

Lesson Four: Uranium Mining in Northern Australia

Subjects: Geography, Geology

OVERVIEW

Students take on the roles of different stakeholders in a community affected by Ranger Uranium Mine, Northern Australia. In this case study, they work with data to put forward their position as to what should happen to the future of their town, Jabiru.

MATERIALS

Stakeholder briefings / PowerPoint

ROOM LAYOUT

For group work.

LEARNING OBJECTIVES

- All students will be able to **identify** key stakeholders in uranium mining.
- Most students will be able to **explain** the tensions between different groups at Ranger Uranium Mine, Australia.
- Some students will be able to **evaluate** differences in power between groups in their case study, as well as the globalisation of uranium as a resource.

Note: this lesson focusses on uranium extraction, rather than the use of uranium in nuclear power. Therefore, the learning objectives do not include the chemistry/physics of nuclear fuel production in any depth.

STARTER: **The lay of the land** (5 minutes)

Note: Our PowerPoint presentation (available online) will help you lead the discussion outlined below, see: www.bit.ly/CNDCriticalMass

Ask students as a class to state what they know about nuclear weapons. What is a nuclear bomb? Have nuclear weapons ever been used? Collect answers, and fill any gaps in knowledge. Then ask, where does the nuclear material come from?

PRESENTATION (20 mins):

a) Uranium

- Outline how we get uranium (and plutonium), and where from. Briefly look at how uranium is extracted, processed, and enriched. Emphasise that the same process of enrichment produces fuel for nuclear weapons as well as nuclear power reactors. Provide an overview of risks when working with uranium, from extraction to decommissioning.

b) Ranger Uranium Mine

- Outline a brief history of uranium mining, noting that although beginning with scientific research, demand for uranium skyrocketed during WWII, as technology for a nuclear bomb was worked on. From 1954, the British mined for uranium in Australia, which has one third of the world's known uranium resources!
- Introduce the case study – Ranger Uranium Mine, Northern Territory, Australia. Pay particular attention to its geography: its location in a National Park, on Aboriginal land, and with its own township, Jabiru.

MAIN ACTIVITY: **Ranger! Ranger!** (20 minutes)

An emergency town meeting is held in the town of Jabiru. Where the following stakeholder groups are represented:

- Anti-nuclear weapons campaigners
- Representatives from Energy Resources of Australia
- Locals: residents of Jabiru
- The government of the Northern Territory
- Traditional owners

The stakeholders are faced with the following news:

- Ranger's lease is coming to a close, and if the lease is not extended then everything involved with the mining operations will need to be turned back to how it was before the mine operated including the town of Jabiru. Traditional owners have the power to accept or reject deals brought to them regarding their land, but also have their own views to consider.
- What will happen to the town of Jabiru? Will the town choose to extend the mining lease? Are there other, more sustainable options? What are the social, economic and environmental impacts of the mine?
- In groups of 5 or 6, students take on the role of one stakeholder group. They are given a 'stakeholder briefing' sheet (p.41-45). Students must produce a statement that presents the opinions of the stakeholder group, but also uses facts and figures to make their case. They must identify what they want to happen and what they would not agree to (10 minutes to prepare). Each group is also given a 'Framing the Information' worksheet (p.46)
- The town meeting begins, and the teacher acts as Mayor/facilitator. The 'traditional owners' group, who must agree to any proposal concerning their land, will give their position first. Other groups may then state their position, and make a proposal for the future of Jabiru (up to two minutes per presentation).

The teacher/facilitator must listen carefully and write different proposals, or concerns on the board. These will be returned to later.

- Encourage students to ‘build on’ the points made by previous speakers, and ensure there are opportunities for students to ask questions of other groups’ suggestions.
- At the end of the town meeting, the ‘traditional owners’ group rank the stakeholders’ suggestions from most acceptable to least acceptable. Teacher notes these preferences on the board, next to each suggestion. A class vote is taken to see which group’s suggestion wins (this can be a multi-vote, where students can vote for as many options as they like).

PLENARY (5 mins)

- Compare the events of the town meeting with the actual plan for Ranger Uranium Mine, which is to regenerate the area and maintain the town of Jabiru as a tourism hub.

