OVERVIEW OF RESEARCH REACTOR DECOMMISSIONING

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INTRODUCTION

Decommissioning of a research reactor is a not glamorous however, it is technically challenging. It is a complex task with many stakeholders, which requires a deal of planning. After reactor shutdown "doing nothing" is just not an option.

1. Overview of decommissioning of Research Reactor

This paper covers:
- the world view
- major concerns raised by the IAEA
- touch on national strategies & policies
- some pending issues

Also covered is the Australian experience of **management & planning** with ANSTO as a work in progress for example.

2. From the First IAEA Report on Decommissioning in Vienna 1975

"There are no insurmountable technical problems for decommissioning"

This was a bold statement for its time. When you consider the journey since 1975 the Industry has substantially moved on. We have evolved into a much safer and more environmentally aware industry with strong regulations.

There have been many improvements in technology.

The community have expectations that the industry will be more open and share a greater sharing of information & experiences

3. Statistics of Research Reactors

From the statistics

- Of the listed 832 research reactors
- There are 114 reactors shutdown
- There are 410 that are classified as decommissioned
- With 115 which are either unknown or undecided.

- At least 207 are unrestricted.
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4. Future of Research Reactors

In the future research reactors will need to be more economically competitive and safe. Research reactors will need to be well managed, planned, researched, financed and marketed. There are a high number of old Research Reactors still operating around 200. Many are well past their time, both environmentally and financially.

5. Global Picture

The global demands for research reactors are shrinking. More reactors will be retired over the next 10 years. Demands for experience in decommissioning will grow.
With around **50%** of the world's research reactors in varies stages on shutdown to unrestricted.

- **"DOING NOTHING" is not acceptable.**

There are three acceptable strategies
- Immediate dismantling
- safe enclosure
- Entombment

The last two are not final they will be a legacy for future generations.

6. Major Concerns

IAEA have some major concerns with the lack of attention to decommissioning by operating organisations, regulatory bodies and decision makers.
- there is a lack of appropriate funding for infrastructure,
- there is a lack of adequate management, understaffing and a poor exchange of information.
- there is a need to focus on the planning of decommissioning activities
- In addition, that the final shutdown operation should be performed in a timely manner.

There is also the issue of harmonised clearance criteria and safety issues during transition.

7. Radiological v's Safety Risk

In transitioning phase the **radiological risk** is substantially lower however the **industrial safety risk increases**.
This is a human factor issue.
There is a tendency to complacent when the radiological safety is reduced.

8. Reasons for Decommissioning

There are various reasons for decommissioning:
- At Oak Ridge, the ORR reactor was shutdown as it had become obsolete.
- The other Oak Ridge reactor HFIR has just undergone a refurbishment program costing some US$70M and the life has been extended to around 2020.
- In Germany FGR-1 will continue with its research work until to 2010.
- FGR-2 is now shutdown
- In Jason in the centre of London, there is a greater need for the land
- In Russia, there were nine research reactors in Moscow and public pressure shut them down.

- In Australia MOATA was shutdown in 1995 it is in the “safe enclosure” phase at present, from early next year we will commence decommissioning.
- HIFAR was shutdown on 30th January 2007 and this reactor will transition to safe enclosure

9. National Policy, Strategy Factors & Challenges

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A few issues require some special attention during decommissioning:

Regulator are concerned with nuclear & radiation safety, clearances & release criteria

Challenge for regulators is to keep pace with the ever changing situation i.e. UK start a new public body, Denmark – changed from an operating structure to decommissioning almost overnight.

With Resourcing -

Challenge is that power reactors just make provisions for Decommissioning in their tariff structure. Another resource issues are the technical expert with know-how follow the money and move with the technology.

Re-utilisation or better use of land & facilities

Challenge may be other options such as construction of dry storage of nuclear material within the facilities, nuclear museum like in Karlsruhe, other uses of hot cells

Waste Management for conditioning and storaging waste

Challenge is how to deal with the special considerations for beryllium, tritiated water & graphite Legacy issues

There is enhanced scrutiny by Regulators, Governments, Public

Challenge is the social impact (loss of jobs & impact local economy), consultation & public relations

Safeguards of nuclear materials

Challenge: risk of possible misuse of fissile material and radionuclides used in weapons

Stakeholder acceptance of reactors Experts

Challenge is the ageing experts with specialised skills reducing,
IAEA have initiated a number of programmes

10. Management & Planning Factors

Management & Planning of decommissioning is the responsibility of the operating organisation and these factors should be addressed early that is before shutdown.

