CONTROL AND INSTRUMENTATION NUCLEAR SAFETY RESEARCH

- BRITISH ENERGY PARTICIPATION
- CEMSIS - Cost-Effective Modernisation of Systems Important to Safety

by

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BE Participation in C&I Nuclear Research

- Current projects BE contribute to:
  - Software Diversity (City University and University)
  - Reliability Quantification by Testing (Bristol University)
  - Improvements in Legacy Code Analysis (Advantage Ltd.)
  - Software Test Coverage and Formal Proof (LDRA)
  - Assurance of Smart Sensor Software (Adelard)
  - Generic Documentation to Support SMART Sensors (Moore Industries)
  - Safety Implications From the Use of PC's In Low Safety Integrity Level Systems (Adelard)
  - Essential Capability
    - — Reactor Protection Equipment (Alstec Ltd.)
    - — Neutron Flux Instrumentation (Canberra Harwell)

CEMSIS Objectives

- Programmable Instrumentation and Control (I&C)
  - safety systems (e.g. protection)
  - safety-related systems (e.g. control, data presentation)
- Common approach to development and safety justification
  - maximise safety
  - minimise cost
- Modernisation/Refurbishment
  - analogue/discrete logic replacement with computer-based systems

‘Stakeholders’ in CEMSIS

- Nuclear Plant Operators

British Energy	British Energy (co-ord.)	UK	electricity generation
EDF	Electricite de France	F	electricity generation
BNFL	British Nuclear Fuels	UK	nuclear fuel processing

- Suppliers & System Integrators

A	Framatome ANP	DE	C&I supplier
CarlBro	CarlBro (Sycon International)	SE	system developer

- Safety Authorities & Assessors

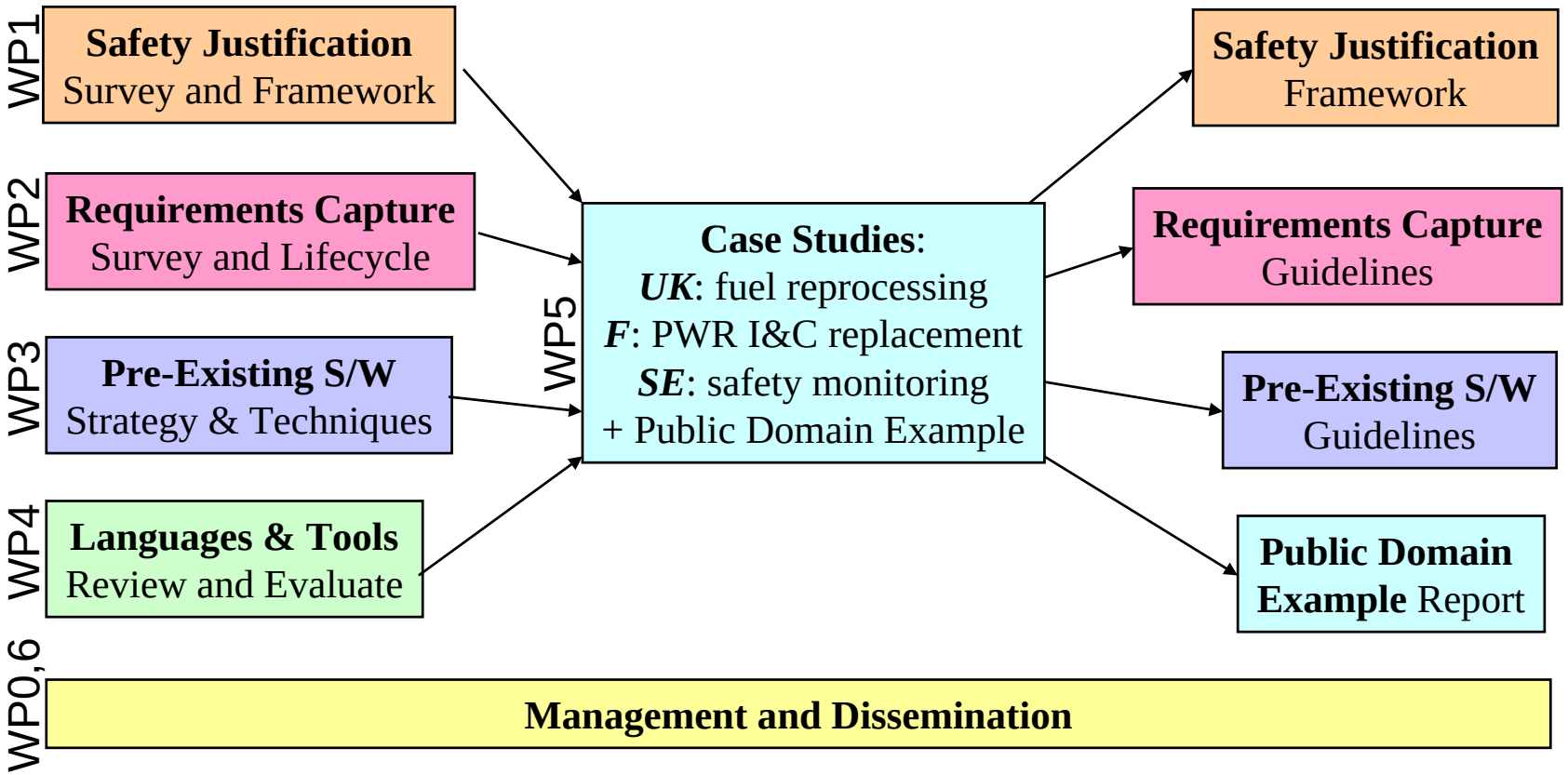
AVN	AV Nuclear	B	inspection & licensing
Adelard	Adelard	UK	safety consultancy
SKi	SKI	SE	inspection & licensing

