Chapter 4 Fission and fusion

Module 4.3 Nuclear fusion

Evaluation and Analysis 4.3.1 Research topics

Australia's future nuclear waste

Like many countries, Australia must plan for the disposal of nuclear waste products in the future. Currently, spent nuclear fuel from Lucas Heights in Sydney is sent to France for reprocessing.

- Should we build our own nuclear waste facility?
- Find out the current Federal Government plans for the construction of new storage or even reprocessing facilities in Australia. For example, Muckaty Station in the Northern Territory has been a proposed location for the storage of waste. What else has been proposed?
- What implications would there be for Australians if we built a reprocessing facility?
- Where should it be built?
- Will transporting the products be a concern?
- How fail-proof will the transport flasks and vehicles need to be?
- What about security and supervision of the substances during the journey?
- Will/should our governments allow other countries to dispose of their waste here?

What is ANSTO?

The Australian Nuclear Science and Technology Organisation (ANSTO) is Australia's national nuclear research and development organisation and the centre of Australian nuclear expertise.

- What are the main tasks and services carried out by this organisation?
- What facilities do they run?
- Explain the main functions of each of their facilities.
- Are they a profit-making organisation?
- Describe some of the nuclear physics related occupations that exist at ANSTO.
- Report on some recent significant research (of your choice) that has been carried out by ANSTO.

Depleted uranium in artillery

The use of depleted uranium in artillery and its recent use in Iraq have come under question. Depleted uranium is used to make the tips of armour-piercing shells because it is extremely dense and has the ability to 'self-sharpen' as material, which has been spread out by the impact, ignites and burns off as the munitions pierce their target.

- The use of 'DU' has been given considerable media coverage. Find out about the arguments for and against the use of this material.
- Which groups of people are involving themselves in this debate?
- Using your knowledge of nuclear physics, collect and summarise enough information so that you can form your own opinion about this controversial issue.

Russian atomic bombs

The Western nuclear physicists of the middle of the last century are well known to us. But have you heard of Citizen Kurchatov, the physicist who became the driving force behind the Soviet Union's race to develop the atomic bomb? Igor Kurchatov, born in 1903, has been called 'Stalin's bomb-maker'. He believed the Russian revolution would lead to the bright future of scientific socialism.

- Find out about the life and work of this incredible man during the critical years of the growth of both nuclear physics and international tension.

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Can the nuclear industry be closed down?

Since the nuclear disaster in Fukushima Japan in 2011, many environmental groups believe that safe nuclear reactors are a myth. They aim for global nuclear disarmament and closure of the nuclear industry, replacing it with non-radioactive alternatives. How possible is this? How likely?

- Find out about the aspects of the nuclear industry that *could* be replaced today. For example, we do have the technology to produce electricity by other means.
- What technology exists to replace other nuclear-based applications?
- If cost was not a concern, could all countries (currently using nuclear power stations) produce their electricity another way?
- For which nuclear industrial and medical applications do alternatives exist? What are they?

Fusion for energy and industry

- How is the development of power from fusion going?
- How much fusion research is going on? Where?
- Is fusion currently being used to power anything?
- How long do scientists think it will be before fusion is available as a source of our energy?
- Can fusion offer the world a secure energy supply?
- Why are scientists so optimistic about the favourable aspects of using fusion as a source of energy?
- What is a tokamak?
- Find out about ITER. What does ITER stand for?
- Fusion research is bringing tangible benefits to many companies. How are the technologies of fusion research making a difference to some industries?

Los Alamos

- The nuclear facility at Los Alamos was set up in 1942. It was central to the birth of the nuclear physics industry. The work carried out at Los Alamos literally shaped our world.
- Find out about the pioneer work done at Los Alamos nearly 70 years ago.
- Who were the key scientists working in the new world of nuclear physics in the middle of last century?
- How much did Oppenheimer, Fermi, Compton and the team really know of the reality of the effects of their bombs?
- Many of the documents relating to the work on the first A-bombs are now available to the public. Did the Trinity tests give them a full understanding of all of the 'radioactive fallout'?

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