Leigh Creek Energy
UCG Trial Proposal

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Energy Resources Division
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PGE ACT REGULATORY FRAMEWORK

In South Australia
Petroleum Exploration and Production Activities regulated under:

- Petroleum and Geothermal Energy Act 2000 (PGE Act);
- Environment Protection Act 1993;
- Natural Resources Management Act 2004;
- National Parks and Wildlife Act 1972;
- Aboriginal Heritage Act, 1988;
- Development Act, 1993;
- Work Health and Safety Act 2012;
- Public and Environmental Health (Waste Control) Regulations 2010;
- Environment Protection and Biodiversity Conservation Act 1999;
- Commonwealth Native Title Act 1994

**Interaction between PGE Act and other South Australian Acts administered through Administrative Arrangements with respective agencies**
DEFINITION OF ENVIRONMENT

Includes:

- Land, air, water, soil
- Plants & animals
- Social, cultural and heritage features
- Visual amenity
- Economic and other land uses
LICENSING AND APPROVALS PROCESS FOR EXPLORATION AND PRODUCTION ACTIVITIES

• Stage 1 – Licensing

• Stage 2 – Environmental Assessment and approval of Environmental Objectives

• Stage 3 – Activity Notification and Approval
STAGE 2 – ENVIRONMENTAL ASSESSMENT AND APPROVAL OF ENVIRONMENTAL OBJECTIVES

Environmental Impact Report (EIR)

• Needs to consider all risks to the environment (definition provided previously) and how these risks will be managed to sufficiently enable an informed decision to be made on the likely impact the activities will have on the environment.

Statement of Environmental Objectives (SEO)

• Be prepared on the basis of the EIR and include:
  • Environmental objectives to be achieved
  • Guide on how objectives will be achieved
  • Assessment criteria to measure objectives
EIR AND SEO

• Developed in consultation with relevant stakeholders – e.g. landholders/ native title claimants and government agencies (DEWNR/AARD/EPA/ DPTI/ DOH/ SWSA)

• If approved the documents will be published on DPC website

• Reviewed every 5 years or as required by Minister
Confidentiality - I#-A#

EIR & Draft SEO

Environmental Significance Assessment

- LOW IMPACT: Internal Govt Consultation
- MEDIUM IMPACT: Public Consultation
- HIGH IMPACT: EIS Process

Statement of Environmental Objectives

APPROVAL
Aboriginal Heritage Issues

- DPC-ERD and all South Australian State Government agencies continue to recognise and respect the sensitivities of all Aboriginal heritage matters in the State and the importance that these are appropriately addressed through the regulatory process, both during the approval stage and the compliance monitoring and enforcement stages.

- To this end, DPC-ERD has reached out to the lead (prescribed) native title body, the Adnyamathanha Traditional Lands Association Native Title Body (ATLA) to address any such issues and will continue to respectably and sensitively engage with ATLA on this matter.
Aboriginal Heritage Issues

• DPC-ERD also recognise, and understand that while ATLA is the key representative body. All views are taken into account in relation to the Aboriginal heritage – with the views of ATLA taken as the amalgam of the community’s views.

• If this project goes ahead, it will have to comply with the South Australian *Aboriginal Heritage Act 1988* which includes measures for the protection and preservation of Aboriginal sites, objects and remains.
Aboriginal Heritage Issues

• As required under the AH Act, and the PGE Act, LCK has attained Work Area Clearances (WAC) from ATLA as a precedent to commencing any on ground operations. These WACs are the standard assurance that reasonable steps have been taken to avoid damaging, disturbing or interfering with Aboriginal sites and objects protected under the AH Act.

• DPC-ERD will require WACs to continue as required by ATLA.

• This is an SEO requirement, Objective 1
# Aboriginal Heritage Issues

## Table 1: Environmental Objectives and Assessment Criteria

<table>
<thead>
<tr>
<th>Environmental Objectives</th>
<th>Assessment Criteria</th>
<th>Guide to How Objectives Can be Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Avoid damage, disturbance or interference to Aboriginal heritage sites, objects and remains unless prior approval under relevant legislation obtained.</td>
<td>Areas of proposed land disturbance have been subject to a cultural heritage Work Area Clearance and land disturbance has been undertaken in accordance with conditions of the cultural heritage clearance. Damage, disturbance or interference to any Aboriginal sites, objects and remains (all as defined under the <em>Aboriginal Heritage Act 1988</em>) is avoided unless authorisation has been obtained under the <em>Aboriginal Heritage Act 1988</em>. Any Aboriginal heritage sites, objects and remains discovered during operations have been appropriately reported and responded to, consistent with the <em>Aboriginal Heritage Act 1988</em>.</td>
<td>All new land disturbance contained within cultural heritage Work Area Clearance area. Signage and fencing (where required) will be installed to delineate approved areas. Areas of sensitivity (e.g. cultural heritage exclusion areas, if present) flagged and / or fenced off where necessary to prevent disturbance. Training and induction for all personnel on cultural heritage issues and the importance of remaining within designated / approved areas. If suspected cultural heritage material is discovered during operations, investigations are undertaken with the Adnyamathanha Traditional Lands Association to identify an appropriate course of action.</td>
</tr>
</tbody>
</table>
Information to date
Site selection is very important. The permeability field strongly affects the amount of gas escape and contaminant transport to protected groundwater.

