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# **GDA – Step 4**

## **The emerging picture of EPR**

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## The emerging picture of EPR :-

- Progress & Metrics
- Systems Assessment
- Engineering & Hazards
- MSQA, Radwaste & Decommissioning, Radiation Protection
- Cross Cutting Topics
- Security
- Environment Agency
- Forward Milestones
- Achievements

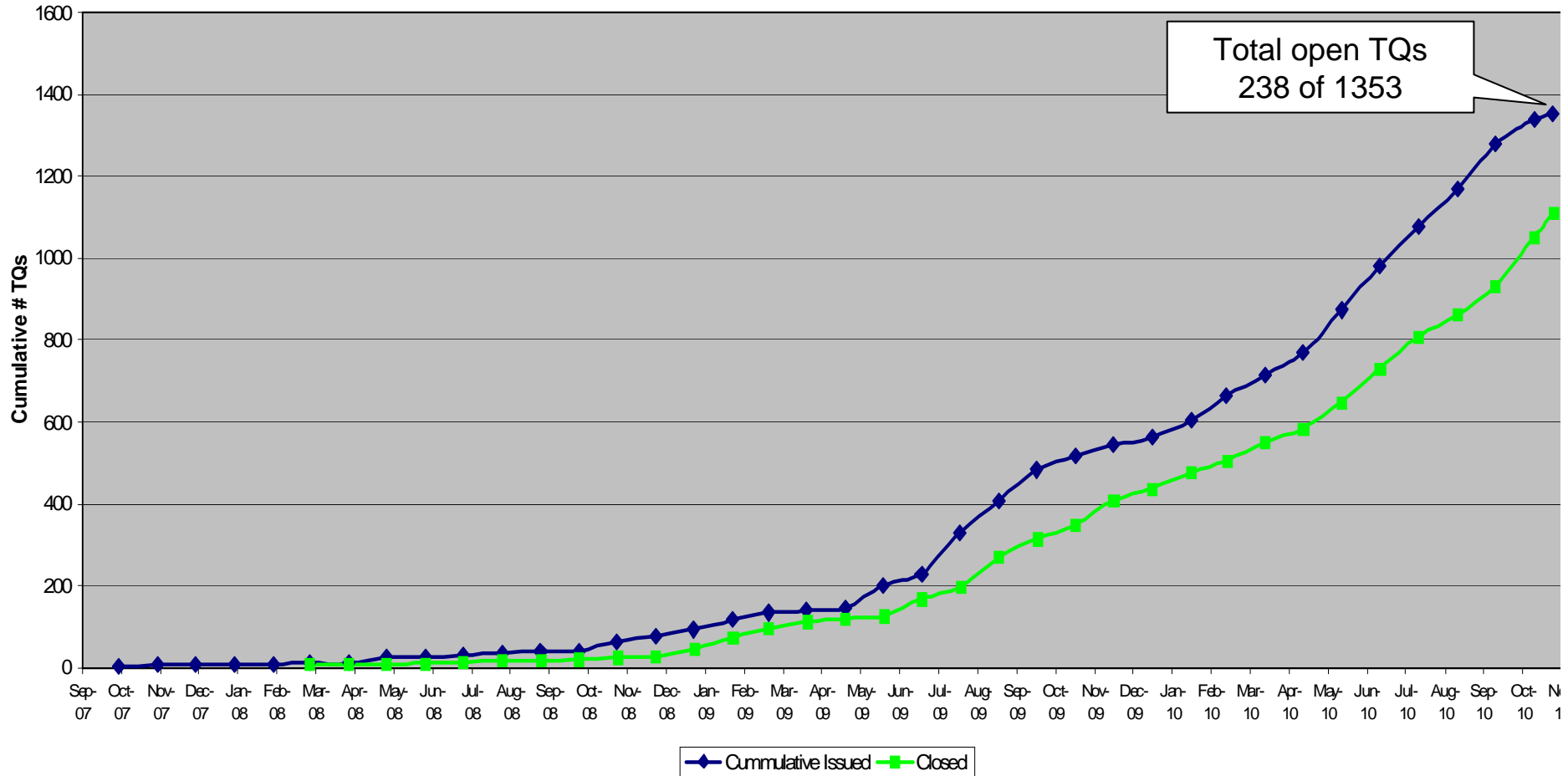
## GDA – Progress

- Shared baseline – interim milestones achieved to date
- EA consultation completed
- 256 meetings held EPR during Step 4
- ROA – 172 raised / 116 responded to fully / 68 closed
- TQ – 1353 raised / 1115 closed
- Health-check and Key Points updates completed
- Technical Convergence Meetings completed



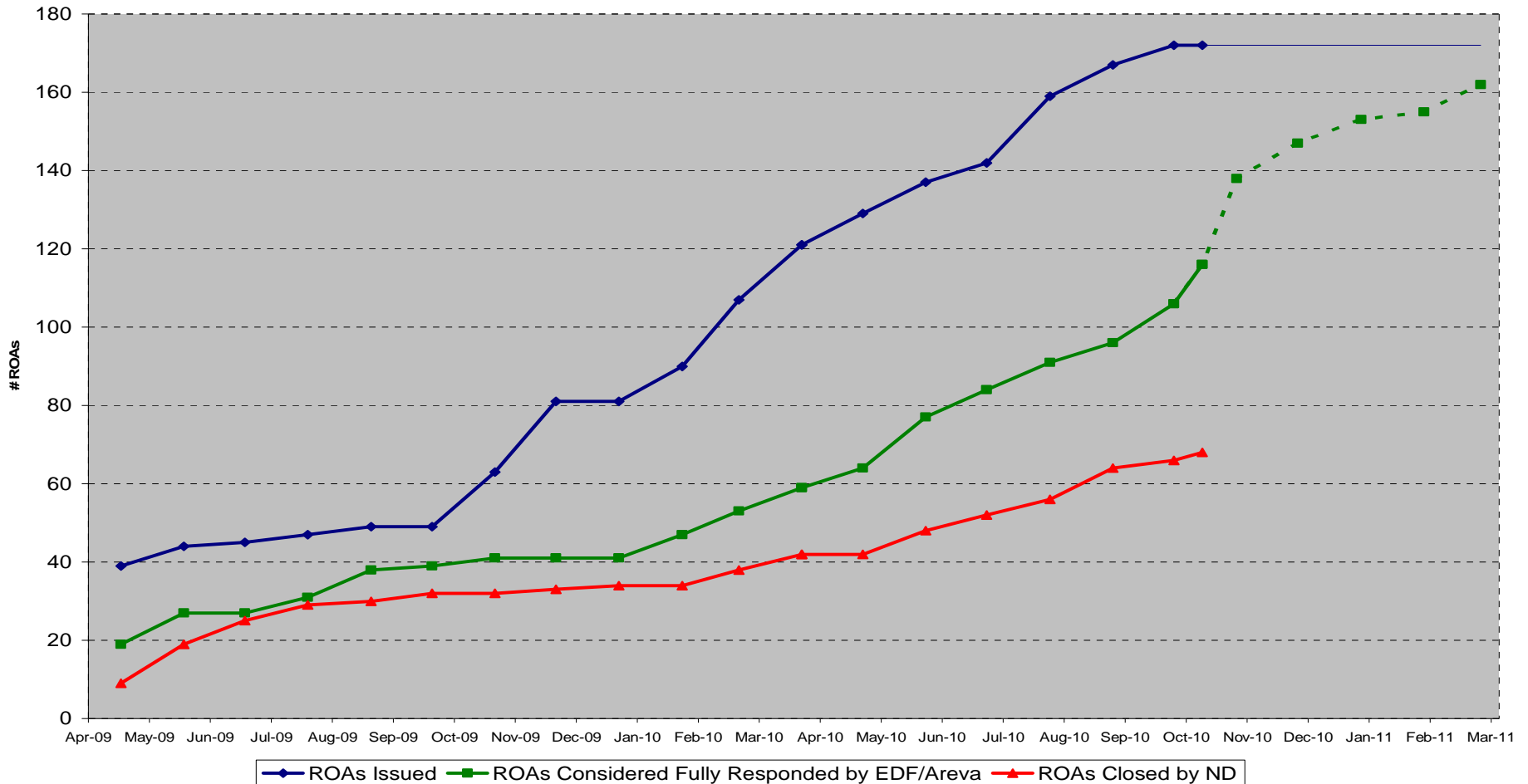
# GDA Project Status – Quality - ‘TQs’

