Why
Underground Coal Gasification
Should Be Banned

Submission of Evidence Against the Planned
Underground Coal Gasification
Trial in Kincardine

and

Other Conditional UCG Licenced Operations
Across Scotland

08 July 2016
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Introduction

Underground coal gasification is a process to burn coal underground, where it lies, to produce synthetic gas (syngas), instead of burning coal safely in power stations, i.e. creating underground gasworks (Pearce 2014)\(^1\).

Slide 28 of a presentation on the “Status of Underground Coal Gasification (UCG) as a Commercial Technology” (Dryburgh, 2005)\(^2\) states

“Despite 50 years of trials no commercial UCG project has been demonstrated. There has been a great deal of recent progress with pilot projects showing considerable promise and the current pilots could result in commercial operations within five to seven years, providing greatly increased confidence in the technology.”

It had been hoped new horizontal drilling techniques could prove to be the breakthrough that would prove UCG could finally be undertaken safely.

The Queensland government decided no industrial scale UCG operations could go ahead until three trials, by private companies, to be monitored by the Queensland government, were undertaken first, to assess if UCG could finally be undertaken safely using the latest horizontal drilling techniques, after other recent trials around the world reported issues with groundwater contamination with cancer causing...
chemicals and an uncontrolled explosion that resulted in the EU trial being abandoned.

The Westminster Government has issued conditional Underground Coal Gasification (UCG) licenses across Scotland, England and Wales, to brand new companies, set up to apply for the conditional UCG licenses, companies with absolutely no UCG experience, with Cluff Natural Resources Kincardine UCG license chosen to be the one used to conduct the pilot of UCG in the UK using new horizontal drilling technology.

Julie Lauder, CEO of the Underground Coal Gasification Association (UCGA), based in London (which has now gone into administration), claimed the Linc Energy UCG trial in Chinchilla, Queensland has proved to be the “eureka moment” for UCG. (Pearce 2014)\(^1\)

This statement proved to be premature as in April 2016 the Queensland Government’s Natural resources minister Dr Anthony Lynham declared all commercial UCG was completely banned immediately (Associated Press 2016)\(^3\), with laws to follow, all remaining trial sites would be decommissioned, with the state environment minister, Steven Miles, saying

> “What we have in Hopeland, near Chinchilla, is the biggest pollution event probably in Queensland’s history,” Miles said. “Certainly the biggest pollution investigation and prosecution in Queensland’s history.”

This submission is intended to present the evidence, which we believe proves conclusively, based on the results of latest trials around the world, using world leading horizontal drilling techniques and other evidence widely available, including two reports commissioned by Cluff Natural Resources, that underground coal gasification (UCG) still cannot be undertaken safely, which is why, like the Queensland Government, the Scottish Government should enforce a complete ban on underground coal gasification immediately, with laws to follow too, the Kincardine UCG trial proposed by Cluff Natural Resources stopped from going ahead and all UCG licenses revoked.
The Broad Alliance: Who We Are

We are an alliance of groups from Scottish communities directly or indirectly at risk from the unconventional gas extraction industry, within Scotland.

Broad Alliance Community Group Members include:

- Canonbie and District Residents Association (Canonbie)
- Clackmannan Against Unconventional Gas (Clackmannan)
- Concerned Communities of Falkirk (Falkirk)
- Don't Frack The Brig (Bishopbriggs)
- Dunbar Anti Fracking Team (Dunbar)
- East Lothian Against Fracking (Pencatlan)
- Halt Unconventional Gas Extraction (Cumbernauld)
- Highlands and Islands Against Fracking (Highland districts)
- Iona Community Mull and Iona Family Group (Iona)
- No Fracking North Berwick (North Berwick)
- Our Forth (Portobello)
- Kincardine CC (Kincardine, Fife)
- Coastal Regeneration Alliance (Portobello)
- PEDAL (Transition Grp) (Stirling)
- Transition Stirling (Stirling)
- Markinch Environmental Action Group (Merose)
- Transition Town Linlithgow (Linlithgow)
- South Lanarkshire Against Unconventional Gas (Fife)
- Frack off Fife (Denny & Dunipace)
- Midlothian Against Fracking (Midlothian)
- Stirling Against Unconventional Gas Extraction (Stirling)
- Greens (Dumfries & Galloway) (Dumfries & Galloway)
- Scotland Against Fracking (Central Belt)
- Friends of the Earth Stirling (Stirling)
- Friends of the Earth Falkirk (Falkirk)
- Glasgow Frack Watch (Glasgow)
- Torrance Against Fracking (Torrance)
- Forth Under Fire
- Scottish Pagans Against Fracking
- Frack Off West Lothian (FOWL); Frack Off Scotland (West Lothian)
- Shotts Say Frack Off (Shotts)
- Frack Free Forth Valley (Forth Valley)
- Milton Community Garden Group (Milton)

Supporters of the Broad Alliance include:

- Friends of the Earth (Scotland)
- Unison Scotland
- Radical Independence Campaign (National Forum)
- Women’s Environmental Network Scotland
- Radical Independence Campaign East Kilbride
- Environmental Justice Network
- Scottish Education and Action for Development
- Frack off Scotland
- Transition Scotland
- Coal Action Scotland
- BioFuels Watch
- Educational Institute of Education, Further Education Lecturers Association
- Scottish Hazards Campaign
- Reclaim the Power Scotland
- Assemblies for Democracy
The Queensland UCG Pilot Experience which has resulted in a ban on UCG in Queensland

UCG trials in Wyoming America (Burton, Friedmann, Upadhye, 1993)⁴, leached into groundwater with “Elevated levels of coal tars, residual organic carbon, BTEX (benzene, toluene, ethyl benzene, xyylene) found in coal seam and overlying aquifers.

As a result the Queensland Government in Australia decided no industrial scale UCG could go ahead unless three small scale trials were undertaken, by private companies Carbon Energy, Cougar Energy and Linc Energy, while being closely monitored by the government to prove UCG could finally be carried out safely.

Within a year, Carbon Energy’s small UCG trial in Bloodwood Creek contaminated water and land with cancer causing chemicals, which the company failed to report (Nancarrow 2011)⁵, forcing the Queensland government to shut down the trial for seven months and also resulting in Carbon Energy being fined $62,000 (plus costs) in court for the environmental damage caused and breaching environmental protection laws (Powell, 2012)⁶.

Within weeks of Cougar Energy’s UCG trial in Kingaroy commencing in 2010, the trial contaminated groundwater with cancer causing chemicals, with directors failing to notify the authorities as quickly as they could have done, (Wall 2011)⁷ which resulted in the trial being permanently shut down by the government, with Cougar Energy fined $75,000 in September 2013 (Powell, 2013)⁸.

Cougar Energy abandoned UCG operations and announced they were changing their name to Moreton Resources declaring “its current name is strongly linked to UCG and may be disadvantageous for attracting and retaining the support of investors in the future (Yeo, 2013)⁹.

