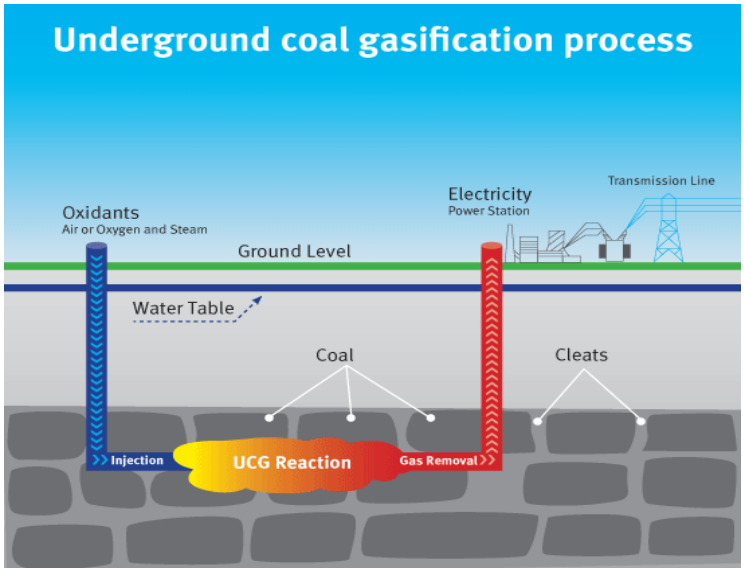
Doctors for the Environment Australia

Fact sheet

Underground coal gasification

Underground coal gasification (UCG) is the process by which coal is converted to gas underground via enforced combustion. UCG is used to access coal resources that are either uneconomic to work by conventional open cut or underground coal mining methods, or are inaccessible due to depth, geology or other considerations. http://abceducation.net.au/videolibrary/view/underground-coal-gasification-115

Coal gasification underground in situ is still experimental. The process is basically that two wells are drilled into the coal seam creating a connection with hydrofracturing. One of the wells injects oxygen or air, while the other extracts gas. Once the wells are connected, the coal is ignited. Coal gasification produces hydrogen and carbon monoxide. The sulphur and nitrogen in the coal are converted to hydrogen sulphide and ammonia.



Source: QLD DEHP http://www.ehp.qld.gov.au/management/ucg/ucg-csg.html

Local groundwater contamination is considered the most serious environmental risk. Two out of 34 pilots in the US were associated with groundwater contamination. UCG creates cavities underground similar to longwall mining: subsidence can impact groundwater flows, shallow aquifers, infrastructure etc. There appear to have been problems with all 3 demonstration sites in QLD: http://www.ehp.qld.gov.au/management/ucg/index.html

Contaminants can remain underground and contaminate aquifers. Products such as ash leachates, soluble tar effluents and gases have been found to migrate in underground aquifers during and after the gasification process. Aquifer interconnection may occur due to subsidence or ground movement associated with the gasification process. Product gases including tars can escape to the surface during or after gasification. http://www.tandfonline.com/doi/abs/10.1080/15287398209530219

While UCG is new, coal gasification in gasifiers is not. The International Agency for Research on Cancer has determined that coal gasification from this source is carcinogenic to humans. Occupational exposure to coal gasification has been associated with increases in a range of cancers, particularly lung cancer.

Genotoxicity is considered the likely mechanism for carcinogenicity of coal gasification emissions, predominantly due to the presence of mutagenic polyaromatic hydrocarbons (PAH).

http://monographs.iarc.fr/ENG/Monographs/vol100F/mono100F-15.pdf

Research from the US has suggested there might be different human health concerns depending on different UCG processes. Mutagens in groundwater were found to persist for two years after a gasification pilot ceased. Compounds from produced gas were found to be genotoxic in bacterial and mammalian cells. http://www.tandfonline.com/doi/abs/10.1080/15287398209530219

Underground coal to liquids technology

Underground coal to liquids (UCTL) technology or underground coal liquefaction is a process whereby coal is liquefied underground into a crude oil substitute at high temperature.
http://www.regalresources.com.au/index.php?option=com_content&view=article&id=7&Itemid=9
This underground technology is experimental in Australia although coal liquefaction plants have operated overseas for some time. Coal liquefaction can be direct, or indirect (where it goes through gasification first).

Indirect liquefaction involves breakdown of the coal producing hydrogen and carbon monoxide (syngas). Gasification products are reacted in the presence of a catalyst, and the synthetic liquid products produced may vary according to the catalyst and conditions used. Hydrocarbons produced may include methanol. http://www.princeton.edu/pei/energy/publications/texts/dclversussicl.pdf
Pollutants from coal liquefaction can be produced through a wide range of processes. Some of these are PAHs (polyaromatic hydrocarbons) which include known carcinogens and mutagens. Coal liquefaction productions have produced tumours and reproductive effects in laboratory animals. The IARC has determined that occupational exposures to coal-tar distillation are carcinogenic to humans, causing cancer of the skin.
http://monographs.iarc.fr/ENG/Monographs/vol100F/mono100F-16.pdf

Phenol, naphthalene, phenanthrene, pyrene, biphenyl, BTX (benzene, toluene, xylene) and their derivatives are present in relatively high concentrations in various products.
http://www.sciencedirect.com/science/article/pii/S0016236100002039

Waste streams may contain phenols, ammonia, PAHs, chlorides, sulphates, cyanides, heavy metals. Air emissions, may be less than for traditional coal-fired power plants, but still including hydrocarbons, CO_2, hydrogen sulphide, odours.
http://journals.cambridge.org/action/displayAbstract;jsessionid=F3D201D099F4AC600826DC94481E7CBD.journals?fromPage=online&aid=5940740
http://www.ncbi.nlm.nih.gov/pubmed/6522668

Identified environmental concerns include – disruption of aquifers, water pollution, loss of land productivity, loss of wildlife habitat, land subsidence. Certain compounds of coal liquids can accumulate in vegetation and coal liquids are highly toxic to aquatic life. When coal liquids are released into experimental ponds or streams, extensive changes occur in the structure and function of the biological community. http://www.sciencedirect.com/science/article/pii/0360544284901026

Medical surveillance has been recommended for workers at coal liquefaction plants in the US due to the risk of skin sensitisation and other potential health effects (respiratory, nervous system, cardiovascular, haematological, hepatic, renal). http://www.cdc.gov/niosh/docs/81-131/81-131.pdf
http://www.ncbi.nlm.nih.gov/pubmed/7963236
http://www.biomedsearch.com/attachments/00/00/78/90/789066/envhper00489-0195.pdf

In Australia, a study of a brown coal liquefaction plant in Victoria, Australia, found an increase of reported photosensitivity in workers with higher cumulative skin exposure http://www.ncbi.nlm.nih.gov/pubmed/7579298.

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Healthy planet,
healthy people

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