TQ Profile mid-November 2010



# GDA Project Status – Quality - ‘ROAs’

ROAs Profile mid-November 2010



## Systems Assessment

- PSA
- Fault Studies
- Control & Instrumentation
- Fuel
- Electrical Systems
- Human Factors

## PSA

- The EPR PSA has been produced to a modern standard using the latest version of advanced software
- The level of detail and completeness is consistent with our expectations for a Generic PCSR

### Potential GDA Issues

- None anticipated

### Potential Assessment Findings

- Updating the PCSR PSA to one more focused on the Operational Safety Report

# Electrical Engineering

- Assessment process has gone well with the EPR electrical system introducing a major innovation over existing reactors with the addition of the Station Blackout Diesels

## Potential GDA Issues

- None anticipated

## Potential Assessment Findings

- Software verification for SMART devices using the methodology agreed within GDA
- Finalising the grid connection arrangements
- Undertaking detailed transient analysis to confirm the detailed design conforms with the PCSR

## Fuel and Core Design

- Fuel and Core - design an evolution of and modest extensions to 50 years of design experience
- Assessment progress has generally gone well with no major surprises and work generally of a high standard

### Potential GDA Issues

- None anticipated

### Potential Assessment Findings

- Development of a detailed surveillance programme to ensure the fuel conforms with the PCSR

## Fault Studies

- Interactions with EDF and AREVA have been good. Codes and methods applied generally in accordance with our expectations
- The Design Basis Accident (DBA) analysis differs in some respects from the UK approach

## Potential GDA Issues

- A number of deliverables are expected or are still under assessment and therefore there remains the potential for GDA Issues including :-
- Heterogeneous boron dilution
- Diverse protection against frequent faults
- Failure of support systems (C&I, cooling down) needs to be subject to DBA analysis

## Potential Assessment Findings

- Additional code validation required through international benchmark exercise

## Control and Instrumentation

- Subject of the only Regulatory Issue (RI) for the EPR.
- A number of design changes have been proposed by EDF and AREVA including:
  - the introduction of a Non-Computer-Based Safety System (NCSS),
  - the use of a simple Class 1 Safety Information and Control System (SICS),
  - the introduction of one way diodes to prohibit lower class systems having write access to Class 1 systems,
  - the introduction of a Class 1 Qualified Display System,
  - Enhancing the safety class of a number of key diverse trips.
  - Enhancing the safety class of the reactor control surveillance limitation system (RCSL).
- Regulatory Issue closed – residual actions captured in RO

# Control and Instrumentation

## Potential GDA Issues

- NCSS technology decision not yet made and detailed design not available within GDA – this will need to be assessed

## Potential Assessment Findings

- Assessment will largely focus on the evidence part of the claims arguments and evidence chain. A good example being the commitment to undertake statistical testing on one division of reactor protection equipment.

