 Change in the modern world - The nuclear age 1945–2011 program

Duration - 10 weeks (30 indicative hours)

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Unit description

Students investigate key features in the history of the Nuclear Age 1945–2011. The Historical concepts and skills content is to be integrated as appropriate.

Focus questions

* The development and use of the atomic bomb
* The struggle to maintain weapons parity
* The nature of deterrence
* Social, political and environmental impacts of the nuclear age
* Proliferation and non-proliferation
* Problems and issues with the use of nuclear energy

Outcomes

A student:

* MH12-1 accounts for the nature of continuity and change in the modern world
* MH12-2 proposes arguments about the varying causes and effects of events and developments
* MH12-3 evaluates the role of historical features, individuals, groups and ideas in shaping the past
* MH12-4 analyses the different perspectives of individuals and groups in their historical context
* MH12-5 assesses the significance of historical features, people, ideas, movements, events and developments of the modern world
* MH12-6 analyses and interprets different types of sources for evidence to support an historical account or argument
* MH12-7 discusses and evaluates differing interpretations and representations of the past
* MH12-8 plans and conducts historical investigations and presents reasoned conclusions, using relevant evidence from a range of sources
* MH12-9 communicates historical understanding, using historical knowledge, concepts and terms, in appropriate and well-structured forms

Related Life Skills outcomes – MHLS6-1, MHLS6-2, MHLS6-3, MHLS6-4, MHLS6-5, MHLS6-6, MHLS6-7, MHLS6-8, MHLS6-9, MHLS6-10, MHLS6-11

Historical concepts and skills

The following skills, which incorporate the concepts of causation, continuity and change, perspectives, significance and contestability, are to be integrated with the content of the Year 12 course.

Analysis and use of sources

* Explain the meaning and value of sources for an historical inquiry (ACHMH007, ACHMH009)
* Analyse sources to identify and account for the different perspectives of individuals and groups in the past (ACHMH010)
* Analyse and synthesise evidence from different types of sources to develop reasoned claims (ACHMH008)
* Identify and analyse problems relating to sources in the investigation of the past (ACHMH011)

Historical interpretation

* Analyse the extent and nature of continuity and change over time (ACHMH001)
* Identify and analyse the varying causes and effects of events and developments in order to construct historical arguments (ACHMH001)
* Form judgements about historical significance, recognising that significance may be attributed for different purposes
* Analyse and evaluate contested interpretations and representations of the past (ACHMH011, ACHMH012)

Historical investigation and research

* Frame questions to guide historical inquiry and develop a coherent research plan (ACHMH004)
* Use evidence from a range of sources to inform investigation and research (ACHMH005)
* Acknowledge sources appropriately (ACHMH015)

Explanation and communication

* Develop texts, particularly historical accounts and arguments, supported by relevant evidence from sources (ACHMH013)
* Communicate historical understanding, using historical knowledge, concepts and terms, in forms appropriate to purpose and audience (ACHMH014)

Assessment

* Formative and summative assessment implemented throughout this unit of work by the teacher. Examples of formative assessment can be found in the table heading ‘Evidence of learning’.
* Assessment task – feature article

