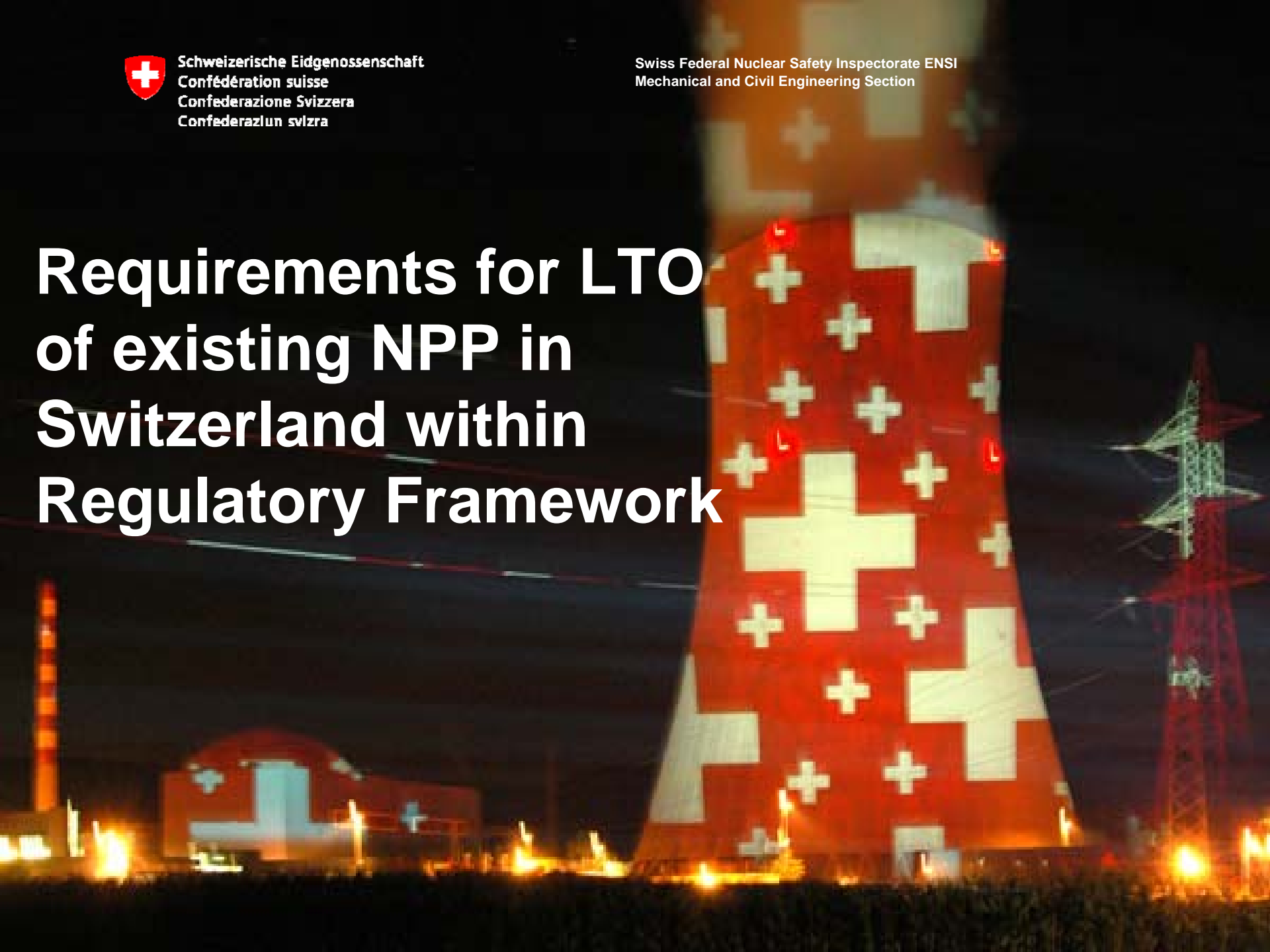




Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Federal Nuclear Safety Inspectorate ENSI
Mechanical and Civil Engineering Section

Requirements for LTO of existing NPP in Switzerland within Regulatory Framework





Basis data of the NPP in Switzerland

| NPP | Type | Manufacturer | Output (MWe) | Commissioning |
|------------------|--------------|------------------|--------------|---------------|
| Beznau-1 | PWR (2-Loop) | Westinghouse | 365 | 1969 |
| Beznau-2 | PWR (2-Loop) | Westinghouse | 365 | 1971 |
| Mühleberg | BWR | General Electric | 355 | 1972 |
| Gösgen | PWR (3-Loop) | Siemens KWU | 970 | 1979 |
| Leibstadt | BWR-6 | General Electric | 1165 | 1984 |



Verification and integral parts of LTO

- Laws and regulations relevant to LTO
- Review of the principles of design basis according to the current state of backfitting
- Current probabilistic safety analysis
- Review of existing plant programmes (ISI, IST,...)
- Review of ageing management programmes
- Time limited ageing analysis

