

Nuclear Security during the Decommissioning of NPPs

Alexander Rduch, GRS

International Conference on Physical Protection
of Nuclear Material and Nuclear Facilities
13-17 November 2017, Vienna, Austria

Germany's decision to phase out

- Consensus to phase out since 2000
- Lifetime extension of German NPPs 2010
- Fukushima March 2011



German NPPs – in operation

Brokdorf	KBR	
Emsland	KKE	(*)
Grohnde	KWG	
Gundremmingen	KRB B	
	KRB C	
Isar	KKI 2	(*)
Neckarwestheim	GKN 2	(*)
Philippsburg	KKP 2	



(*) in operation until 31.12.2022 (AtG)

German NPPs – non operational

Biblis	KWB A
	KWB B
Brunsbüttel	KKB
Grafenrheinfeld	KKG
Isar	KKI 1
Krümmel	KKK
Neckarwestheim	GKN 1
Philippsburg	KKP 2
Unterweser	KKU

non-operational since 06.08.2011
 KKG since 27.06.2015



Decommissioning guideline 2016

- reduced risk potential
- with or without nuclear fuel elements
- nuclear facilities nearby

- until removal of nuclear fuel elements:
 - heat release from fuel pool
 - coolant loss from fuel pool
 - handling and storage of nuclear fuel elements

- description of nuclear security measures (security report)

Guide to the decommissioning, the safe enclosure and the dismantling of facilities or parts thereof as defined in § 7 of the Atomic Energy Act

as at 23 June 2016

Unofficial translation by Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) gGmbH.

This translation is intended solely as a convenience to the non-German public. Any discrepancies or differences in the translation are not binding and have no legal effect for compliance or enforcement purposes. In case of discrepancies the German official version shall prevail.

Contents

1	Introduction	6	Handling of radioactive and non-radioactive materials from decommissioning
2	Framework	6.1	Release from regulatory control
2.1	Principles	6.2	Measurement methods and sampling
2.2	Legal regulations	6.3	Clearance
2.3	Guidance instruments	6.4	Removal
2.4	International regulations, standards and recommendations	6.5	Treatment and storage of radioactive substances
3	Decommissioning planning and application documents	7	References
3.1	Decommissioning strategies	8	Annex 1: Definition of terms
3.2	Decommissioning concept	9	Annex 2: Classification of the BML/BMLB and KTA standards in terms of their applicability to decommissioning procedures
3.3	Post-operational phase	10	Annex 3: Comments on application adapted to protection goals or partial application of the BML/BMLB announcements and KTA safety standards in decommissioning procedures
3.4	Application documents	11	Annex 4: Application documents for decommissioning, safe enclosure and dismantling of nuclear facilities in the Federal Republic of Germany
3.5	Safety considerations		
3.6	Definition of decontamination and dismantling techniques		
3.7	Staffing provisions		
3.8	Financial security		
4	Licensing procedures		
4.1	Checking the licensing prerequisites		
4.2	Transition from operating licence to decommissioning licence		
4.3	Licensing procedure with several steps		
4.4	Environmental impact assessment and involvement of third parties		
5	Supervision		
5.1	Work permits for decommissioning activities		
5.2	Documentation		

Physical Protection needed during Decommissioning ?

- Option A: no power generation – no security needed
- Option B: keep the full physical protection system running
- Option C: look up your license document
- Option D: neither Option A, B, nor C.
Try something else and use common sense

Decommissioning of NPPS – phases

- operation
 - power operation
 - post operation phase
- residual operation
 - decommissioning
 - shutdown
 - safe enclosure
 - dismantling
 - with nuclear fuel elements
 - without nuclear fuel elements
 - decontamination
 - removal of other radioactive material

Remaining risk potential during the decommissioning

- nuclear fuel elements
 - fresh fuel
 - spent fuel
- other radioactive material
- remaining threats
 - sabotage
 - theft
 - insider

Possible procedures

- DBT for all phases
- DBT for nuclear fuel elements
- DBT for other radioactive material

- different risk potential for sabotage and theft

- Graded security concept
 - large amount of nuclear fuel
 - small amount of nuclear fuel
 - without nuclear fuel
 - completing decontamination, other radioactive material

Graded Approach using the 19 Security Functions from Deterministic Security Analysis (DSA)

