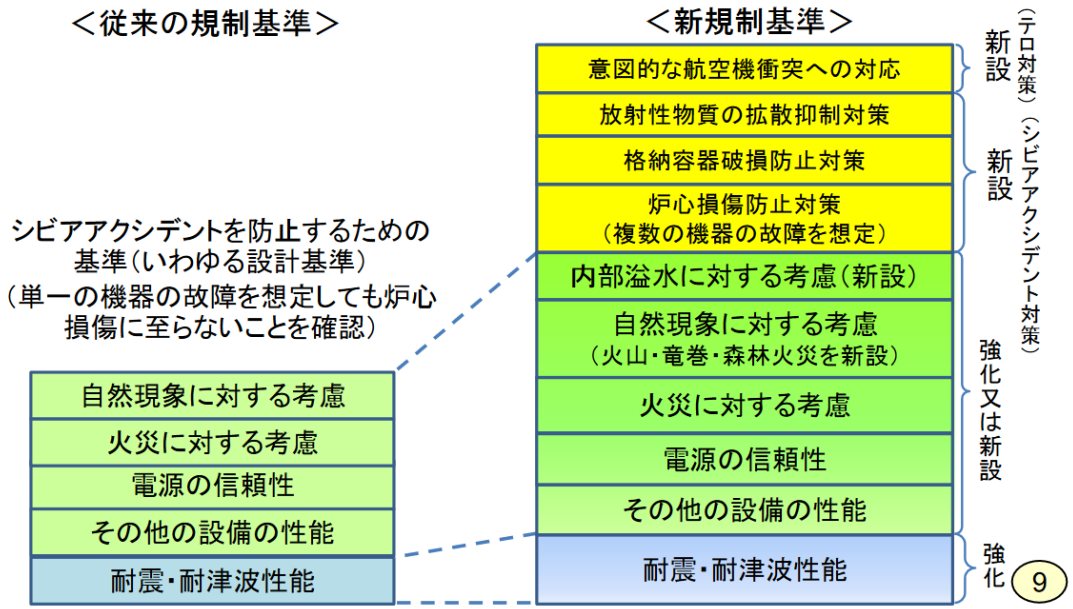
NRAの従来の規制基準

NRAの新規制基準

Risk-informed regulation なので、この部分の導入状況について、不明

従来の規制基準と新規制基準との比較

➢ 従来と比較すると、シビアアクシデントを防止するための基準を強化するとともに、万一シビアアクシデントやテロが発生した場合に対処するための基準を新設



NUREG/BR-0058
Revision 4

Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission

Manuscript Completed: August 2004
Date Published: September 2004

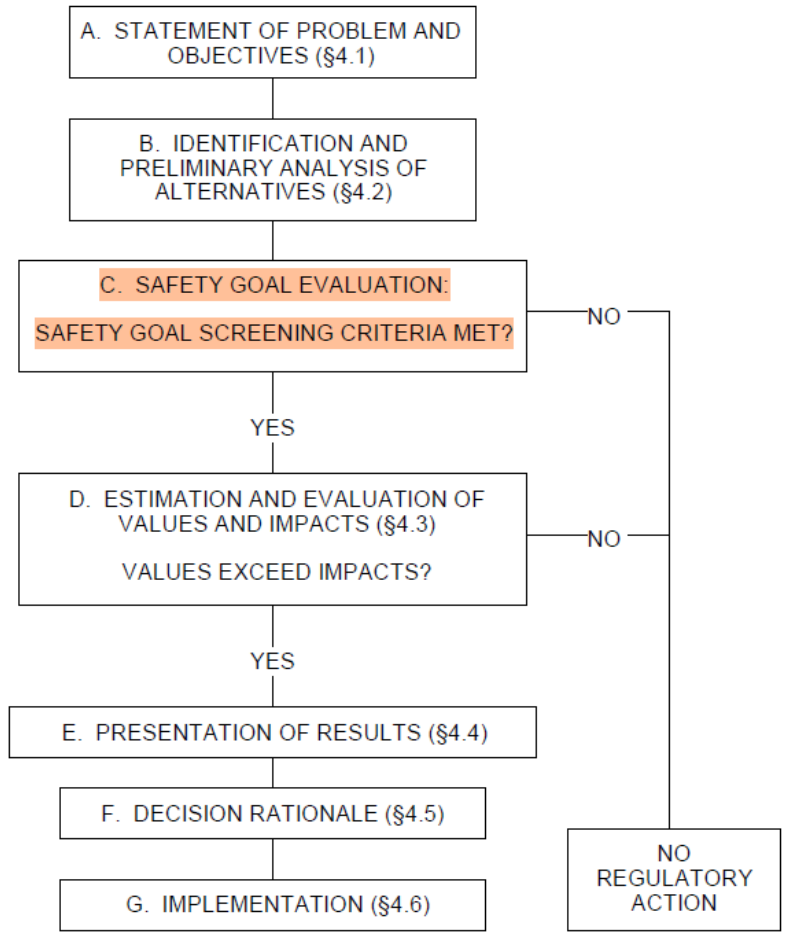


Figure 3.1 Regulatory Analysis for Nuclear Power Plant Cost-Justified Substantial Safety Enhancements

規制分析（Regulatory Analysis）における安全目標の使い方

Regulatory Analysis

A regulatory analysis is a formal analysis of a proposed government agency requirement, including estimates of benefits and costs that are quantified to the fullest extent possible . The NRC uses regulatory analyses to consider preferred alternatives from the potential courses of action studied. A regulatory analysis contains estimates of benefits and costs with a conclusion as to whether the proposed regulatory action is cost justified and documents the analysis in an organized and understandable format.

A regulatory analysis is performed to support numerous actions affecting reactor and material licensees but is always required by NRC policy when an NRC action is expected to impact industry resources. In general, the NRC ensures that all mechanisms used to establish or communicate generic requirements, guidance, requests or staff positions that would affect a change in the use of resources by its licensees include an accompanying regulatory analysis. These mechanisms include rules, bulletins, generic letters, regulatory guides, orders, standard review plans, branch technical positions, and standard technical specifications. Regulatory analyses are used to comply with Office of Management and Budget guidance and executive orders and as a decision tool for policy makers by providing a rationale for action and transparency for agency decision making.

出典：https://www.nrc.gov/about-nrc/regulatory/rulemaking/regulatory-analysis.html