| Outcomes/content | Teaching and learning | Evidence of learning |
| --- | --- | --- |
| Survey   * The birth of the Nuclear Age, including:   + Truman, Stalin and the Potsdam Conference (ACHMH192)   + the Manhattan Project and Trinity Test (ACHMH192) | Lesson one – students are to view a number of images of the nuclear bomb attack and discuss what they see. Students should focus on their senses and to imagine what it would be like to be a citizen of a country that was experiencing nuclear war. Use [the day the nuclear age began](https://www.theatlantic.com/photo/2015/07/70-years-since-trinity-when-we-testednuclear-bombs/398735/).  [Read 'What hope is there for humanity in a nuclear age? The answer must be: none'](http://www.smh.com.au/world/what-hope-is-there-for-humanity-the-answer-must-be-none-20170822-gy1b1i) with students. Reflect on message of article and things that come to mind as a result. Questions, concerns and things students would like to learn more about.  Use the resource entitled ‘[The Potsdam Conference’](http://www.historylearningsite.co.uk/world-war-two/the-war-conferences/the-potsdam-conference/)  Students are to identify and discuss the ‘Big Three’ leaders attending the conference. Students should use the above resource and their own investigation to; describe the context of the period and the role of the major leaders during the time.  Identify and describe the issues that were to be discussed at the conference and explore the different issues being presented at the conference. Students should investigate who benefited from each issue and summarise in their workbooks.  Lesson two – students are to read the article [“The Potsdam Declaration”](http://afe.easia.columbia.edu/ps/japan/potsdam.pdf) and answer the associated questions attached. Students create a summary of the outcomes. Students should particularly focus on Truman and what were the motivations behind the project?  Students create their own [timeline of the ‘Manhattan project’](http://www.atomicarchive.com/History/mp/chronology.shtml) | * Discussion responses. * Student summaries of key information. * Responses to set questions. * Student timelines. |
| Focus of study   * The first use of atomic weapons and nuclear deterrence, including:   + the dropping of the bombs on Hiroshima and Nagasaki, their impact and legacy   + Truman and the debate on the use of the bomb (ACHMH118, ACHMH119, ACHMH192)   + US and Russian nuclear capacity 1945–2011, and the doctrine of Mutually Assured Destruction (MAD) | Lesson three – students are to complete a KWL chart demonstrating their understanding of the Birth of the Nuclear Age. Ask students to make three columns in the notebooks – Above each they are to write the following headings – know, want to know, learnt. Students are to populate the first two columns. In the first, they are to write down everything they know about the birth of the nuclear age. In the second column, students are to write down things that they would like to learn more about/what they expect to learn in this topic. The third column will be completed as a summary of student learning when the content of this dot-point has been covered in full.  Students, with support from the classroom teacher, are to read [‘The Bombing of Hiroshima and Nagasaki’](http://www.atomcentral.com/hiroshima-nagasaki.aspx) and [‘Hiroshima, Nagasaki & the First Atomic Bombs](https://www.livescience.com/45509-hiroshima-nagasaki-atomic-bomb.html)’ by Marc Lallanilla. Students are to summarise the information.  Lesson four – students are to [explore the digitised newspaper article on the Hiroshima bombing](http://trove.nla.gov.au/newspaper/article/971455). Students are to read and to summarise the historical source. Students then use subheadings Perspective, Reliability and Usefulness to assess the source.  Students [visit the Atomic Heritage Foundation website](http://www.atomicheritage.org/history/bombings-hiroshima-and-nagasaki-1945) and fill in the resource provided to detail the differing perspectives of Hiroshima. The perspectives being investigate include; Pilot Paul Tibbets, Navigator Theodore Van Kirk, Tail gunner Robert Caron, college history professor, Medical doctor Michihiko Hachiya, writer Yoko Ota, a six-year-old boy, a sociologist, a boy in fifth grade, a grocer, a sixth-grade girl, a fourteen-year-old boy.  Lesson five – handout article from the Sydney Morning Herald – Putting the bombings into perspective. Article titled [‘What if the Hiroshima bomb was dropped on Sydney or Melbourne?’](http://www.smh.com.au/world/what-if-the-hiroshima-bomb-was-dropped-on-sydney-or-melbourne-20150806-gisw5y.html) by Inga Ting.  Students [visit this webpage on the effects of the atomic bombings](https://www.ibiblio.org/hyperwar/AAF/USSBS/AtomicEffects/AtomicEffects-2.html) and summarise the effects of the atomic bombing attacks under the following sub headings:   1. Casualties 2. Morale 3. The Japanese Decision to surrender   Lesson six – students research the legacy of Hiroshima and Nagasaki during the period of nuclear war and today.  