Julie Lauder, the CEO of the UCG (trial) Association in London (which is now in administration) claimed Linc Energy’s Chinchilla UCG trial in Hopeland Queensland was to be the “Eureka Moment” for UCG (Pearce 2014)¹.

In June 2013 the Independent Scientific Panel Report On Underground Coal Gasification Pilot Trials (Moran, de Costa, Cuff, 2013)¹⁰ recommended a continued ban on commercial scale UCG in Queensland as the two remaining trials had “still not proven they could demonstrate safe decommissioning, by extinguishing the fires, shutting off reactions and preventing groundwater contamination.”
In November 2013, unhappy with this decision by the independent panel of Scientists, Peter Bond, CEO of Linc Energy said they were shutting down their Chinchilla UCG trial and transferring operations to Asia, Peter Bond claiming this was “Due to the regulatory uncertainty” (Validakis, 2013)¹¹.

The Queensland government announced five months later, as a result of a nine month ongoing investigation, they were taking Linc Energy to court on four counts of causing serious environmental harm (Willacy, 2014)¹².

But later news reports revealed, just weeks before Peter Bond’s announcement his company’s offices were raided after search warrants (Frost, 2015)¹³ were issued on the basis of tip offs from former workers regarding alleged toxic gas leaks and other serious problems at the Linc Energy plant (Solomons, Willacy, 2015)¹⁴.

As investigations continued, by 1st March 2015, the Queensland government issued a warning deadly gases carbon monoxide, hydrogen and hydrogen sulphide had been found just below the surface in two private properties in the Hopeland area, near the Linc Energy UCG trial, with farmers told not to excavate below two meters unless they contact the government first (Willacy, 2015)¹⁵.

Yet the next day, on the 2nd March 2015, Fife Today (Trimble, 2015)¹⁶, in an article headlined “Cluff claims UCG plans for Forth pose ‘negligible risk’” the Chief Operating Officer of Cluff Natural Resources, Andrew Nunn, declared their planned UCG trial in Kindardine posed “negligible risk”, making no reference to events unfolding in Australia claiming

“The only way to further the evidence base is to proceed in a cautious manner with a small pilot operation with rigorous oversight from all the various regulators and members of the local community.”

This despite the fact it is well documented all three UCG pilots in Queensland had resulted in major environmental damage, with what could be the biggest environmental disaster in Queensland’s history reported the previous day, due to the Linc Energy UCG trial – despite close government monitoring with rigorous oversight from all the various regulators and members of the local community.

Andrew Nunn went on to say, as opponents of called for it not only to be included in the moratorium but completely banned
“This scientific study was carried out between 1999 and 2009 and culminated in a feasibility report for a UCG demonstration project in the Firth of Forth. The Scottish Government has always been committed to an evidence-based approach to energy Policy and the deliberate exclusion of UCG from the moratorium is acknowledgement the evidence base for UCG already exists.”

The UCGEngineering.com website reveals, the study Andrew Nunn refers to was

The trial was undertaken by the Spain, the UK and Belgium, and was supported by the European Commission.

The Spanish trial was completed successfully (although operating hours were low) and it demonstrated the feasibility of gasification at depth, the viability of directional drilling for well construction and intersection and the benefits of a controllable injection and ignition point (CRIP- controlled retractable injection point).”

But what Andrew Nunn, the UCG Engineering website and Westminster’s DECC website also do not reveal was this UCG trial had to be completely abandoned after the pipe feeding the combustion products got blocked, resulting in an explosion, which could not be controlled, covering the surface site in contaminants and the entire UCG trial had to be abandoned, with DECC only stating

“the trial demonstrated that UCG wells in deep seams could be successfully constructed. The encouraging results of the European trial led the DTI to reevaluate UCG as a longer-term option for clean coal exploitation in the UK, as described below.”

So with no mention of the fact the part funded DTI EU trial was forcibly abandoned after it was impossible to unplug a blockage in the tube carrying the TEB and methane to the burner resulted in an explosion that could not be controlled, as revealed by the European UCG Case Study (Green 2011) revealed why the UCG trial had to stop so soon.
While Andrews Nunn goes on to claim

“The only objection to this sort of scientific approach can be that it will expose the extremists’ anti-UCG rhetoric for what it is and leave communities wondering what all the fuss was about.”

and

“Unfortunately for those opposed to UCG, you cannot randomly pick which scientific evidence you choose to believe in. If you accept unequivocal evidence for climate change you also have to accept similarly strong evidence that a well-executed UCG project will have a negligible risk of adverse environmental outcomes.”

With Andrew Nunn failing to mention the EU trial was forcibly abandoned after an underground explosion it appears it is Andrew Nunn being picky with the scientific evidence, along with DECC and the UCG Engineering website.


Meanwhile in Britain, on the same day, academic expert Harry Bradbury, the boss of Five Quarter, who held UCG licenses in the Firth of Forth, at the time, claimed those protesting against the UCG proposals who had signed a petition against his company’s UCG plans for the North East coastline where being “alarmist” and were “misinformed” (McCusker, 2015)21, with the report going on to say

“About its technology Mr Bradbury was unequivocal.”

“Five-Quarter is not running experiments – the initial technology roll out uses technology tested over 15 years with five years of Australian Government monitored trials using expert witnesses, the results of which have been that the follow-on commercial programme has full Government approval.”

With Harry Bradbury making absolutely no mention of the disaster unfolding in Australia as a result of the Linc Energy flagship UCG trial – after Linc Energy had fled the country months earlier with the Queensland government suspecting the coal fire may still possibly be burning underground from that Linc Energy trial, the Cougar Energy trial being closed down within weeks of starting and the Carbon
Energy trial also resulting in a court case- 100% of the UCG trials in Australia resulting in 100% of the companies being taken to court for causing serious environmental damage.

By 17th March 2015, further reports stated Linc Energy were facing further allegations, (Solomons, Willacy, 2015)22, with the ABC News report revealing staff complained to the company of nose bleeds, dizziness, nausea, vomiting, headaches, blurred vision and respiratory ailments, which the company is alleged to have failed to report, with another news report claiming it had been confirmed, the workers had been exposed to toxic gases (Hagemann, 2015)23.

Linc Energy’s Chairman is quoted as saying in response to the allegations “We have not received direct complaints from former employees (Solomons, Willacy, 2015)22.

Further allegations claim “unreported incidents at Chinchilla allegedly include a fire caused by a clogged pipe” and Linc Energy knew in 2013 all the gasifiers were fractured, with fractures also occurring on site, which also happened in the EU trial causing an explosion that could not be controlled which resulted in the the entire UCG trial having to be abandoned (Solomons, Willacy, 2015)22.