Spectrum activity, based on the following questions:

- ‘If you were a [traditional owner/resident of Sydney/Northern Territory labourer...] would you support the mine?’
- ‘Is uranium an essential resource for today?’
- Are nuclear weapons fair?’ or ‘Which is more (un)fair: the use or the creation of nuclear weapons?’

DIFFERENTIATION

- A higher attaining student or group of students can act as a mediator in the main activity, and it is their job to produce a draft deal which considers most points of view. This draft deal is then presented to the class to vote on.
- The demands of this lesson can be planned for in advance. Consider asking students to research a particular stakeholder position, or Ranger Uranium Mine more generally, before the lesson.

EXTENSION (Homework or subsequent lesson ideas)

- Students re-cap what they heard in the town meeting, and identify the social, political, economic, and environmental concerns surrounding uranium mining. Who are the winners and losers generally, and is the situation changing?
- Students to write a comparison between two stakeholder groups – can they suggest agreements, or possible solutions to any tensions (short essay format).
- Students to design a poster campaign for a stakeholder group

Given that nuclear power is banned in Australia, students research where Ranger’s ‘yellowcake uranium’ has been exported to and used. Examples include the Fukushima Daiichi Nuclear Power Plant in Japan, but could it have also gone into weapons production?

Our teaching pack, The Bomb Factor, features a lesson on the Chernobyl disaster, including an A3 map and worksheet. Available via our website.

ENRICHMENT

Visit nuclear power/fuel station in the UK e.g. Springfields Nuclear Fuel Manufacturing Facility, Preston:
<http://www.westinghousenuclear.com/springfields/about>

Contact organisations working in nuclear issues, to find out more. You could contact:

- The Campaign for Nuclear Disarmament (CND): <https://cnduk.org/campaigns/no-nuclear-power/>
- Kick Nuclear, UK: <https://kicknuclear.com/>
- The Nuclear Education Trust: <http://www.nucleareducationtrust.org/>
- World Nuclear Association: <http://www.world-nuclear.org/>
- Nuclear Institute (UK): <https://www.nuclearinst.com/>

All resources available for download from: www.bit.ly/CNDCriticalMass

Stakeholder Briefing:

1. Australian anti-nuclear weapons campaigners

It's true that Australia has an abundance of natural minerals such as uranium, but we believe that mining these radioactive rocks pollutes the environment and carries many other costs.

Nuclear disasters, such as Chernobyl and Fukushima Daiichi, show that serious accidents can still occur at modern power plants, and there is no long-term solution for what to do with radioactive waste.

With its history of spills, accidents and waste, nuclear energy should never be called 'clean'. By contrast, renewable technology like solar and wind is a less expensive and less dangerous alternative that still reduces greenhouse gas emissions.

Nuclear materials are associated with many health risks, as exposure to radioactive materials can lead to health problems like cancers developing. Did you know that women are twice as vulnerable as men to the impacts of radiation, and children more so?

Most serious hazards associated with nuclear power have not changed since the Cold War. We can't guarantee that nuclear material won't be used to make nuclear weapons, as civilian power reactors can be also used for weapons-grade plutonium production. Only stopping uranium mining once and for all can guarantee a future free from nuclear weapons.

We want: _____
_____.

Our worst case scenario is _____
_____.

Information

Fukushima

After an earthquake in March 2011, a 15-metre tsunami cut off the power supply and cooling of reactors at Fukushima Daiichi nuclear power station in the region of Tōhoku, Japan, causing the reactors to melt and triggering a nuclear accident.

Australia

In 2016 Northern Territory decided not to lay charges against Energy Resources of Australia for an accident in 2013 at the Ranger Uranium Mine, which spilled 1,400 cubic meters of radioactive slurry. This was because it was unsure whether it could successfully prosecute the company. Nuclear power generation is banned in Australia, so uranium is an export only.

Stakeholder Briefing:

2. Energy Resources of Australia

We are Energy Resources of Australia (ERA). We are one of Australia's largest uranium producers and we have been operating on the site of Kakadu National Park since 1979. We belong to the global corporation Rio Tinto. Australia's known uranium resources are the world's largest and amount to a third of the world total.

We believe that uranium is a clean, cost-effective and profitable source of electricity. Across the world, major cities such as Seoul, Moscow, Paris, Los Angeles, and Toronto run on nuclear generated electricity.