Students should [visit this webpage on the legacy of Hiroshima](http://www.theweek.co.uk/64578/legacy-of-the-atomic-bomb-70-years-after-it-fell-on-hiroshima) as a basis for their investigation. Students are to compose a 1000 word essay which details the legacy that the bombings had on the wider society (both internal and external) and the political implications of the bombings. Students should find at least five sources to support their investigation.  Lesson seven/eight – students are to form two groups. The classroom teacher will act as President Truman. The first group will investigate the reasons for the use of the bomb whilst the other group will investigate the reasons against using the bomb. Students will form a solid and sustained argument and will engage in a classroom debate with the classroom teacher as the adjudicator. Student’s would formulate their arguments and be prepared to rebut the opposition’s points. The classroom teacher will adjudicate and the audience will be asked to vote as to whether or not to drop the bomb or not. Students will collate their arguments and write in their workbooks.  Students could use the following websites to support their investigation:   1. [Background – the decision to use the atomic bomb](https://www.historyonthenet.com/authentichistory/1939-1945/1-war/4-Pacific/4-abombdecision/1-background/index.html) 2. [Arguments supporting the bomb](http://www.historyonthenet.com/authentichistory/1939-1945/1-war/4-Pacific/4-abombdecision/2-support/) 3. [Arguments against the bomb](http://www.historyonthenet.com/authentichistory/1939-1945/1-war/4-Pacific/4-abombdecision/3-against/index.html)   Lesson nine – teacher to define the term ‘arms race’.  [Source analysis questions](https://ourworldindata.org/nuclear-weapons/)  Source 1.1 Nuclear Weapons over time:   1. Identify the warheads inventory of America and the USSR in 1970. (answer – America 26008 and USSR 11736) 2. Identify the difference between America’s inventory between 1950 and 2000. (answer – 10278)   Source 1.2 Number of Nuclear Tests   1. In what year was there a peak in nuclear tests in the United States? How many tests are conducted? (answer – 1962 and 96) 2. In 1995 how many Nuclear Tests did America conduct? (answer – 0)   Source 1.3 World Map of Nuclear Explosions Since 1945   1. Identify the first year of detonation for the United States, USSER and North Korea? (answer – 945, 1949 and 2006) 2. Draw the table in your books   Lesson ten – teacher hands out ‘[Global Nuclear Weapons inventories, 1945 – 2013’](http://www.tandfonline.com/doi/pdf/10.1177/0096340213501363?needAccess=&). Students are to summarise the document. In pairs students are to create a one page fact sheet about the important information being explored within the journal article, specifically, on the capacity of nuclear weaponry.  Lesson eleven – students will be introduced to the doctrine of Mutually Assured Destruction (MAD) Students should read [‘No Cities’ speech](http://www.atomicarchive.com/Docs/Deterrence/Nocities.shtml) by Sec. of Defence McNamara on July 9, 1962 and 1967 [‘Mutual Deterrence’ speech](https://goo.gl/zY2KKQ) by Sec. of Defence Robert McNamara (page 1 -3)  Students read the document [‘mutual assured destruction’](https://www.immagic.com/eLibrary/ARCHIVES/GENERAL/WIKIPEDI/W111002M.pdf) | * KWL charts. * Source analysis responses. * Perspectives worksheet. * Class discussion about implications. * Summary. * Student essay responses. * Student debate responses. * Source analysis responses. * Document summaries and fact sheets. * Student discussion and summaries. |
| * The nuclear threat and weapons testing, including:   + civilian fears and state programs in the USA to survive the bomb and fallout   + the nature and impact of nuclear tests in the US and Soviet Union   + selection of Maralinga for British nuclear tests, state secrecy, and impact of the tests on local Aboriginal people and Australian service personnel (ACHMH189)   + the nature of French nuclear tests in the Pacific, the international response, and the activities of Greenpeace, including the ‘Rainbow Warrior’ incident | Lesson twelve – students view [‘Duck and Cover’ film](https://archive.org/details/DuckandC1951). Discuss reactions to the film and whether such a film would have been a positive or negative addition to the civilian fears in the USA.  Watch [‘How to Protect Yourself from Nuclear Fallout and Survive an Atomic Attack – 1950s Educational Film’](https://archive.org/details/Fallout_582)  Compare the two films for purpose, audience, perspective, reliability and usefulness.  Students read [‘Living with the Bomb’](http://www.learnnc.org/lp/editions/nchist-postwar/) by David Walbert and create brief summaries of the information under each subheading.  