- Safety goal screening criteria are to be applied only to safety enhancements and evaluated for the affected class of nuclear power plants. Safety goals are to be used as a reference point in ascertaining the need for safety enhancements. However, the safety goals are not requirements, and, with the Commission’s approval, safety enhancements may be implemented without strict adherence to the Commission’s safety goal policy statement.
- Safety goal evaluations are to be performed in conjunction with the substantial additional protection standard contained in the backfit rule and applied to 10 CFR 50.109 analyses associated with substantial safety enhancements, wherein the estimated costs of the implementation are justified in view of the estimated safety improvement.
- Evaluations of proposed regulatory initiatives for consistency with safety goals should identify and integrate related issues under study. The integration of related issues is essential to the efficient application of staff and industry resources. The overall objective is to avoid a piecemeal evaluation of issues.

- 規制を超えた安全性向上は、規制要求（Regulatory requirements）になっていないため、Cost-Justified Substantial safety enhancementかを判断する（Backfit analysis, safety goal analysis）必要があり、Backfitting等の言葉を直接に使ったほうが誤解が少ないかもしれません。

- The NRC promulgated its first rule concerning the "backfitting" or safety-enhancement of nuclear reactors in 1970. In explaining the need for such a rule, the NRC noted that "rapid changes in technology in the field of atomic energy result in the continual development of new or improved features designed to improve the safety of production and utilization facilities."
- In explaining the rationale supporting these three exceptions, the Statement of Considerations accompanying the final rule states that "[t]he consideration and weighing of costs contemplated by the rule applies to backfits that are intended to result in incremental safety improvements for a plant that already provides an acceptable level of protection."

Nos. 85-1757, 86-1219
United States Court of Appeals, District of Columbia Circuit

Union of Concerned Scientists v. U.S. Nuclear Regulatory Commission

824 F.2d 108 (D.C. Cir. 1987)
Decided Aug 4, 1987