The blockage in the Linc Energy trial, “which the company tried to clear by increasing the pressure so much that the rock above it cracked, allowing the gas to escape”

It was also alleged that groundwater was contaminated with benzene, at levels 60 times higher than allowed and attempts were made to hide gas leaks by covering them with crusher dust and that carbon monoxide was penetrating the surface as well as syngas from Gasifier 4, with the management of Linc energy aware of this and ordering staff to reduce the pressure during a site inspection by Government staff to conceal the leakage (Solomons, Willacy, 2015)22.

The news report also states the Environment Department also alleges “extremely high levels of contaminants were recorded at monitoring wells on the site, with levels of contaminants so high a third party laboratory, which tested samples, rejected them on the basis they could damage laboratory equipment” (Solomons, Willacy, 2015)22.

So both Cluff Natural Resources and Five Quarter, both holders of UCG licenses in the Firth of Forth, make statements at the same time this UCG trial disaster in Queensland was unfolding, which combined claimed those against their UCG trials are being “alarmist” and “extremists” and being picky with evidence.
Harry Bradbury also stated his plans to go into full industrial scale production in the UK, without any trials, justifying this statement by saying there is no need, referring to a similar facility in Australia (The Journal, 2014)\textsuperscript{24} - one of the Australian UCG trials which has resulted in a total ban on UCG as of April this year, attempting to use a technology for the first time - in an environment UCG has never been tried before – under water

The Broad Alliance, whose members were fully aware - and following this unfolding disaster in Queensland - assert it is Cluff Natural Resources and Five Quarter, to protect their own investments, who were being picky with the scientific evidence, when neither made reference to the on-going ban in Australia, put in force by an independent panel of scientists, with no vested interest, as the trials had still not proven the latest UCG techniques, proposed for Scotland, using that very technology, could be carried out safely from start to finish, neither made reference to the previous environmental damage that resulted in one UCG trial being shut down within weeks of starting a second UCG trial also ending up in court for causing serious environmental harm.

But most importantly both companies making these statements when it had already been reported just weeks earlier the Queensland government had imposed a 320sq km excavation exclusion zone near the Linc Energy trial warning “property owners should seek advice from The Department of Environment and Heritage Protection (EHP) if they plan to excavate to the dept of 2 metres or deeper within this zone.” (EPA 2015)\textsuperscript{35} as toxic combustion gases were present just below the surface at explosive levels.

When the three private companies involved in the Australian trials failed to report in a timely fashion, at best, covering up serious problems from a UCG trial and breaches of UCG pilot regulation and fleeing the country while the investigation into major problems at the Linc Energy UCG trial at worst, these statements made by these companies prove a level of recklessness that begs the question are either of these companies fit to hold a UCG license, especially as Algy Cluff had already misled the people of Fife when he stated categorically water is not used in UCG operations – yet he told prospective investors “oxygen and steam” are used in the UCG process, not once but twice

Despite these statements the Broad Alliance were following events closely in Queensland and by 10\textsuperscript{th} August 2015 an ABC news report, revealed (Solomons, Willacy, 2015)\textsuperscript{26} “A study commissioned by Queensland's environment department says an experimental plant operated by mining company Linc Energy at Chinchilla, west of Brisbane, is to blame and has already caused "irreversible” damage to strategic cropping land.
The department, which has launched a $6.5 million criminal prosecution of the company, alleges Linc is responsible for "gross interference" to the health and wellbeing of former workers at the plant as well as "serious environmental harm".

On the same day a report revealed (Brisbane Times, 2015)37

“Four Queensland government workers were hospitalised while investigating an underground coal gasification plant at the centre of serious pollution allegations.

Documents obtained by the ABC reveal the environment departmental investigators suffered suspected gas poisoning while testing soil at the site of the Linc Energy operation at Hopeland, west of Brisbane.

One of the workers said he was nauseous for several hours and his blood tests showed elevated levels of carbon monoxide.

An expert study commissioned by Queensland's environment department, also obtained by the ABC, says gases released at the plant have caused the permanent acidification of nearby soil”

By October 2015, (Robertson, 2015)28 farmer George Bender, who was said to be “proud of his "clean and green" produce, and had won many awards for his wheat” committed suicide, unable to take any more of life due to the effects on his farm and his life by the Coal Seam Gas and UCG operations, with his daughter Helen saying to a government panel

“On Saturday we buried my father [who was] struggling for 10 years against the CSG industry and Linc Energy.

With the Guardian report going on to say

“A Chinchilla local, Karen Auty, told the panel credible medical studies had identified problems with exposure to gas, which had led to children in her area for the past two and a half years suffering from nose bleeds, rashes and insomnia from headaches.”

When Federal Assistant Health Minister Fiona Nash was asked what she “would do in response to lingering health concerns among residents near Queensland’s gasfields.” she said studies were on going

“But there’s no doubt we need to do more,” Nash said. “Where there are health impacts, we need the work to be done to show us. I know there is existing work already but we need to build on that to get a clear and proper picture exactly of
what these health impacts are.

“And from my view in all of this, we should take the precautionary principle, we should be conservative and things should be on hold until they can be proven not to have an impact, in my view.”

UCG Banned In Queensland April 2016

As a result of the Cougar Energy, Carbon Energy and Linc Energy UCG pilots and the resulting environmental disaster in Hopeland as a result of the Linc Energy UCG trial, on April 18, 2016 in a joint statement, Government Ministers, the Honourable Anthony Lynham, and The Honourable Steven Miles revealed, The Palaszczuk Government has moved to ban underground coal gasification because of its environmental impact stating (Lynham, Miles, 2016)  

“We have looked at the evidence from the pilot-operation of UCG and we’ve considered the compatibility of the current technologies with Queensland’s environment and our economic needs.

“The potential risks to Queensland’s environment and our valuable agricultural industries far outweigh any potential economic benefits,” he said.

“The ban applies immediately as government policy, and I will introduce legislation to the Parliament by the end of the year to make it law.”

“As a government, we support our resources sector for the jobs and economic growth it generates, but UCG activity simply doesn’t stack up for further use in Queensland.”

“In addition, our new chain of responsibility laws will provide new powers to require that contaminated sites must be cleaned up.”

Two days later it was reported in the Ilawarra Mercury, (Phelps 2016) farmers affected by the UCG disasters are collectively suing Linc Energy’s insurers and from the Queensland government stating
“The State Government is the ultimate owner of mineral resources in this state and they are responsible for the granting of licenses to exploit those resources,” Mr Marland said.

“They owe a duty of care to the community that those licenses are appropriately granted, regulated and monitored.”

Why UCG Should Be Banned In Scotland Too

With the Queensland government having now banned UCG completely, based on the evidence from all three pilots, which all resulted in severe environmental damage, one trial forcibly shut down within weeks and the other two trials being decommissioned, with all three private operators charged in court with causing serious environmental damage and breaching environmental safety regulations, this is not the only evidence available which proves conclusively UCG should also be banned in Scotland.