Lesson thirteen – in groups, students assess [each of the documents on nuclear fallout](https://www.archives.gov/education/lessons/fallout-docs#documents) and [Page 51-52 of Life Magazine](https://goo.gl/HuoP6m) (primary sources used in civilian preparation during 1950s). For each source, students to complete a table with the headings:   * Source information * Audience and purpose * Reliability * Usefulness for historian studying civilian fears and govt. programs   Using information gained from the range of sources assessed, students to design (and set up) their own fallout shelter. Written reflection on issues they encountered whilst considering design for their fallout shelter.  Extra resources for this point:   * [How we learned to fear radiation](https://blogs.scientificamerican.com/guest-blog/the-rise-of-nuclear-fear-how-we-learned-to-fear-the-bomb/) * [Atomic fears](https://www.khanacademy.org/humanities/ap-us-history/period-8/apush-1950s-%20america/a/atomic-fears-and-the-arms-race)   Lesson fourteen/fifteen – watch CNN clip of [‘Newly declassified films show US nuclear tests’](https://goo.gl/eVxU9b) and [the interactive map](http://www.arcgis.com/apps/Time/index.html?appid=b8540a8a2500472c8037bdd2a35c4be0) (can be accompanied by the article ['One map that shows every nuclear explosion in history'](http://www.independent.co.uk/news/science/this-map-shows-every-nuclear-explosion-in-history-a6914056.html) for further context).  [Read an article on the first atomic detonation at the Nevada test site](http://www.history.com/this-day-in-history/first-atomic-detonation-at-the-nevada-test-site). Discussion about the scope of testing within the US and reasons for this.  Students to split into two groups. Group A create a shortened timeline of US nuclear tests and impacts using the extensive timeline at [Fifty Years of Nuclear Testing](http://www.jstor.org/stable/23625642). (1995). Arms Control Today, 25(6), 28-34. Access using State Library of NSW. Free to all NSW residents. Group B will use the same resource to create a shortened timeline of Soviet Union nuclear tests and impacts. Students to share results in pairs.  Lesson sixteen – students to read Kissinger, Henry A. [“Nuclear Testing and the Problem of Peace.”](http://www.jstor.org/stable/20029327) Foreign Affairs, vol. 37, no. 1, 1958, pp. 1–18. JSTOR, (or an excerpt selected by teacher). Create a summary of Kissinger’s perspective on US Nuclear Testing and the impact on peace in the world. This can be chunked in groups if reading level is too high.  Lesson seventeen – read [‘The Polygon: Former Soviet Union nuclear test site on Kazakh Steppe now open for tours’](http://www.abc.net.au/news/2015-08-13/the-polygon-a-nuclear-guide-to-the-kazakhstan-steppe/6694834). Students to write an extended assessment on the ongoing impact of US and SU nuclear testing using the resources they have encountered.  Lesson eighteen – students to research 5Ws (who, what, where, why, when) of Maralinga nuclear tests and present in a Google Slides/PowerPoint to share with the class. View the [interactive map and accompanying information](https://australianmap.net/maralinga/) to help with this task.  Lesson nineteen – students to listen to the podcast [‘Liz Tynan on the secret history of Maralinga’](http://www.abc.net.au/local/stories/2016/08/09/4515140.htm) (49mins). As they listen, students to take notes on the following:   * British role in the development of the bomb * Reasons for Australia becoming involved * Public and parliament knowledge about testing * Why Maralinga? * Clean up operations and ongoing fallout issues * Health effects for Aboriginal Australians   Lesson twenty – students to form 5 groups. Distribute the following articles amongst the groups. Each group is to read their article and summarise the key points made, as well as any limitations for a historian in using the article. Groups to report back to the class. Using this information and their own research, students to write an essay responding to the question ‘Assess the impact of the Maralinga nuclear testing on local Aboriginal people and service personnel.’   * Article one – [‘Maralinga: Sixty years on, the bomb tests remind us not to put security over safety’](http://www.abc.net.au/news/2016-09-27/sixty-years-on-from-the-maralinga-atomic-bomb-tests/7880364) * Article two – ‘[Maralinga: How British nuclear tests changed history forever’](https://www.creativespirits.info/aboriginalculture/history/maralinga-how-british-nuclear-tests-changed-history-forever#axzz4nQVHQTD5) * Article three – [‘New generations of Australian families suffering deformities and early deaths because of ‘genetic transfer’’](http://www.news.com.au/lifestyle/health/health-problems/new-generations-of-australian-families-suffering-deformities-and-early-deaths-because-of-genetic-transfer/news-story/5a74b7eab2f433402aa00bc2fcbcbea4) * Article four – [‘The secret destruction of Australia’s Hiroshima’](http://www.news.com.au/lifestyle/real-life/news-life/the-secret-destruction-of-australias-hiroshima/news-story/9eabf722dbe2f87e03a297c2a348a8e1) * Article five – Palmer, K. (1990). [Dealing with the legacy of the past: Aborigines and atomic testing in south Australia. Aboriginal History](http://www.jstor.org/stable/24045775), 14(1/2), 197-207.   