Ranger Uranium Mine in the Northern Territory aims to deliver clean energy to the world. We take care of the country and the people we provide for. Our objective is to safely produce uranium oxide and protect the environment, contributing to the global energy market and the local economy in return.

Our operations in the Ranger Project Area benefit the local economy and indigenous populations through salaries and local spending. We provide workplace numeracy and literacy training, and offer work experience and apprenticeships for local students.

We work with the local stakeholders and rehabilitate the parts of the mine that are no longer in use. We take sole responsibility for the management of the region's transition to post mining, though we would prefer to extend our mining lease.

We want: _____

Our worst case scenario is _____

Information

- Ranger mine will stop all operations in 2021 and close down completely in 2026.
- It will cost an estimated \$507 million to clean up the site, which must be reintegrated into the surrounding World Heritage-listed Kakadu national park by 2026.
- As of 2017, ERA's employment in the Jabiru region features 13% indigenous peoples, 18% women and 46% Jabiru locals
- \$473 million has been invested in rehabilitation projects since 2012 (as of 2018).
- A nearby mine, Jabiluka, is now completely closed. Revegetation is ongoing with over 16,000 saplings over a 10 year period.
- Nuclear energy supplied 3.2% of India's electricity in 2017, 4.2% of China's electricity in 2018. These countries' economies are growing rapidly.

Stakeholder Briefing:

3. Locals

We are the residents of the town of Jabiru, which was created in 1982 when Ranger Uranium Mine began operating. The town of Jabiru has grown since then, and now has a population of over 1,000. Its economy is not reliant only on Ranger Uranium Mine because it also serves as a hub for tourists visiting Kakadu National Park.

We have serious environmental and cultural concerns regarding the decision to stop mining, and call on Northern Territory government to protect the future of our town.

The Uranium mine operates in an important, wetland-style environment in the middle of Australia's largest national park, with many indigenous communities living downstream from the mine. Many of Jabiru's residents are Aboriginal.

In 2013, a large spill occurred at the mine, resulting in one million litres of radioactive acid and slurry being released into the park. This was the latest of over 200 incidents since the Ranger mine started operating. The 2013 spill demonstrates the dangers of the mine to local people and the local environment too.

Planning the closure of the mine must not ignore the local population! Business owners and their families will have to leave to find jobs if the town is not supported, but Jabiru's large indigenous population will find it even harder to settle elsewhere. We are worried about the environmental risks associated with the mine, and the impact on our way of life after it closes. A plan for the future needs to manage both of these concerns.

We want: _____

Our worst case scenario is _____

Information

- The population of Jabiru is around 1,100 (as of 2016). A quarter of the population is indigenous, and 350 people are ERA employees.
- Jabiru is the only town in Kakadu National Park, located almost 160 miles from Darwin.
- There are around 200,000 tourists to Kakadu National Park each year.

Stakeholder Briefing:

4. Northern Territory Government

We are the government of the Northern Territory and we believe that the town of Jabiru has a nuclear-free future. It shouldn't be closed because of the scheduled closing of Ranger Uranium Mining in Kakadu National Park.

Ever since Jabiru was purpose-built for the mine over thirty years ago, the town has also served a secondary role as a tourism service center for the visitors to Kakadu. It is a vital hub for the work of Aboriginal organisations and community groups in an otherwise isolated area.

Tourism is an important economic activity for the Northern Territory, with iconic destinations such as Uluru, Darwin and Kakadu – all popular choices for domestic and international visitors.

It is right that Energy Resources of Australia (ERA) restore the land they have been mining, but we are concerned about the town closing, losing electricity, and being without an airport. This is a possibility because ERA is obliged to return the town to a 'pre-mine' state.

Investing in Jabiru would mean that the mine closure will not have such a significant impact on the local economy. The Northern Territory can help keep services going, attract tourists to the area, and create sustainable jobs in hospitality and retail if it invests a lot of money. We're willing!

We want: _____
_____.

Our worst case scenario is _____
_____.