Sepa has admitted it has no way to monitor UCG operations in Scotland

All UCG trials around the world to date have been conducted and monitored onshore. The results of these trials were varied with some of the problems reported being:

- Groundwater contamination with BTEX chemicals
- Land contaminated with BTEX chemicals
- Livestock contaminated with BTEX chemicals
- Underground explosions, which could not be stopped, due to pipes feeding the combustion material into the UCG cavity becoming blocked
  - With the pipes becoming blocked in both the part DTI funded EU trial and the Linc Energy Chinchilla trial
- Subsidence underground and at ground level
- Workers exposed to toxic gases
- UCG cavities fractured by too much pressure leaking toxic gases hydrogen, hydrogen sulphide and carbon monoxide underground, rising to just below the surface to gather at explosive levels across a 320sq km radius in Queensland and toxic gas leaks from the cavity in the Polish trial too.

With one Queensland resident reported as saying (The Australian, Weekend Australian Magazine)

““Anyone who has a bit of common sense would wonder about it,” …
“You’re lighting a fire down there, pumping all that air pressure in – something’s got to give. I don’t know how anyone could dream they could contain it.”

With the **Weekend Australian Magazine**\(^{31}\) going on to report

“In the 16 months since then, they’ve become a lot more enlightened. They’ve learnt that Linc Energy stands accused of fracturing the rock beneath their land and releasing toxic chemicals into the soil, air and groundwater over a six-year period. They’ve read that Linc’s workers were told to cover up the contamination and drink milk to protect themselves. They’ve been told that digging a hole in a paddock might release “potentially explosive and/or toxic and/or asphyxiating mixtures of gases”. They’ve heard the Queensland environment minister, Steven Miles, describe it as “the biggest pollution event probably in Queensland’s history”.”

With the two of the three UCG trials in Australia, both running for several years, still managing to cause severe environmental harm, despite being carefully monitored by the Queensland government – how on earth do Sepa propose to monitor a pilot UCG trial, by a company with absolutely no commercial UCG experience under the Firth of Forth?

In **response to a freedom of information request**\(^{32}\), on 28\(^{th}\) September 2015 to FOI FOI85781 Sepa officials state

- Point 3.2 “at this time, no monitoring plans or processes specifically related to UGC have been developed.

The Ferret, online investigative reporting news website reported in December 2015 in an article headed “Mining for coal gas could cause blasts, fires and quakes, says Sepa” (**Edwards, 2015**)\(^{33}\)

“Plans to gasify coal under the sea around Scotland could cause pollution, earthquakes, underground explosions and “uncontrollable” fires, according to confidential draft reports from the Scottish Environment Protection Agency (Sepa).

The Scottish Government’s green watchdog admits that it doesn’t know what level of protection its safety regulation can provide against the hazards of underground coal gasification (UCG). The risks were “sometimes unknowable”, it says in one report.

The revelations have prompted anger from politicians, community groups and environmental
campaigners. They are demanding that the government’s temporary moratorium on UCG be turned into a permanent ban.”

The news report went on to say FOI requests had revealed

“In preparation for regulating the technology, Sepa scientists have drafted reports outlining the potential hazards. A first draft from early this year and a second, marked “confidential” and dated July 2015, have been released under freedom of information law.

Drawing on evidence from UCG facilities in Europe, the US and Australia, the reports list eight things that can go wrong. Groundwater can be polluted by toxins such as phenols, cyanides and radioactivity, they say.

Air can be polluted by highly toxic particles, ash, heavy metals and a series of hazardous gases, says the latest draft. Emissions of the greenhouse gases that disrupt the climate are estimated to be lower than from coal but higher than from natural gas though “large uncertainties remain”, it warns.

There is a risk that “induced seismicity” could damage boreholes and surface installations, as well as spread pollution. Underground explosions, which have been recorded abroad, could inflict similar damage, Sepa says.

Igniting the coal underground could lead to “uncontrollable fire”, which would worsen water and air pollution. The danger of underground “cavity collapse” could cause subsidence on the surface.

“The fundamental cause for concern with regards to UCG is that the conditions under which the reaction takes place are naturally variable and difficult to know (sometimes unknowable), placing an inherent limitation on process control,” says Sepa’s first draft. “This, combined with a number of significant environmental and human health hazards, creates risk.”

The more recent draft points out that some of these risks could be reduced if developers drill down to more than 800 metres below the sea, as they plan to do. But it doesn’t say the risks could be eliminated.

There are “significant technological and knowledge gaps”, it warns. Because controls and regulations are still being clarified “it is not possible at this stage to assess the level of protection
they will provide.”

Emails released in response to a freedom of information request also reveal that Sepa was anxious to alter the minute of a meeting with the UK government officials discussing UCG in February 2015. Sepa sought to remove a sentence questioning whether there was “a robust regulatory environment in place”.

The Ferret Report listed the eight hazards of underground coal gasification:

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<th>Hazard</th>
<th>Description</th>
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<tr>
<td>Groundwater pollution</td>
<td>Toxic gases and metals could contaminate the ground and possibly find their way into drinking water.</td>
</tr>
<tr>
<td>Surface water pollution</td>
<td>Toxic gases and metals could contaminate the sea and other surface waters.</td>
</tr>
<tr>
<td>Air emissions</td>
<td>Ash, particles, metals and gases could pollute the atmosphere, risking health and worsening climate change.</td>
</tr>
<tr>
<td>Underground explosion</td>
<td>Inflammable gases could be ignited by a spark and explode, damaging boreholes and buildings.</td>
</tr>
<tr>
<td>Cavity collapse</td>
<td>Underground cavities could collapse and cause subsidence on the surface.</td>
</tr>
<tr>
<td>Seismicity</td>
<td>Earthquakes that would damage boreholes and surface installations, as well as spread pollution.</td>
</tr>
<tr>
<td>Groundwater depletion</td>
<td>Other users could be deprived of water, and environmental damage could be caused.</td>
</tr>
<tr>
<td>Uncontrollable fire</td>
<td>Underground coal could burn out of control, causing air and water pollution and risking cavity collapse.</td>
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With Sepa admitting “The assessment of potential risk requires significant additional work”

With explosions in the UCG trials in Spain and Poland – with the UCG cavity cracking and releasing toxic gases in the Polish trial – just as happened in the Linc Energy trial in Queensland, this proves conclusively this technology is not controllable at levels closer to the surface onshore than that proposed by the Cluff Natural Resources trial under water – and even with government monitoring of the onshore trials major environmental damage could not be prevented.

As onshore trials have been so disastrous it is impossible to go ahead with a UCG trial in Scotland under water as Sepa admit they have no idea how to monitor this trial under water, as this has never been tried anywhere in the world, and are not aware of any country in Europe having developed any safety policies in relation to UCG based on EU directives.