Lesson twenty-one – students to research the Greenpeace ‘Rainbow Warrior’ incident and create a Prezi outlining the following:   * Where in the world was France completing nuclear tests? * What is Greenpeace and what was their involvement in this incident? * What was the incident? * Why did it happen? * What were the opposing views that created the conflict? * What was the international response?   Additional resources about French nuclear tests in the Pacific.   * Thakur, R. (1996). [The Last Bang before a Total Ban: French Nuclear Testing in the Pacific](http://www.jstor.org/stable/40203124). International Journal, 51(3), 466-486. doi:10.2307/40203124 * Maclellan, N. (2005). [The Nuclear Age in the Pacific Islands.](http://www.jstor.org/stable/23722064) The Contemporary Pacific, 17(2), 363-372. | * Discussion responses. * Student responses to purpose, audience, perspective, reliability and usefulness. * Written summaries of key information * Completed tables * Reflection statement * Student timelines for US and Soviet Union testing * Summary of Kissinger’s main points. * Extended writing assessing US and Soviet Union testing impacts * PowerPoint/Slides presentations * Student notes on Maralinga * Student essays about impact of Maralinga testing * Prezis assessing Rainbow Warrior incident and international responses. |
| * Towards nuclear disarmament, including:   + anti-nuclear movements and the role of the United Nations: test ban treaties, arms limitations, non-proliferation   + nuclear disarmament after the Cold War (ACHMH224)   + issues of proliferation, 1945–2011: Israel, India, Pakistan, Iran and North Korea | Lesson twenty-two – students are to complete a KWL chart demonstrating their understanding of the nature of Nuclear Proliferation Ask students to make three columns in the notebooks – Above each they are to write the following headings – know, want to know, learnt. Students are to populate the first two columns. In the first, they are to write down everything they know about the nature of nuclear disarmament – treaties, testing, accidents/incidents, anti-nuclear movements. In the second column, students are to write down things that they would like to learn more about/what they expect to learn in this topic. The third column will be completed as a summary of student learning when the content of this dot-point has been covered in full.  Read and summarise the article – ‘Arms control, disarmament and the United Nations’ by Patricia Lewis and Ramesh Thakur. Article can be found with a google search.  Students are to discuss the notions put forward in the article. How crucial were the United Nations in maintaining peaceful nuclear relations to 2011?  Use the resource entitled ‘Towards Nuclear Disarmament’. Students are to first discuss and define the terms ‘arms control’ and ‘disarmament’. As a group discuss the difference between these two concepts and their role in the nuclear debate.  Lesson twenty-three – in order to get a complete understanding of the anti-nuclear movement, students need to have a basic understanding of Cold War diplomacy, particularly in the era of détente (1960s and 1970s). Read through the information provided in the handout and have students define the term ‘détente’. Discuss with the group the major differences in policy between Carter and Reagan, particularly in relation to Reagan’s ‘Star Wars’ initiative.  Students are to read about, and explain the SALT I and II talks between US Presidents Nixon and Carter, and Soviet leader, Brezhnev. As you continue to work through the document, compare these to the Reagan-Gorbachev talks at Geneva, Reykjavik and Washington. Questions for consideration include:  What were the major differences in the approaches of Reagan and Nixon/Carter?  Was Reagan a better diplomat or was he able to achieve his goals purely because of a failing Soviet economy?  What was the impact of these talk on the wider international community? (Consider here the role of the UN in controlling Arms proliferation)  Lesson twenty-four – students move into an exploration of the Nuclear Non-Proliferation Treaty. In order to do this, there is a fact sheet attached to the document, as sourced from from United States Institute For Peace Study Guide – [Controlling the Proliferation of Nuclear Weapons](https://www.usip.org/publications/2005/04/controlling-proliferation-nuclear-weapons)  The [Nuclear Threat Initiative (NTI) website](http://tutorials.nti.org) has a number of modules that allow students to explore and understand the Non-Proliferation Treaty. Students are to complete the module on this topic, as well as the final quiz, completing the questions in the document as they go.  Discuss student responses to the questions in the worksheet. In what areas do they differ? The resource asks students to think more deeply about three issues associate with the NPT.  Discuss these in the group. Engaging in a class debate around these issues would be a good way to develop deeper knowledge and understanding of the NPT and its wider, international implications.  