Laws and Regulations relevant to LTO

International Standards: Principles and Guidelines for LTO

- IAEA-Safety Guide NS-G-2.6, Maintenance, Surveillance and ISI
IAEA Vienna, 2002
- IAEA-Safety Guide NS-G-2.12, Ageing Management for NPP
IAEA Vienna, 2008
- IAEA-SALTO, Safety Aspects of LTO of Water Moderated Reactors
IAEA Vienna, 2007
- IAEA-SALTO Guidelines, Peer Review of LTO and Ageing Management of NPP
Service Series No. 17, IAEA Vienna, 2008
- IAEA-PLIM, Plant Life Management for LTO of Light Water Reactors
Principles and Guidelines, Technical Reports Series No. 448, IAEA Vienna, 2006
- WENRA Reactor Safety Reference Levels
 - Level K: Maintenance, Surveillance and ISI, 2007
 - Level I: Ageing Management, 2007

Laws and Regulations relevant to LTO

Switzerland: Laws, Regulations and Guides for LTO

- Act on Nuclear Power, SR 732.1, 2003
 - Art. 22, Para. 2 c, d, g
- Regulation on Nuclear Power, SR 732.11, 2004
 - Art. 33, 34 and 35
- Regulation on Criteria for the Preliminary Shutdown, SR 732.114.5, 2008
 - Revision of the principles of design basis according to the state of backfitting and the operational experiences
 - Criterion on RPV irradiation embrittlement
 - Criterion on cracks in reactor coolant components
 - Criterion on corrosion of steel containments
 - Criterion on concrete ageing of containments
- Guidelines of the Swiss Federal Nuclear Safety Inspectorate ENSI
 - ENSI-B01, Ageing Management, 2009
 - ENSI-B06, Maintenance, 2009
 - ENSI-B08, In-Service Inspection, 2009

Review of the principles of original design basis and upgrades according to the current state of backfitting

- Documentation of the design codes and standards used in the original design and upgrades, documentation of internationally recognised and accepted safety standards and methodology
- Definition of the current state of backfitting for the specific type of NPP
- Current safety analysis especially for the realised backfitting measures and analysis of operating experience, as well as experience learned from incidents and accidents
- Regulation on Criteria for the Preliminary Shutdown:
Review of the original design principles and upgrades is required if
 - internal incidents and accidents \geq INES 1
 - external incidents and accidents \geq INES 2

Review of existing plant programmes

- Maintenance, ENSI-B06
- ISI, In-service Inspection, ENSI-B08
- IST, In-service testing, ENSI-B06
- Surveillance and Monitoring, ENSI-B06
- Equipment qualification, ENSI-B07
- Quality assurance, ENSI-G11

Review of ageing management programmes according to IAEA-SALTO

- Definition of the programme scope
(specific SSC subjected to an ageing management review)
- Identification of preventive actions or parameters to be monitored
- Detection of ageing degradation/effects
- Monitoring and trending including frequency and methodologies
- Pre-established acceptance criteria
- Corrective actions if a component fail to meet the acceptance criteria
- Conformation that required actions have been taken
- Administrative controls to provide a formal review and approval process
- Operating experience feedback

Time limited ageing analysis, ENSI-B01

- Reactor vessel irradiation embrittlement
(RT_{NDT} , RT_{To} , ASME CC N629, N631, KTA 3203, Reg.-Guide 1.99)
- PTS analysis
(ASME III, App. G, ASME XI, App. A, 10 CFR 50.61, Reg.-Guide 1.154, KTA 3201.2)
- Fatigue analysis including thermo-mechanical fatigue and vibration, environmental effects, monitoring, usage factors for LTO
(components: RPV, RPV internals, reactor coolant piping and pump, steam generator, PWR pressurizer and surge line, BWR feedwater piping)
- Fracture mechanics analysis (LBB for reactor coolant piping, EUR-18549, NUREC 0800 SRP 3.6.3, Reg.-Guide 1.45)
- Corrosion analysis of the steel containment
(monitoring and mitigation measures)

Documentation requirements on Ageing Management Programs

To be prepared by the Swiss NPPs according to HSK-R51 (ENSI-B01 in preparation)

- General Documentation
 - General catalog of principle Ageing Mechanism
 - Guidelines addressing specific plant details as engaged materials, water chemistry, etc)
- Fact sheets Ageing Management on a system basis (typical ca. 30 reports per NPP)
 - Identification of relevant ageing mechanism for each safety relevant component.
 - Crosscheck with existing inspection & maintenance program.
 - Identification of possible gaps and definition of required actions
- Annual summary report on aging management topics
 - Tracing and documentation of relevant int. & ext. operating experience
 - Evaluation of latest conclusions from R&D (lab. results, sensitivity studies etc.)
 - Review of previous assessments regarding specific material susceptibility