With none of the UCG license holders in the UK having any commercial UCG experience, Sepa and the EA having no experience monitoring UCG onshore, never mind under water, Sepa and the EU unable to figure out what regulations should be in place and no one able to say how this should be regulated in
line with EU directives, the Underground Coal Gasification Association in London going into administration and the Queensland government declaring a complete ban on UCG, based on the evidence from their trials over many years - even investors have walked away from UCG in the UK, resulting in Five Quarters, one of the UCG license holders in Scotland going into administration in April this year, despite being given £15million of taxpayers money and a £1billion taxpayer guarantee by the Westminster Parliament, to cover investor losses should it all go wrong.

Even the Westminster UCG group ask the question, given the risks involved and the fact the technology is relatively unproven, should the UK be the first country in the world to roll out UCG (UCG Working Group, 2014).34

The Broad Alliance believes the Queensland government answered that question conclusively in April 2016– UCG cannot be undertaken safely – so much so an immediate ban across Scotland (and the rest of the UK) should also be put in place, with laws to follow– as UCG is so dangerous has even small pilots of UCG, using world leading horizontal drilling techniques can cause irreversible environmental damage and pollute and put endanger the economy, business and those living within hundreds of square kilometres when things go wrong.

It is vital this ban is put in place across the whole of Scotland as the Kincardine and other UCG licenses in Scotland are issued near densely populated areas, with the real possibility each UCG licenses could leak toxic combustion gases hydrogen sulphide, carbon dioxide and hydrogen from underground up to densely populated areas via honeycombs of old mine workings and fault lines, affecting even our capital City of Edinburgh.

Why Kincardine & the Firth Of Forth Are Not A Suitable Area for UCG licenses

The “UNDERGROUND COAL GASIFICATION (“UCG”) POLICY STATEMENT FOR LICENSING BY THE COAL AUTHORITY” (UK Government December 2009) 35 states

“The Authority will normally only consider UCG conditional licence applications for :-

· Offshore areas. Offshore licence areas can also include an onshore access strip to facilitate the sinking of exploration boreholes during the conditional licence phase and for sinking directional access boreholes into the offshore UCG area during the operational phase. (see note 2)

· Onshore areas, but only where it can be demonstrated that the surface is suitable for piloting this technology. (see note 3)

· Areas where there are :-

o no other Coal Authority Mining Licences & Agreements;
no existing Petroleum Licences;
o no identifiable defence installations; and
o no existing or proposed wind farm sites or other major structures on the seabed.

(see note 4)

· A maximum initial application area of 10,000 hectares. (see note 5)

· Areas where the Department of Energy & Climate Change, The Crown Estate, The Ministry of Defence or other relevant bodies do not raise objections. Consultation will be undertaken by the Authority with these relevant bodies on receipt of a conditional licence application. (see note 6)"

The license conditions state

“Licences will be subject to advertising by the Authority in order to stimulate competition. The initial term of the Conditional Licence will normally be restricted to a maximum of three years

The Authority will require Conditional Licence holders to undertake further discussions with the Department of Energy & Climate Change, The Crown Estate, The Ministry of Defence and other relevant bodies during the conditional period as they formulate the detail of their operations. The conditions will include a requirement for the applicant to undertake an agreed programme of works during the term of the Conditional Licence. Failure to complete the agreed programme of works will result in the Licence being revoked unless the Authority can be satisfied that the Licensee is committed to the pilot project.

Where the proposed UCG operation and its ancillary activities have a potential to interact with or damage third party property interests then a condition will be included requiring the Licensee to provide evidence of the existence of a Commercial Agreement between the parties outlining the manner in which any interaction or damage so caused is managed, remediated and funded. (see notes 8 & 9)

Further requirements for de-conditionalising a licence in whole or in part will be incorporated into the licence conditions and are set out in more detail in the Authority’s Model Underground Coal Gasification Licensing Documents.”

The September 2004 DTI Report “Review of the Feasibility Of Underground Coal Gasification In the UK” (DTI, 2004)36 stated

“Firth of Forth UCG Study : A study, entitled “The Coalmine of the 21st Century” has been initiated by Heriot-Watt University with support from DTI, Scottish Enterprise and Scottish and Southern Energy Ltd. Its aim is to undertake a feasibility of UCG in the substantial coal resources of the Firth of Forth This study builds on work already undertaken as part of the initial search for a test site, and will establish whether this area offers prospects for large-scale UCG and power generation. If the one-year study is successful, a prospectus will be produced to attract investment funds in the development of the project.”

The duration of the study was 13 months, from March 2004 to March 2005 and the report of study stated (Heriot-Watt University, 2006)37
“The search for a site became a greater challenge than initially expected. Kincardine was soon ruled out because the river narrows to the west of Kincardine Bridge and any UCG operation beyond the initial trial would require the inclusion of onshore resources, parts of which are licensed for CBM extraction.

Grangemouth was more promising as the river is unusually wide and the surface banks already have significant industrial activity. However, the previous work had found that the Longannet-Grangemouth area had an unacceptable geological risk, and this was largely supported by the present study.

Some structurally benign areas can be found within the prospect for trial purposes, but large areas are likely to be affected by structural and igneous features which would probably eliminate a commercial scale operation.

As the study progressed, the coal seam area of Musselburgh to the west of Edinburgh was found to be superior on geological and hydrogeological grounds and the best geological option for large-scale UCG production. However, the parallel environmental impact study showed that surface constraints at the shoreline would make access and shore facilities difficult to locate, and any UCG operation would need to be based entirely on offshore platforms. For the other sites, there were more options for the location of shore-based plant, but the geology was less certain, and more data were required to prove whether any of the sites would be suitable for a UCG trial.”

The feasibility study concluded

“Four potential regions of the FoF, Kincardine, Grangemouth, Musselburgh and East Fife, were examined as potential areas for commercial UCG. All had commercial quantities of coal potentially suitable for UCG (>20M tonnes), but the first three regions identified above had either data deficiencies, limitations on coal geology or surface constraints.”
In a report commissioned by Cluff Natural Resources, (Beltree Limited, 2015) the study looked at an area of interest 2km around the Kinardine license area

On page 5 of the report it says

“CNR’s Kincardine licence lies in the Midland Valley of Scotland (MVS) – a southwest-northeast trending basin cutting the central belt of Scotland (Figure 1.1). The MVS is around 80km wide, extends roughly 150km onshore across Scotland and is a major population centre with five of Scotland’s seven cities lying within it. (Beltree Limited, 2015)

On page 26 of the report it says

“Uncharted mine entries and abandoned workings in multiple seams of coal and associated minerals within the Coal Measures should be anticipated wherever they outcrop in the Kincardine UCG license area of interest. Shallow voids, loosely compacted mine waste, and weak roof-supporting pillars within abandoned workings pose a high risk of rockhead and surface instability and loss of fluid circulation at drilling locations (Beltree Limited, 2015)