Information:

- In 2018, the Kakadu National Park received a total of about 200,577 visitors, an increase of 12,641 on the previous year's total. Meanwhile over \$250 million was spent in the Kakadu region in 2019.
- It is estimated that saving the town of Jabiru will cost \$500 million, including projects such as a \$16 million education precinct, and \$40 million to maintain Jabiru airport.
- The area of Kakadu National Park has recorded 171 places of indigenous cultural heritage significance and more than 160 archaeological sites and artefacts, including one that proved Aboriginal people have been here for up to 80,000 years! The park is dual World Heritage listed.

Stakeholder Briefing:

5. Traditional owners

We, the Mirarr people, state that Uranium mining in Kakadu is and has always been developed against our wishes. We want our land to be protected forever, and to have a say over what happens to it.

The environment we inhabit is very vulnerable and easily affected by the spillage incidents that occur at the Ranger mine. The site is part of our ancient traditions and we believe that it should not be disturbed by human action.

We understand that uranium mining is a contentious issue in Australia as it brings wealth and work to people, but the mining has completely upturned our lives, bringing many changes to our culture, such as substance abuse and arguments about money into our community.

We have been told that the spillages that occurred over the years have been controlled and did not contaminate our waters, but nevertheless our land is being transformed before our eyes with toxic chemicals in natural creeks and hills. UNESCO has identified mining as a key management issue in the national park, but we have previously not been listened to in land use meetings.

We are also saddened to see other communities suffering from the uranium mined on our land, such as those affected by the 2011 Fukushima nuclear disaster. Our relationship with our land leads us to feel a sense of responsibility. In future, we need to have control over what happens with our land, as we have the longest and deepest understanding of it. We don't want a big company making decisions on our behalf.

We want: _____

Our worst case scenario is _____

Information

Kakadu National Park was granted UNESCO World Heritage Site status in 1981 (the site excludes the Ranger lease). Kakadu 'is a place of living culture used by Mirarr and other Bininj (Aboriginal people) every day. This living culture stretches back thousands of years as can be seen in numerous prehistoric rock art paintings, as well as dreaming tracks and sites of cultural significance. Age-old stories have been handed down from tens of thousands of years ago to the present day.

Aboriginal people have lived continuously in the area now known as Kakadu for over 60,000 years and the region contains one of Australia's oldest sites of human occupation.

By comparison, British occupation is recent, dating back to the 1890s.

(Source: www.mirarr.net/pages/kakadu)

Over 70% of the world's uranium reserves are located on Indigenous land and in Australia. Indigenous people feel a disproportionate impact of the environmental, health, social and cultural impacts of uranium mining.

Over 200 spills, leaks and breaches of licence conditions have occurred in the four decades of Ranger Uranium Mine's existence, including:

- December 2013: The tank containing radioactive material collapsed and up to one million litres of radioactive slurry and acid spilled out of the site. The mine was shut down for 6 weeks.
- April 2010: Millions of litres of contaminated water leaked from the Ranger uranium mine to the wetlands in Kakadu National Park.
- March 2004: The mine was shut down due to safety concerns. Drinking water had been contaminated by 'process water' used in the mine's operations.
- February 2002: Leakage of uranium contaminated water to Coonjimba and Magela Creeks caused by incorrect stockpiling. It was the fourth such incident since 1999.

Framing the information worksheet

What is your most persuasive piece of information? _____

What does it emphasise? _____

How can it help your argument? _____

Supporting information

What is uranium?

Uranium is a heavy metal, which occurs naturally in the Earth's crust in quantities as common as tin. It was 'discovered' by German chemist Martin Klaproth in 1789 and named after the planet Uranus. A small proportion (about 0.7%) of uranium isotopes are 'heavy', meaning that an atom contains fewer neutrons. These heavy isotopes can easily become unstable or 'fissile', which can lead to an atom splitting and creating a lot of energy.

How is uranium made into nuclear weapons fuel?

The process of getting uranium out of rocks in the ground and into nuclear weapons can be lengthy and expensive:

- Uranium ore is extracted from the ground, typically by open-cast mining.
- Acid is used to remove uranium from the ore by dissolving it.
- This process of 'leaching' produces yellowcake uranium (uranium oxide concentrate) which can be transported and sold.
- Yellowcake uranium is converted into a gas (uranium hexafluoride).
- The gas is spun in industrial centrifuges, which separate out the heavy isotope, U-235. This process is repeated again and again until enough heavy uranium has been separated. 'Highly enriched uranium' is produced, which can be as concentrated as >90% U-235.
- The enriched uranium gas is turned into uranium dioxide, and pressed into pellet form. The pellets are put into metal rods, which are inserted into reactors.
- The fission of the uranium atoms causes an extremely powerful chain reaction.