1. fence against violent group of people
 2. vehivle barriers
 3. surveillane
 4. interference from outside PA
 5. detection
 6. protected area (PA)
 7. delay
 8. Central Alarm Station (CAS)
 9. secured access to Inner Area
 10. Security Guard Service
 11. protected guard building
 12. access control to protected area
 13. access control to inner area
 14. prevention and detection of theft
 15. prevention against insiders
 16. recognition of extortion
 17. planned substitute measures
 18. trustworthy personnel
 19. Infrastructure for response forces
- no modification
 - system-dependent consideration
 - changes after analysis and verification

3 Examples

- new central alarm station and new spent fuel pool
- water inlet structure (building, pipes) removed from inner area
- spent fuel moved to an other interim storage at a different nuclear facility

Specifics

Phase with nuclear fuel elements

- Separation of buildings with consideration of Inner Area
- Additional security measures for interfaces
- Protected Area needed without any changes
- Optional relocation of Central Alarm Station

Phase without nuclear fuel elements


- Adjustment of security concept
- Reduction in defence in depth – concept
- Change in access control procedures
- Additional locks for material and vehicles
- Detection of barriers with technical means or with personnel

Where do we end up?

- full Physical Protection System according to DBT
- reduced measures after system-dependent consideration, analysis and verification
- Change in regime (from nuclear security to radiation protection)
- Buildings with strong walls and doors (RC 6), with intrusion detection system, alarm communication system and alarm evaluation
- normal industrial storage with doors (RC 2) and detection measures

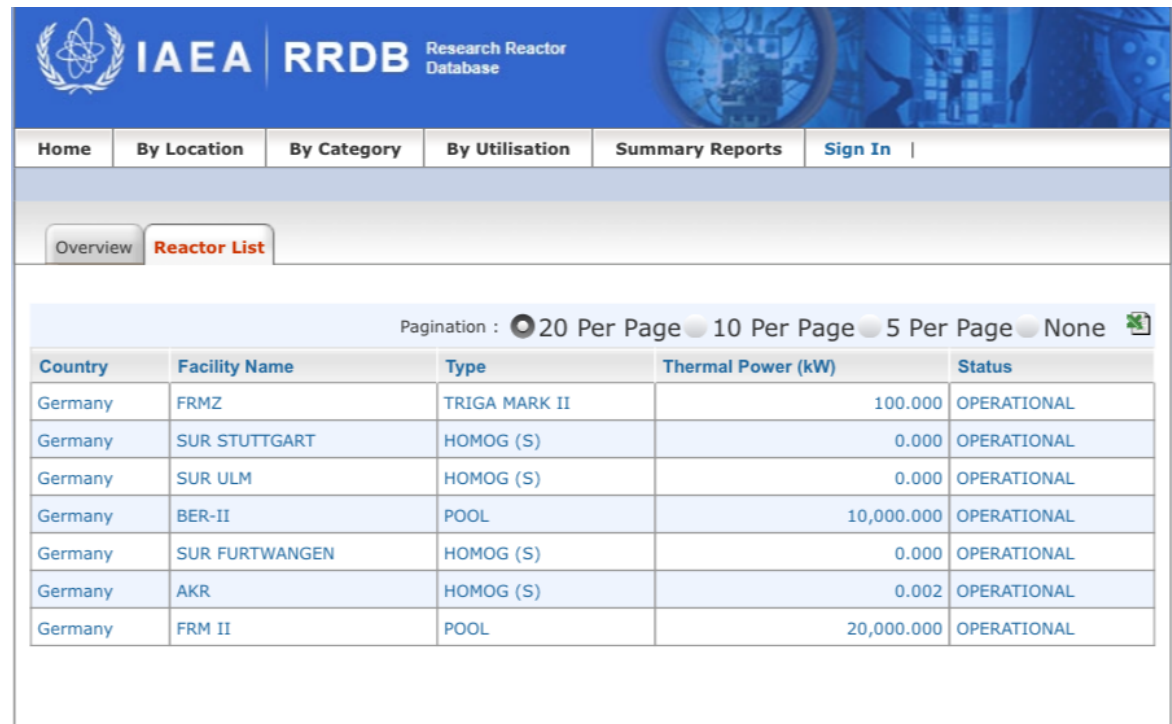
always needed:

full security concept with path analysis for intrusion (sabotage or theft)