Page 26 of the report also reveals

“The Bowhousebog Coal, in the upper part of the Passage Formation locally attains a thickness of 1.3m between Larbert and Dunmore and several old pits are believed to have worked it at both locations and in the intervening ground.
Abandoned mine workings therefore pose a risk to surface stability and loss of circulation at drilling locations wherever the lower part of the Passage Formation subcrops beneath superficials, and close to the outcrop of the Bowhousebog Coal.” (Beltree Limited, 2015)³⁸

Page 34 of the report gives a map showing “location of a lineament of fatal mine explosions in workings within Limestone Coal Formation seams in the Central and Clackmannan Coalfields. Data from UK Government statistics summarised by scottishmining.co.uk. Note that a break in the lineament occurs in the axis of the Clackmannan Coalfield where the seams were too deep to be mined but where high gas contents and saturations have reported to have been measured by Composite Energy in exploratory CBM drilling at Airth. (Beltree Limited, 2015)³⁸

Page 36 of the report reveals

“All of the target coals have been worked by traditional mining methods within the project AOI. All except the Upper Hirst have been worked in the east of the licence area where they are at shallower depths. The Upper Hirst seam conversely has been worked in the west – extensively onshore and to a lesser degree under the Firth of Forth” (Beltree Limited, 2015)³⁸

Page 41 reveals

“However, despite the reasonable quality, the seismic lines are widely-spaced in relation to the structural complexity, so borehole tops, fault analyses and mine abandonment plans of Old Coal Workings (OWS) have been key to understanding the structure and filling some of the gaps between seismic lines. Without this supplementary data, seismic faults and the target continuous
reflection event segments would almost certainly be mis-correlated. Even with the supplementary drilling and mining data, some areas are of the licence have too poor data coverage to make an unambiguous interpretation” (Beltree Limited, 2015)

Page 44 goes on to say

“with faults progressively migrating out of the licence to the north and to the south with increasing depth” and “The Midland Valley sill, known from drilling, does not image well in the legacy seismic. Line TOC86M112 tentatively images a flat zone at the appropriate depth predicted by its penetration in the Inch of Ferryton 1 well. It is hoped that reprocessing might strengthen the confidence in this pick and its extrapolation away from well control.” (Beltree Limited, 2015)

Page 48 says of possible coal panels for the UCG operations

“It is important to point out that the identification of these panels is largely based on legacy 2D seismic of insufficient density and resolution to image faulting that can be observed in the mine abandonment plans. It should therefore not be assumed that the panels identified in Figure 4.15 are completely free of faulting or folding of a complexity that might have a negative impact on successful execution of a horizontal UCG well.” (Beltree Limited, 2015)

Page 49 says

“In fact, most of the small faults displayed on the interpretation have throws smaller than 20 m and, if encountered during drilling of a horizontal production lateral, could result in premature termination of the wellbore if the seam could not be found on the other side of the fault. “(Beltree Limited, 2015)

While the people of Scotland are told not to worry this UCG trial will operate at depths much deeper than previous failed UCG trials, this report reveals on page 53, this trial in fact is specifying a minimum depth of 300m up to a maximum of 2000 metres – so Cluff proposes burning coal just 300m below the surface – not as deep as we have been led to believe. (Beltree Limited, 2015)

The Belltree Ltd report conclusions are

“After collating, reviewing and interpreting the public domain data that is available for the Kincardine licence and adjacent areas, it is concluded that current data density
(from boreholes, mine abandonment plans and particularly seismic) may be insufficient to:

- Detect the presence of some barriers to UCG burn progression such as minor faulting which may also compartmentalise the resource;
- Accurately plan the trajectory of a horizontal well (especially the in-seam land-out coordinates at the end of the build section, and provide early warning of steering requirements imposed by structural undulations or discontinuities); and
- Characterise faulting in terms of its ability to transmit water and gases without further modelling. (Belltree Limited, 2015)\textsuperscript{38}

The academic paper, “The groundwater hydrology of underground coal gasification coupled to carbon capture and storage” states subsidence of the UCG cavity “could” provide the benefit of making the rock in the roof above the cavity “more permeable” up to 60 times higher than the cavity itself P.L. (Younger, G. González 2010)\textsuperscript{39}

With the Belltree Ltd report revealing the minimum depth of the coal being considered for the Kincardine trial being just 300m below the surface, once the UCG cavity inevitably collapses, as Professor Paul Younger who used to be on the board of UCG company Five Quarter states, how close to the surface this rock will become more permeable.

Professor Younger’s paper is an academic paper and if those calculations are incorrect – and that cavity collapse causes the rock above the cavity to become permeable all the way to the surface then this could allow the waters of the Firth of Forth to access not only the UCG cavity but the honeycomb of interlinked mine workings, charted and uncharted, surrounding the cavity made accessible when the cavity collapses too.

There is no way to support a UCG cavity, as one can in a traditional coal mine, which makes undertaking a UCG project in an area honeycombed with old mine workings and fault lines an unsuitable area for any UCG project – a conclusion the Heriot Watt university feasibility study has already concluded.

While the Westminster government can draw a line on the shoreline for each UCG license – fires and gases escaping from UCG trials do not respect the lines drawn on a map but follow fault lines and permeable rock and gaps caused by old mine workings which would allow the gases from a process that cannot be controlled underground to rise to the surface in a densely populated area.

Cluff Natural Resources stated in January 2016 their UCG plans for Scotland are not “dead in the water” (Lammey 2016)\textsuperscript{40} with the Energy Voice report stating
“CNR said in a statement it felt there was more support for investment in energy and industry in England, where there is no moratorium on UCG.”

This statement was proven wrong after Five Quarter went into administration just three months later, after investors could not be found, despite the £1billion Westminster government taxpayer guarantee.

The Midland valley faces a UCG-CBM-Fracking perfect storm, with fracking and UCG both known to cause earthquakes in an area with known fault lines and seismic activity before any of these UGE proposals are moved forward – fault lines on which both Scotland’s ailing nuclear power plants also sit on.

Should millions of tons of coal be set on fire, underground, using a process where operators have proven time and again they have no control over once things go wrong, in an area where fracking operations are taking place to fracture rocks deep underground to release methane gas.

Imagine a combined UCG/fracking/CBM methane underground explosion from the underground coal fires of the UCG trial meeting methane from fracking operations that has seeped through underground fractures and fault lines, the explosion ripping through a honeycomb of coal mines, many not documented, in a densely populated area with two major road bridges, a chemical plant, Rosyth Naval Base, with decommissioned nuclear submarines and the biggest methane tanker in Europe in a densely populated area – a disaster which would make the recent chemical plant explosion in China appear like a small fire work exploding should this very realistic scenario happen.

But the risks do not end there.