For more information on uranium processing visit: <https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/introduction/what-is-uranium-how-does-it-work.aspx>

Uranium and colonialism

Historically, it has often been the case that imperial powers have benefitted from uranium extraction, whilst indigenous peoples under occupation have shouldered much of the associated negative impacts.

- Much of the uranium used in the Hiroshima and Nagasaki bombs was extracted through forced labour of the Congolese people under Belgian colonial rule. Shinkolobwe mine was worked from 1921, and ultimately closed in 2004 (though the USA stopped sourcing uranium from the mine in 1960) yet the local community still suffers the impacts of exposure through birth defects, deformities, and severe illness for example.
- Between 1944 and 1986, 30 million tonnes of uranium was mined on the land of the Navajo nation, in the West of the USA. Navajo men dug uranium for less than the minimum wage, bringing radioactive debris home to their families with them. Private industry became involved in mining initiatives, which complicated indigenous land rights. Other indigenous nations experienced similar hardships. Workers were not warned of the dangers of working with radioactive material, nor did the US government provide protective gear. Navajo cancer rates doubled between the 1970s and 1990s, and 27% of Navajo people had levels of radioactive uranium in their bodies five times higher than the US average. Today, the land of the Navajo nation is still being cleaned up.

For more information on the harm done to indigenous communities by uranium extraction and use, see:

<https://outrider.org/nuclear-weapons/articles/human-cost/>

Australia and uranium

Australia's known uranium resources are the largest in the world. Almost a third of all the uranium in the world can be found in Australia. Uranium was first mined in Australia as early as 1906, at the so-called 'Radium Hill' and today it is the world's third-ranking producer, behind Canada and Kazakhstan, of yellowcake uranium which it exports. Radium Hill has been credited with providing the uranium for early US and UK nuclear weapons programmes, including for Australian nuclear tests in the 1950s and 60s.

For more information visit: <https://www.world-nuclear.org/information-library/country-profiles/countries-a-f/australia.aspx>

Indigenous Australians/Aboriginal People

Prior to the British settling in Australia (in 1788), over 500 different indigenous groups (some 750,000 people) lived on the continent. Aboriginal cultures date back over 60,000 years making them the world's oldest. Through the introduction of new diseases, the stealing of land from communities and direct, violent conflict, 90% of Australia's indigenous population were killed as a result of British colonisation. Later, Aboriginal populations were heavily controlled by both the state and Christian religious initiatives, which together removed Aboriginal people from their own cultures, languages and even families.

Aboriginal people were housed, moved and managed in 'reserves', housing estates created by colonial occupiers, which lead to further ostracising Indigenous Australians, and entrenching their marginalisation in Australian society. These legacies of colonialism and more are experienced by indigenous Australian groups even today.

Because uranium extraction in Australia happens in large part on Aboriginal land, indigenous communities bear the brunt of the environmental and health impacts of mining. These include chronic illness, acid leaching into the environment, contaminated drinking water, and the influence of corporations in traditional land ownership agreements. Some Aboriginal communities report a deep sense of guilt that uranium from their traditional lands has caused harm abroad, against their will (a recent example being the Fukushima disaster of 2011).

For more on Indigenous Australian history, visit Australians Together: <https://australianstogether.org.au/discover/australian-history/>

Ranger Uranium Mine

Located approximately 230km East of Darwin lies Ranger Uranium Mine and the nearby town of Jabiru. The mine lies within Kakadu National Park, a major tourist attraction and has been operating since 1980. The 'orebody' was completely mined by 2012 and now 'Ranger' processes ore which has already been extracted. In its four-decade life-span, the mine has produced over 125,000 tonnes of uranium.

After decades of protest from Aboriginal groups in particular, more than 200 accidents, and a slump in uranium prices following the Fukushima disaster of 2011, the profitability of the mine is in decline. Aboriginal communities have opposed uranium mining on their land, and have refused to extend the mine's lease beyond 2021, meaning that multinational company Rio Tinto is set to take on a clean-up project costing up to \$808 million.