



APPROACH TO ZERO LEVEL DEFECT IN VVER 1000



**VVER 2016 – Power Upgrades, LTO and New Builds,
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- 1. Introduction**
- 2. Aspects of The Zero Failure Level Project**
- 3. Conclusion**



INTRODUCTION

- Utility Dream:
 - Problems free operation
 - Cost effective operation
 - Failure Free Fuel operation
- Utility Fuel Requirements:
 - safety
 - cost effective,
 - operational flexibility,
 - fuel cycle flexibility,
 - failure free FA → reliable FA
- TVEL initiative:
 - 8/2014: 5 participants, 29 units VVER 1000
 - Uniqueness - 1 supplier with 2 FA designers + 2 FA manufacturers
 - 4 utilities operating in different environments ↑

ASPECTS OF ZERO FAILURE LEVEL PROJECT I.



- Standard Fuel
 - Design
 - Manufacturing
- Standard basic operational conditions
 - Supplier's conditions – utility requirements
 - Licensed conditions
 - Operating procedures
 - Operating conditions – OEF
 - Handling practices
 - Reload Core Design – practices, tools, CMS
 - Mixed core - number of LTA, LUA, LA
- Why „the same“ fuel behaves in „the same“ reactor type different ?
- Failure – any deviation from fuel design/assumptions

ASPECTS OF ZERO FAILURE LEVEL PROJECT II.



- Failure tree (D,M,O)
- Compare „comparable“:
 - Real design and manufacturing conditions – FA Sub types by:
 - design
 - manufacturing
 - Real operating conditions:
 - ~ 280 param. by: FA design, TS, Oper. Procedures, Oper. Practices
 - ~ 250 Reactor parameters
 - Groups of units by operational conditions
 - FME
 - What is the FM? (definition, shape, size)
 - Practices - VVER specifics - Space for improvement
 - Database – experience sharing
- True OEF - true reliability – true root causes

ASPECTS OF ZERO FAILURE LEVEL PROJECT III.



- No obvious violations in Design, Manufacturing, Operation
- Recommendations - 10
- Search for root causes
 - further activities in Design
 - further activities in Manufacturing
 - further activities in Operation
 - FME
 - Inspection – benefit for D, M, O
- EP-SPOT
 - Database
 - Tools, Models
 - System



EP-SPOT

CONCLUSION



- Operation safety increase
- Operation reliability increase
- Spent fuel amount decrease
- Rad waste decrease
- Maintenance staff exposure decrease
- Operation economy increase

Thank you for your attention