Lesson twenty-five – students are to complete the opening question on the resource entitled ‘Post-Cold War Disarmament: Wows and Wonders Resource’ – This will provide a good opportunity for students to demonstrate their understanding of some of the key treaties that had been forged towards the end of the Cold War. As a group discuss student responses.  Mind Map – What were the biggest threats in the Post-Cold War Period? Share ideas about significant world events in the 90s and early 2000s – This might include:   * The Gulf War – American actions in Kuwait * Conflict in the Balkans * Growing conflict between India and Pakistan * The emergence of North Korea as a Nuclear threat * 9/11 Attacks and the emergence of global terrorism * The American response – Iraq and Afghanistan   Lesson twenty-six – watch the 2010 documentary, ‘Countdown to Zero’. This can be purchased on DVD online or can be downloaded (for a cost) from [Google Play Store](https://play.google.com/store/search?q=countdown+to+zero&c=movies)  As students watch the film they are to complete the Wows and Wonders sheet – This is a basic summary sheet that asks them to pick out important facts from the film. However, the resource also requires students to consider their own knowledge, encouraging them to write down questions that come to mind as they watch the film so as to enhance their understanding afterwards. Ask students to share the questions that they wrote down. Discuss these in the group.  Complete the source activity on the end of the resource – pay particular reference to the last question in discussing the nature of student responses. Students should be encouraged to analyse the sources critically, particularly in relation to the political cartoon.  Lesson twenty-seven – watch the YouTube video [‘What countries have nuclear weapons?](https://www.youtube.com/watch?v=swUA33FGXZU)’  Read and summarise the information included in the resource entitled ‘Issues of Nuclear Proliferation’. This resource includes an article by George Friedman about the ‘Geopolitics of Nuclear Weapons’.  Students are to complete the attached questions  Discuss student responses to question 4. What do they understand about the threat of global terrorism? This forms an important part of the documentary they have watched previously so they should have some understanding of the threat posed by terrorism.  Lesson twenty-eight – in 2010 a global summit on Nuclear Security was held in Washington DC. This lesson will involve hosting a similar summit. Place students into pairs or small groups – There are 9 national fact sheets available. However, if numbers are limited one or two of the major NPT nations can be left out. The aim of the summit is to come to a communal agreement on the following three areas:   * Compulsory membership of the NPT. * A shared agreement on the proliferation of fissile material, particularly in relation to states that are deemed to be ‘dangerous’ (NK, Iran, Syria). * A shared agreement on actions to curb the threat of nuclear terrorism.   In their groups, students are to read the fact sheets that they have been given and come up with a view on these three aims in accordance with their national profile. Each group has access to the Nuclear Profile of the others, students are to consider the potential aims and actions of other groups as they prepare their submission to the summit. Each group is to be given 2 minutes to make their proposal to the summit – After each group has spoken there will be an opportunity for communal debate. The groups are to push for a joint resolution on each of the proposed aims – Each state then has the opportunity to sign their agreement to the resolution. They may choose not to sign if it does not suit their national aims.  As a group discuss the nature of these discussions:   * What made them difficult? * Who was able to dominate the discussion and why? * How important was it to be diplomatic, particularly in working with the smaller states like Iran and North Korea?   Students to read the article entitled ‘nti.org-The April 2010 Nuclear Security Summit One More Step Toward the Mountaintop.’ Students to write a summary of the Washington Summit for their notes. | * KWL charts. * Discussion responses. * Definitions and discussion. * Responses to questions and activities in Towards Nuclear Disarmament document * Answers to questions. * Quiz responses. * Class debate. * Mindmap. * Film Analysis responses. * Source activity. * Student summaries. * Responses to questions. * Participation in group task and student solutions to issues presented. * Discussion responses. |