**The Impact of UCG On The Climate**

In the academic paper “*Underground coal gasification with CCS: a pathway to decarbonising industry* (Younger, G. González 2010)

the former directors of Five Quarter stated

“Underground coal gasification (UCG) opens up the prospect of accessing trillions of tonnes of otherwise unmineable coal. When combined with carbon capture and storage (CCS), UCG offers some attractive new low-carbon solutions on a vast scale. This paper has several aims: to review key developments in technologies for UCG, CCS and CO2 storage in coal seam voids; to quantify the scale of the opportunity that these technologies open up; .. and to
propose a basis on which UCG-CCS can sit at the heart of plans to decarbonise present day industry in a way that dovetails with longer-term ambitions for an economy based on renewable energy.”

They report states in the introduction

“If UCG can be successfully linked to CCS, then the combined UCG–CCS offering provides a way of harnessing the energy contained within huge untapped coal resource whilst remaining within the ever-tightening targets for reducing CO2 emissions. The requirements for achieving long-term storage of CO2 and the CO2 trapping mechanisms for deep saline aquifers and depleted hydrocarbon fields are well documented”

In section 2 of the UCG technology it states

“The basic idea is that energy can be recovered from deeply buried coal seams by gasification of the coal in situ. This is readily achieved by introducing hot steam and oxygen or air to the coal via injection boreholes. In a sense, the uncontrolled combustion of coal underground is well known as a result of the many coal fires that have occurred around the world. However, the controlled gasification of underground coal is a different matter.”

Over 50 years ago the town of Centralia in Washington State had to be abandoned after a fire at a landfill spread to an abandoned coal mine (BBC 2012). And Queensland has discovered UCG is not a different matter and a UCG trial has resulted in toxic combustion gases hydrogen sulphide, carbon dioxide and hydrogen leaking across a 320 sq km radius to gather at the surface at explosive levels, resulting in permanent damage to prime farmland and farmers being instructed not to excavate below 2m – something no traditional coal mine has caused.

Section 2.1 of the report goes on to say

“The target coal seam can be on-shore, near-shore or off-shore. In all three cases, a fundamental requirement is the ability to accurately and remotely direct drilling equipment to create the network of gasification channels, injection wells and production wells for a UCG operation”
This requirement cannot be met in the Midland Valley as the Belltree report conclusions state clearly

“After collating, reviewing and interpreting the public domain data that is available for the Kincardine licence and adjacent areas, it is concluded that current data density (from boreholes, mine abandonment plans and particularly seismic) may be insufficient to:

- Detect the presence of some barriers to UCG burn progression such as minor faulting which may also compartmentalise the resource;
- Accurately plan the trajectory of a horizontal well (especially the in-seam land-out coordinates at the end of the build section, and provide early warning of steering requirements imposed by structural undulations or discontinuities); and
- Characterise faulting in terms of its ability to transmit water and gases without further modelling.

In section 3.2 of the report “Storage Potential” (for CO2) the report states

“For the reasons given in Section 2.3 above there is still a question over the precise volume of CO2 that can be stored in the UCG coal void. Suppose, for the sake of argument, that 50% of the CO2 arising can be stored back in the void space. If the aspiration is to target (say) 4 trillion tonnes of coal for UCG operations, that would translate into 12 trillion tonnes of CO2 arisings, with (say) 10 trillion tonnes of CO2 being captured (if CCS is deployed universally), and 5 trillion tonnes being stored in UCG void space. Compared with current levels of CO2 emissions world-wide of around 27 billion tonnes per year, we are therefore looking at around 200 years of CO2 storage capacity at current emission levels, which is getting close to the figures usually quoted for CO2 storage capacity in saline aquifers. From a global perspective, therefore, the UCG–CCS concept deserves more serious consideration alongside some of the other more prominent carbon management proposals.”

The Environmental Protection Agency in America states on their website
Increasing greenhouse gas concentrations will have many effects

Greenhouse gas concentrations in the atmosphere will continue to increase unless the billions of tons of our annual emissions decrease substantially. Increased concentrations are expected to:

- Increase Earth's average temperature
- Influence the patterns and amounts of precipitation
- Reduce ice and snow cover, as well as permafrost
- Raise sea level
- Increase the acidity of the oceans
- Increase the frequency, intensity, and/or duration of extreme events
- Shift ecosystem characteristics
- Increase threats to human health

These changes will impact our food supply, water resources, infrastructure, ecosystems, and even our own health.

In an article in The Bulletin of Atomic Scientists it states (House 2010)

It's been estimated that around 4 trillion tonnes of otherwise unusable coal might be suitable for underground gasification. If true, then the economic development of this process would expand coal reserves by a factor of about five. Such an expansion would be both good and bad. From the perspective of maintaining a prodigious and affordable energy supply, gasification would be a boon. But from a climate change perspective it could be a nightmare. If just current conventional coal reserves were fully combusted, the concentration of atmospheric carbon dioxide would approximately double. But if an additional 4 trillion tonnes were extracted without the use of carbon capture or other mitigation technologies, atmospheric carbon-dioxide levels could quadruple—resulting in a global mean temperature increase of between 5 and 10 degrees Celsius.

The DTI report on proposals for UCG in the UK states that carbon capture would be required for any UCG operations in the UK.

Yet the “UNDERGROUND COAL GASIFICATION (“UCG”) POLICY STATEMENT FOR LICENSING BY THE COAL AUTHORITY (UK Government December 2009) states clearly in Notes on Policy License Area where one of the assumptions the Authority has made in note 1.6

“The process is outside the remit for carbon capture and storage.”

Yet in the article New Scientist Journal “Fire in the hole: After fracking comes coal” (Pearce 2014) Pearce states

“The Intergovernmental Panel on Climate Change recently reckoned that the world needs to limit total emissions of carbon, from now on, to less than half a trillion tonnes just to keep global warming below 2 C. Most climate analysts agree even burning a large fraction of conventional
fossil fuel reserves would produce unacceptable warming, let alone what could be released by UCG.”

In the Biggar Ecomonics Report, commissioned by Cluff Natural Resources, in section 3.2 Drilling it states

“The drilling of panels will be a continuous operation to supply the oxygen required for the gasification process and to extract the products of this process. Throughout the thirty-year life span of this project, it is anticipated that 108 panels would be drilled. Each panel would have a life span of approximately three to five years before it is decommissioned.”

Cluff Natural Resources stated in 2013, just five of their UCG license areas hold 1.75 billion tons of coal.

This is the equivalent of 680 miners taking 538 years to mine 1.75 billion tons of coal, based on the UK record of 3.25 million tons of coal mined in a single year at the Daw Mill coal mine – which ironically shut in 2013 because of an underground coal fire.

Former Academic Dr Harry Bradbury, and former CEO of Five Quarter, in an article entitled “FIVE-QUARTER: “WIN-WINNING” SOLUTION FROM COAL on the Natural Gas Europe website states there are three trillion tons of coal in the North Sea and he says “getting progressively smarter about how we can access those assets is a real prize for us.

The DTI estimates there are a further 300 years worth of UCG coal onshore.