## Human Factors

- Our Human Factors assessment work started very late
- Difference in French and UK approach to Human Factors
- Analysis of HF in the Control Room has been based on the State Oriented Approach developed following the Three Mile Island event
- Limited HF analysis available and Assessment has focussed on understanding methodologies with a limited number of detailed examples offered during Step 4

## Potential GDA Issues

- There will be a GDA Issue focussing on providing a more detailed safety submission to substantiate the human based safety claims

## Potential Assessment Findings

- Verification and validation of human based safety claims

## Severe Accidents

- Our severe accidents assessment work started very late.
- It is an extremely complex area involving cutting edge computational software and the interpretation and scaling of equally complex experiments.
- EPR uses the 'core catcher' and mitigates the consequences of hydrogen release using Passive Autocatalytic Re-combiners (PAR)
- A pragmatic approach has been adopted due to the modest risk reduction claimed for the severe accident measures

## Potential GDA Issues

- None anticipated

## Potential Assessment Findings

- Assessment findings likely to focus on severe accident response measures

## Functional Categorisation and SSC Classification

- Difference in French and UK practice in the safety function categories and SSC classifications
- EDF and AREVA have made significant progress in moving towards UK practice and meeting HSE expectations

## Potential GDA Issues

- None anticipated

## Potential Assessment Findings

- Review updated System Design Manuals to confirm how UK approach to equipment classification and categorisation has been implemented

## Engineering Assessment

- Internal Hazards
- Civil Engineering
- External Hazards
- Mechanical Engineering
- Reactor Chemistry
- Structural Integrity

## Internal Hazards

- Assessment process has gone well
- EDF and AREVA have agreed to modify internal door control measures

## Potential GDA Issues

- Substantiation of dropped loads from lifting equipment.
- Outstanding Verification and Validation of the claims and arguments for some internal hazards as this may not be available within Step 4.

## Potential Assessment Finding

- Confirm the detailed design changes to the internal door control measures meets the safety requirements.

## Civil Engineering

- Large area of work due to differences between UK and French approach to construction e.g. grouted tendons. There has been a lot of progress in our understanding

### Potential GDA Issues

- The design code ETC-C needs more development to allow use by a wider range of contractors – due December 2010
- The layout, sensitivity and operation of containment instrumentation has yet to be agreed
- Several potential issues arise from the need for evidence that the design process is robust
  - Verification and validation of design software
  - Demonstration that the modelling of NI structures is sufficiently accurate
    - meshing and design reconciliation
  - Provide confidence of how the containment behaves under the design loads
  - Provide an over arching safety justification to draw together the interactions between different teams, methodologies and software

# Civil Engineering

## Potential Assessment Finding

- A number of elements of the civil design are Site or Operator dependent and so are outside the agreed scope for GDA and the assessment of these would be undertaken as a Site Specific activity e.g. detailed design of the common raft foundation, diesel building, cooling water pump house, Nuclear Auxiliary Building Chimney, pool liners.

## External Hazards

- Transfer of Sensitive Nuclear Information between the UK and France has been a challenge – process in place but slow
- A number of deliverables are still expected and these will need to be assessed.

## Potential GDA Issues

- None providing the final deliverables arrive in accordance with agreed schedule and are acceptable

## Potential Assessment Finding

- Demonstration that the Site Specific requirements are contained within the Generic Envelope.

## Mechanical Engineering

- Assessment process has generally gone well.
- EDF and AREVA have agreed to implement a number of changes to the equipment classification and categorisation methodology used for the EPR.

### Potential GDA Issues

- None anticipated

### Potential Assessment Finding

- Sampling of supplier dependent mechanical equipment to confirm it meets the expectations derived from principles which have been assessed in GDA.

## Reactor Chemistry

- Assessment started late and is back end loaded

### Potential GDA Issues

- Boron control via boron metering – the claimed very high reliability needs to be demonstrated
- The evidence about the production of CRUD and its movement through the reactor coolant system will arrive late in Step 4
- Submissions based operational experience - more calculational evidence is needed that the design is consistent with the PCSR
- More evidence that the combustible gas control through passive re-combiners will be effective

### Potential Assessment Finding

- Examine arrangements for hot functional testing to get confidence that this important pre-conditioning will achieve the necessary result

## Structural Integrity

- UK has a structured approach to defect tolerance and inspection of the highest integrity components which it has applied to all types of reactors over many years.