DEUTSCHE NORM <i>Entwurf</i>		Oktober 2016
DIN 25422		DIN
ICS 27.120.30	Entwurf	
		Einsprüche bis 2017-01-16 Vorgesehen als Ersatz für DIN 25422:2013-06
<p>Aufbewahrung und Lagerung radioaktiver Stoffe - Anforderungen an Aufbewahrungseinrichtungen und deren Aufstellungsräume zum Strahlen-, Brand- und Diebstahlschutz</p> <p>Storage and keeping of radioactive materials - Requirements on protection against radiation, fire and theft to be met by storage facilities</p> <p>Conservation et stockage de matières radioactives - Exigences envers les dispositifs de conservation et envers leurs locaux de stockage au niveau de la protection contre les radiations, l'incendie et le vol</p> <p>Anwendungswarnvermerk</p> <p>Dieser Norm-Entwurf mit Erscheinungsdatum 2016-09-16 wird der Öffentlichkeit zur Prüfung und Stellungnahme vorgelegt.</p> <p>Weil die beabsichtigte Norm von der vorliegenden Fassung abweichen kann, ist die Anwendung dieses Entwurfs besonders zu vereinbaren.</p> <p>Stellungnahmen werden erbeten</p> <ul style="list-style-type: none"> - vorzugsweise online im Norm-Entwurfs-Portal des DIN unter www.din.de/go/entwurfe bzw. für Norm-Entwürfe der DKE auch im Norm-Entwurfs-Portal der DKE unter www.entwurfe.normenbibliothek.de, sofern dort wiedergegeben; - oder als Datei per E-Mail an nmp@din.de möglichst in Form einer Tabelle. Die Vorlage dieser Tabelle kann im Internet unter www.din.de/go/stellungnahmen-norm-entwurfe oder für Stellungnahmen zu Norm-Entwürfen der DKE unter www.dke.de/stellungnahme abgerufen werden; - oder in Papierform an den DIN-Normenausschuss Materialprüfung (NMP), 10772 Berlin, Burggrafenstr. 6, 10787 Berlin. <p>Die Empfänger dieses Norm-Entwurfs werden gebeten, mit ihren Kommentaren jegliche relevanten Patentrechte, die sie kennen, mitzuteilen und unterstützende Dokumentationen zur Verfügung zu stellen.</p>		
		Gesamtumfang 25 Seiten
DIN-Normenausschuss Materialprüfung (NMP) DIN-Normenausschuss Radiologie (NAR)		
<small>© DIN Deutsches Institut für Normung e. V. - Jede Art der Vervielfältigung, auch auszugsweise, nur mit Genehmigung des DIN Deutsches Institut für Normung e. V., Berlin, gestattet. Abdruckverbot der Normen durch Beuth Verlag GmbH, 10772 Berlin</small>		
		<small>Prüfgruppe 13 www.din.de www.beuth.de</small>
		 2551024

Phase out of NPPs, but ...

- 7 research reactors
in Mainz, Stuttgart, Ulm, Berlin, Furtwangen, Dresden and Munich
- 1 uranium enrichment plant
in Gronau
- 1 fuel assembly fabrication
in Lingen
- 16 interim storages
- Nuclear Transport



The screenshot shows the IAEA RRDB Research Reactor Database interface. The header includes the IAEA logo and the text 'IAEA RRDB Research Reactor Database'. Below the header are navigation tabs: Home, By Location, By Category, By Utilisation, Summary Reports, and Sign In. The main content area has two tabs: Overview and Reactor List (which is selected). Below the tabs is a pagination control showing '20 Per Page' selected. The main table lists reactors with columns for Country, Facility Name, Type, Thermal Power (kW), and Status.

Country	Facility Name	Type	Thermal Power (kW)	Status
Germany	FRMZ	TRIGA MARK II	100.000	OPERATIONAL
Germany	SUR STUTTGART	HOMOG (S)	0.000	OPERATIONAL
Germany	SUR ULM	HOMOG (S)	0.000	OPERATIONAL
Germany	BER-II	POOL	10,000.000	OPERATIONAL
Germany	SUR FURTWANGEN	HOMOG (S)	0.000	OPERATIONAL
Germany	AKR	HOMOG (S)	0.002	OPERATIONAL
Germany	FRM II	POOL	20,000.000	OPERATIONAL

Final Remark and Suggestion

- decommissioning is coming for each and every NPP
- there is no best way
- Development of an unified standard for evaluation and assessment is needed even for different approaches and procedures