If these values are combined and all this coal was burned underground without capturing any of the CO2 this would result in UCG operations in Britain alone could cause a global mean temperature increase of between 5 and 10 degrees Celsius

Section 6.2 of the report “Potential Contribution to the Scottish Chemicals Sector” it states

“CNR has an interest in several UCG licence areas around the UK but has chosen to develop the Kincardine project first. One of the main reasons for this is because the Kincardine site is located very close to Grangemouth, which is a potential end user of syngas.”

Section 7 SYNGAS USE – POWER GENERATION states
Should UCG be widely adopted across the UK it is considered likely that the majority of syngas produced would be used in new build, high efficiency gas turbines for the production of primary electricity. There is a legal presumption that any new build generation capacity built to consume UCG derived syngas would have to include CCS or at least be CCS ready.

Section 7.1 The UK Energy Market states

The introduction of the 2008 Climate Change Act means that the UK Government is now under a legally binding obligation to reduce the UK’s greenhouse gas emissions by at least 80% (from the 1990 baseline) by 2050

Section 7.3 Kincardine Power Generation states

“The economic impact of the construction phase would depend on the amount of capital expenditure required to develop a new power station. It is understood that this could amount to around £250 million excluding the cost of any associated CCS infrastructure which would be required to transport CO2 from the UCG production site to the proposed Feeder 10 pipeline which is planned to take CO2 from the central belt of Scotland to the Goldeneye CCS project off Peterhead

Section 7.4 UK Opportunity for Syngas Power Generation”

“The development of a 300MW power plant in the vicinity of the Kincardine project would represent a small proportion of the opportunity presented if the full UK UCG resources were utilised.”

“The Kincardine UCG project is based on a site with an estimated coal consumption of 1 million tonnes per annum. This production is expected to be sufficient to produce enough syngas to power a 300MW power plant.”

So the Kincardine UCG trial, the Biggar Economics report states will

“transport CO2 from the UCG production site to the proposed Feeder 10 pipeline which is
planned to take CO2 from the central belt of Scotland to the Goldeneye CCS project off Peterhead”

ON the Peterhead CCS Project factsheet it states on November 25 the Westminster government cancelled funding to develop the Goldeneye CCS project of Peterhead.

This means the Kinardine UCG project has no CCS solution, with the Biggar Economics report completely ignoring all costs associated with CCS in the economic case.

In response to the Committee on Climate Change report, published just three days ago, the government response states

“Moreover, the Government welcomes the CCC’s primary conclusion that shale gas development at scale – i.e. at production stage - is compatible with carbon budgets if certain conditions, set out as three “tests”, are met,”

The government does not state it is not just fracking that will contribute to CO2 emissions in the UK as it has also issued over 20 UCG licenses with plans to initially burn billions of tons of coal underground across the UK without capturing any of the CO2 as there is no CCS solution and the government have put in place a loophole which allows none of the CO2 to be captured from UCG production if the syngas is used for anything other than power production e.g. chemical feedstock, fertilizer production.

Environmental Consultant, Paul Mobbs, in an email stated in response to the report and the governments’ response

“the CCC have completely ducked the issue of fugitive methane emissions.

Yes, they refer to some recent research studies on the issue, but as part of their calculations they're still using the data from "reduced emissions completion" studies in the USA.

Recent peer-reviewed studies on this data has shown that it is flawed because the methane sensor used doesn't work under all test conditions -- and the data from the
Allen study, the standard data source used, demonstrates that it was not sensing high methane releases for some of the time.

The problem with the sensor has been known publicly for about 12 months, and within the industry for much longer. In fact the failure of the measuring equipment goes some was to explaining the difference between "inventory analysis" studies used by the industry, and the recent studies of actual gas concentrations which discovered high methane emissions.

All-in-all then, the report is a move on from the blinkered approach of DECC's 2013 Mackay-Stone report. It does have some interesting conclusions -- such as the fact that current oil and gas regulation standard in Britain can't meet the emissions ceiling necessary to meet the UK's carbon budget.

However, due to its failure to reflect the most recent studies on fugitive emissions form the US, its analysis is deeply flawed. It relies upon data which is know to be significantly in error from actual emissions in order to arrive at its conclusions.

Therefore the CCC's report fails to adequately identify the hazards to the climate from unconventionnal oil and gas exploitation in Britain.

And that is before we factor in billions of tons of coal burned underground without capturing any of the CO2 at the same time.

**Conclusions**

The Broad Alliance concludes the evidence of the disastrous damage to the environment by UCG trials around the world prove conclusively UCG should be banned in the UK, based on the long term pilots in Australia, which used the same technologies proposed for the Kincardine pilot which have likely caused the biggest environmental disaster in Queensland’s history, resulting in an outright ban on all UCG earlier this year.

The Heriot Watt feasibility study stated Kindardine and most of the UCG sites considered in Fife
are unsuitable, Kincardine definitely being unsuitable for UCG and even the report commissioned by Cluff Natural Resources, published in November 2015 by Beltree Limited concluding there is insufficient data available for the Kincardine pilot this alone proves the UCG plans for Scotland are not viable.

The report reveals the Kincardine pilot is based on coal reserves starting from just 300m below the surface and as academic experts state it is inevitable the UCG cavity will collapse and the rock above the cavity, up to 60 times the height of the cavity will become more permeable, this could result in the Waters of the Firth Of Forth seeping into the UCG cavity causing an underground explosion, in an area honeycombed with coalmines and with known and unknown fractures meeting methane from surrounding fracking and coal bed methane operations underneath two road bridges and around a chemical plant, Rosyth naval dockyard, which holds decommissioned Nuclear Subs and the biggest methane tanker in Europe in a densely populated area.

And with no CCS solution for any UCG plans for the Kincardine project – when the DTI report stated all UCG plans for the UK must have a CCS solution again this proves UCG should not go ahead, especially as the UCG plans for the UK, with a convenient loophole stating none of the CO2 need be captured if the syngas is not used for power production, this will definitely result in the UK UCG energy strategy breaching climate change targets not only for the UK but for much of the world – and definitely proves the CCC report published this week, which made no mention of the UCG contribution to UK CO2 emissions and climate change targets does not provide the full unconventional gas CO2 emissions and the impact on global climate and UK climate emissions.

The Broad Alliance believes the evidence from Australia and the information provided in this report alone proves conclusively that UCG should be completely banned by the Scottish Government, especially as the Biggar Economics report, commissioned by Cluff Natural Resources, putting the economic case for UCG completely ignored the colossal cost of CCS and any risks and associated costs to the environment, local people and industries surrounding the proposed Kinardine UCG project and all the other UCG areas licensed in Scotland.

This is just part of the story and as the Broad Alliance reserves the right to submit further evidence as and when it becomes available to ensure the Government investigation to decide if UCG should be allowed to go ahead in Scotland has the fullest information available before making any decision on this matter to ensure the Scottish Government makes the right decisions on behalf of Scottish Communities.
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