| * The benefits and risks of the Nuclear Age, including:   + the contributions of nuclear medicine and energy   + radioactive waste and issues of storage, safety and security   + critical incidents at Chernobyl and Fukushima, and their impact   + ending the nuclear age and the question of expanding or winding back nuclear energy | Lesson twenty-nine – student discussion on society’s uses for nuclear technology.  Teacher led discussion providing brief introduction on how nuclear medicine and energy are used.   * Watch [‘Nuclear 101’](https://www.youtube.com/watch?v=44ovdxOvP_A) * [What is nuclear medicine](https://www.youtube.com/watch?v=wfPza-R2sAY)   ICT Student research. Students are to make a list of the pros and cons of nuclear energy. Research one country that has a functioning nuclear power plant and the benefits that power brings to the country. Respond to reflection question – why doesn’t Australia have any nuclear power plants? [This resource can be used](https://goo.gl/XmdRFL) (Parliament of Australia website)  Student activity worksheet- Students are to examine x-rays, CT scans, and nuclear medicine. Using different colours, or rewriting into a list form, they are to put the information into 3 different categories; benefits, risks, and precautions.  Lesson thirty – brainstorm sources of waste in everyday lives. This could include solid waste (garbage, litter, food scraps, sewage, etc.), liquid waste (sewage, shampoos and soaps down drain, cleaning products, etc.) and gaseous waste (carbon dioxide, sulfur dioxide, etc.). Students may list toxic or hazardous wastes. Hazardous wastes include – carcinogenic, ignitable, corrosive, toxic, explosive, or radioactive.  Watch [‘Safely managing Australia’s radioactive waste’](https://www.youtube.com/watch?v=4mDuX--vzH8) (6:19). Students should be encouraged to take notes during the video. The video shows how used nuclear waste is stored and includes information about both short-term storage and Australia’s plan for the long-term storage of nuclear waste.  Explain that ANSTO is currently working collaboratively with the Australian community to develop a fair process to select a site for the National Radioactive Waste Management Facility. In small groups, students will go through a similar process themselves. Provide each student with a copy of the NRWMF task outline assignment and have each student read over the criteria for the location of the NRWMF, which will help guide their research. Each group will take turns presenting their chosen location. The groups must show their maps and explain their rationale for choosing the location based on the given criteria.  Questions for each group can include:   * Do you see any problems with your proposed location? * What might be some advantages of your chosen location? * What is the closest community to your proposed location?   Discuss the societal reactions to the concept of the NRWMF. Questions for discussion can  include:   * Why is it important that the closest community be “willing” to host the NRWMF? * Why might people be concerned about the NRWMF nearby? * How would you feel if your community was considering hosting the NRWMF? * Although ANSTO’s planned NRWMF is considered scientifically sound, it is socially unacceptable. Why do you think this is the case? * Do you think the NRWMF will ever be considered a socially acceptable choice for the long term disposal for Australia’s nuclear waste?   Lesson thirty-one – students are to be divided into pairs or groups and complete a case study on Chernobyl and Fukushima. They are to use the following focus questions as a guide:   * Where is the site? * When did the critical incident occur? * What caused the critical incident? * How did people react to the critical incident? (E.g. what did officials/government say? What did people think?) * What was the immediate impact of the critical incident? (Include the affected area, people affected, clean up etc.) * What long term impacts could the critical incident have on the area? (How long will it take before the site is safe for humans? What will happen to the environment? Etc.)   Students are to then compare and contrast both case studies, looking for similarities and differences.  Revision – discuss major points of nuclear energy.  Lesson thirty-two – hold a class debate on the question ‘should the use of nuclear energy be expanded or wound back?’ Students will work in small groups, using all information learnt in previous lessons, to brainstorm ideas for either the affirmative or negative and plan their response.  Depending on class size, divide the class in 2 or have a few teams for each side of the argument and students choose who will represent their side.  Post-debate debrief and reflection. Consider the following points:   * How difficult was it to think of points to support one side of the argument? * Do you think you would have done a better job supporting the other side of the argument? * Was I able to convince others of my opinion? * Did my opinion change? * What did you learn from this topic? | * Discussion responses. * Research task and reflection responses. * Responses to activity task. * Brainstorm responses. * Student notes. * NRWMF research task. * Student discussion of questions and written responses. * Critical Incident analysis case study. * Debate responses. * Student reflection. |

Reflection and evaluation