- Academic: TU Lund — SE — research & education

Key Issues

- Harmonisation & Structuring of Safety Justification approaches
- Definition of Requirements for Systems Important to Safety
- Use of Pre-Existing Software in Systems Important to Safety
  - potentially including class A systems
- Use of Languages & Tools in Systems Important to Safety

Work Packages and Deliverables



CEMSIS

Application and Evaluation

- Case Studies:
  - UK Nuclear fuel reprocessing plant control — BNFL
  - I&C replacement on a French PWR — EDF
  - Safety monitoring system on a Swedish NPP — CarlBro
  - Public domain nuclear material transport example — Adelard
- Identify safety and cost-relevant aspects
  - safety requirements
  - implementation options
  - example arguments for safety justification
- Evaluate and refine guidance documents

Continuing Influence

- Public and Limited Circulation Deliverables
  - Use within members organisations and member states
  - Dissemination by web-site http://www.cemsis.org
- Participation in Post-FISA workshop no.4, November, 2003
- Members participation in international activities
  - International standards, e.g. IEC 60880 and 61508 revision
  - European Nuclear Regulators Working Group
  - Electric Power Research Institute (EPRI)
- Continuing research, possibly under Framework VI

CEMSIS- Review

- Strengths
  - closeness to real applications in case studies
  - utilities engaged with the work
  - seen as a very good project by the Commission - reputation gain

- And Difficulties
  - management and collaboration overhead

    ~ 25% of UK effort
  - issues of leadership and authority

Conclusion

- CEMSIS made real progress on key issues - but the issues remain
- Provided practical guidance illustrated with realistic examples
- Key audience:
  - Senior I&C engineers and managers of refurbishment projects
  - Development engineers and managers in the supply industry
  - SMEs and service companies in the refurbishment market
  - Regulators and policy makers
- Impact on strategy:
  - Accelerate inter working in member states
    - — between utilities, suppliers and regulators
  - Help to focus national R&D efforts
- The motivations, risks and benefits of collaboration are still relevant