### Potential GDA Issues

- Demonstration of defect tolerance - differences between UK and French codes have delayed providing the necessary assurances. Further proposals for Fracture Mechanics Analysis are under review
- A high confidence is required that the inspections will reliably detect the defects of concern during manufacture and operations. Qualification of the manufacturing inspections has yet to be agreed.

### Potential Assessment Finding

- Sampling of the implementation of the qualification programmes for all the manufacturing, pre-service and in-service inspections of the highest integrity components.



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- MSQA
- Radwaste & Decommissioning
- Radiation Protection and Level 3 PSA

## MSQA

- QMS for GDA Project adequate
- Design freeze implemented early in GDA (end 2008)
- Design development, design change and configuration control OK
- Limited design changes proposed and incorporated within scope of GDA - need to confirm implementation status of impacted documents resulting from design changes

### Potential GDA Issues

- None anticipated

### Potential Assessment Findings

- Supply Chain quality associated with manufacturing eg Long leads
- QA arrangements for the detail design development from GDA to UK site specific projects

# Radwaste, Spent Fuel and Decommissioning

- Has looked at types of waste produced, it's minimisation, storage and management; and decommissioning
- Spent fuel is assumed to be a waste
- Some work still ongoing (eg spent fuel storage, decommissioning and decontamination) and further progress expected within Step 4

## Potential GDA Issues

- None anticipated

## Potential Assessment Findings

- Management of long term spent fuel storage
- Spent fuel stores
- Fuel limits = new uranium in new fuel, 65MWd/t, 5%enrichment etc

## Radiation Protection

- Has looked at source terms, radiation zoning, shielding, external and internal operator dose levels, health physics facilities etc
- Generally ok
- Some work still ongoing (eg shielding and decontamination) and further progress expected within Step 4

## Potential GDA Issues

- None anticipated

## Potential Assessment Findings

- Three-quarter loop ops (& SG inspection)
- Plant radiation monitoring system
- Individual worker dose assessments

## Cross-Cutting Topics

- Many are covered by assessor leads – severe accidents; source terms; safety classification
- Others are project lead – Design Reference, Design Change, Limits and Conditions

## Potential GDA Issues

- Provide an update of the GDA Submission (PCSR, Design Reference etc) for inclusion in the Final DAC:
  - Changes arising from Resolution Plans / other design changes

## Potential Assessment Findings

- Operational limits
- Maintenance plans
- Commissioning plans

## Environment Agency

- Consultation ended 18 October 2010
- Some joint assessment work ongoing related to:
  - MSQA
  - reactor chemistry
  - decommissioning
  - spent fuel disposability

### Potential GDA Issues

- Reactor chemistry (CRUD) (common with HSE)
- Provide an update of the GDA Submission (PCER, Design Reference, etc.) for inclusion in the Final SoDA (analogous to HSE GDA Issue)

### Potential Assessment Findings

- As set out in the Consultation Document

## Security

- Vital Area Identification
- Conceptual Security Arrangements

## Potential GDA Issues

- None anticipated

## Potential Assessment Findings

- OCNS looking for commitments made in CSA to be delivered by Licensees

## Forward Milestones

- Joint plan to finish agreed with RPs
- Technical Convergence Meetings complete
- Level 1 and 2 meetings arranged through remainder of Step 4
- EDF and AREVA deliver Consolidated PCSR Roadmap – 31 January '11
- EDF and AREVA deliver Consolidated PCSR & Design Reference – 31 March '11
- End of Step 4 and decision for DAC or Interim DAC - June '11

## Achievements

- EDF and AREVA have worked hard to meet the challenges
- Excellent relationships and communication
- Ability to have open, honest and robust discussions
- Agreed and kept to 'No surprises'
- Health-check and Key Points updates provided to facilitate programme
- Convergence meetings – process has worked – prioritised delivery of end stage deliverables
- No showstoppers – UK-EPR-RI-002 closed
- Looks like an Interim DAC/SoDA in June 2011
- Closure of Resolution Plans will signal the end of GDA process



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# EDF and AREVA Response



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# Questions ?