- Selection of the Decommissioning strategy
- The strategy must be the best value for money, environmentally safe and be socially acceptable
- Sustainability will meet present needs and will not compromise future generations
- Release/clearance criteria – in accordance with IAEA guidelines,
- Final surveys are required for release of the facilities for public confidence

- Fuel management – this is a very important step - early defuelling removes the risk of criticality accidents
- Planning for decommissioning should start in the design stage of any new reactor, if not start asap with a structured approach

11. Waste Management Techniques

Waste Management is a specialised area and it is important to have well proven strategies and techniques. Waste minimisation programmes will significantly reduce the volumes of radioactive waste.

11.1 Decommissioning techniques

There are many techniques conventional, robust and commercially available.
Consider the existing operating and "off the shell" type equipment.

11.2 Decommissioning waste management

Recycling and reuse verses disposal need to be considered.
In France, very low activated metallic parts are melted down and used as the containers for more active waste.

12. Information Exchange

There is a substantial quantity of information on decommissioning and it is ready available. There a number of National & International working groups. Practical assistance is available and training from others is available who are decommissioning personnel. ANSTO has sent staff to France and US for training.
Use the conferences and seminars this is useful for networking with other countries.
The IAEA has access to information and also their technical reports are very good.

13. Costs & Funding

Costs and funding are well covered by the IAEA documentation.
Working closer other operators and sharing of resources would be of benefit to all involved.

13. Management & Planning - Australia

The decommissioning strategy is that of "safe enclosure" due to the lack of a waste repository.
Release/clearance criteria – Human, technical & financial resources.
Compliance with IAEA guidelines RSG 1.4, * ARPANSA Act Schedule 2 criteria and the local State Government requirements is necessary.
During Transition it is proposed to remove all associated buildings & structures where there is no contamination. This will reduce financial burden of continuous surveys and shrink the reactor footprint until we commence final decommissioning in 2017.
All HIFAR spent fuel will be removed from site by 2009
The decommissioning planning process commenced over 18 months ago, this was 12 months prior to shutdown.
Regulatory Interfaces/Licensing – As the deferred option has been selected our regulator should issue a "Procession or Control licence" shortly for the care maintenance period prior to a final decommissioning licence.

Management of Plant Status & change – Smooth transition from operation to decommissioning.
During this period we will continue to support HIFAR decommissioning with technical management and funding.
At this time we are focusing on the issue of transitioning so we will identify the most suitable techniques for our project
A staff structure to support the decommissioning programme has been developed from the operating and engineering staff.
Radiological characterisation – This operation will deferred until closer to decommissioning.

14. Conclusions & Recommendations

My recommendations are as follows
General Management Issues
- Establish a decommissioning project early * Ensure adequate retraining in new skills and attitudes
- Ensure corporate memory collected *Keep regulatory bodies informed

Planning Issues
- Establish a comprehensive decommissioning plan *Ensure smooth and timely transition from operation to decommissioning *Plan remove of fuel ASAP after shutdown so criticality is not an issue *Perform all physical activities early

Waste & Fuel Issues
- Remove of fuel ASAP after shutdown it will reduce radiological hazards *Actual decommissioning strategy will be heavily influenced by waste classification, storage, transport and compliance with regulations

Technology Issues
- Use all available technologies *Try to keep all options open for decontamination & dismantling activities (don't re-invent the wheel) *In tool select always consider secondary waste, ease of maintenance, reliability and ease of decontamination

Information Exchange
- Use experience of others *Note lesson learnt for others

Costs & Funding Issues
- Robust cost estimations *Perform early decommissioning cost studies and use comparisons with similar types.
- Pay attention to accuracy of the cost estimates by benchmarking

APPENDIX I

REFERENCES

[1] INTERNATION ATOMIC ENERGY ACENCY, Technical Reports Series no. 446 Decommissioning of Research Reactors: Evolution, State of the Arts, Open Issues Vienna (2006)