**Favorable**
- Valuable/protected groundwater is nonexistent or shallow
- Thick low-permeability strata above cavity
- Low dip, anticline
- No/few/small fractures, joints, or transmissive faults
- Mapped and properly closed boreholes
- Strong rock supports economically-wide cavity with minimal vertical collapse

**Unfavorable**
- Valuable/protected groundwater close to UCG
- No robust low-permeability strata in between
- Dip, syncline
- Fractures, joints, transmissive faults
- Unmapped or improperly closed boreholes
- Weak rock – excessive vertical collapse for economical cavity width
<table>
<thead>
<tr>
<th>ISP recommended site attributes for ISG (Moran et al. 2013)</th>
<th>Demonstration plant site</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal seam at sufficient depth to ensure that any potential environmental contamination can be demonstrated to have minimal environmental consequences. With deeper coal, there are fewer useable aquifers and, if appropriate sealing horizons are present above the gasification depth, there is a much lower probability of materials (gas or liquid) moving to the surface.</td>
<td>✓</td>
<td>Coal is deep (approx. 500 m) with no aquifers in the vicinity.</td>
</tr>
<tr>
<td>Coal seam sufficiently thick to sustain gasification with reasonable likelihood of economic viability.</td>
<td>✓</td>
<td>Coal thickness is in the order of 12 m and considered suitable for gasification.</td>
</tr>
<tr>
<td>Rank of coal should be lignite to non-swelling bituminous coal.</td>
<td>✓</td>
<td>Coal is of sub-bituminous / lignite rank and is suitable for ISG.</td>
</tr>
<tr>
<td>Hydraulic head sufficient to contain efficient gasification.</td>
<td>✓</td>
<td>Hydraulic pressure above the coal seam is estimated to be greater than 500 m and is sufficient to contain gasification.</td>
</tr>
<tr>
<td>Coal seam capped by impermeable rock.</td>
<td>?</td>
<td>Coal seam is capped by approx. 500 m thickness of low permeability carbonaceous mudstone, an aquitard with respect to groundwater.</td>
</tr>
<tr>
<td>Target coal located so that there is sufficient thickness between the target coal seam / measure and any valuable aquifer higher up the geological succession.</td>
<td>✓</td>
<td>There are no aquifers within 500 m of the Demonstration Plant.</td>
</tr>
<tr>
<td>Sufficiently distant from rivers, lakes, springs and seeps to avoid contamination should chemical escape the cavity.</td>
<td>✓</td>
<td>No rivers, lakes, springs and seeps are located near the demonstration plant site (refer to Section 4.7). Pre-mining creek alignments across the broader mine site have been blocked by earthen walls, waste rock stockpiles and mine pits.</td>
</tr>
<tr>
<td>Absence of faulting or intrusions in the vicinity of the site. This is dependent on the size of the cavity.</td>
<td>?</td>
<td>Site is located approximately 100 m south of inferred fault, which does not penetrate the full depth of the Main Series Overburden and is likely closed with respect to potential for movement of gas or groundwater.</td>
</tr>
<tr>
<td>Sufficient distance from the nearest town and / or intensive surface infrastructure, e.g., irrigation or feedlots, and areas of significant environmental value, e.g., world heritage forests or wetlands, to avoid contamination should chemicals escape the cavity and to minimise impacts of odours.</td>
<td>✓</td>
<td>Site is over 8.5 km from Copley and 12 km from Leigh Creek township. No sensitive land-use or areas of significant environmental values are present at or near the site. (Site is within the former Leigh Creek Coalfield).</td>
</tr>
</tbody>
</table>
Key Identified Risks

- Loss of containment due to loss of well integrity
- Migration of chemicals of potential concern away from gasifier
- Gasifier pressure exceeding surrounding groundwater pressure
- Direct escape from the gasifier through drill holes or transmissive faults
- Gasifier chamber growth intersecting potential migration pathway
- Increase in permeability of surrounding by mechanical stress changes and fracturing (including significant gasifier chamber collapse)
- Migration of COPC from gasifier chamber after decommissioning
- **Risk mitigation focus: COPC loss of containment into atmosphere**
- Low/insignificant risk to any aquifers
Geology and Hydrology
Geology and Hydrology: Telford Basin Cross Section (North – South)

Upper Series Overburden contained the only aquifers in the Telford Basin. These have been significantly dewatered by the coal mine to maintain stability of the Upper Series Pit highwall.

Area of interest for understanding groundwater risks
Geology and Hydrology: Registered water bores
Figure 4-19: Cross section showing location of Conceptual Site Model for conditions before, during and after operation of the demonstration plant.
Plateau between Upper and Main Series Coal Pits
Additional Geotechnical Data
Playford 2, 2A and 2B
Playford 2, 2A and 2B
Playford 2, 2A and 2B
Independent Geo-mechanical Assessment

Geomechanical Model,
Leigh Creek, South Australia

Scott Reynolds, Scott Mildren, Oliver Bartdorff, & Jeremy Meyer

19/01/2018
Ikon Science Report Review Status:

- **Ikon main conclusion:** Rock strength for both the mudstone that overlies the proposed pilot UCG chamber and any pre-existing faults within the mudstone are highly unlikely to be affected by planned and controllable operating conditions within LCK’s proposed pilot UCG chamber.

- **DPC-ERD continue to review this report along with other new data acquired from Playford 2, 2A and 2B drilling and Alinta archives.**
Next Steps

- Public submissions on EIR and draft SEO close on 28 February
- DPC-ERD encourage stakeholders to make submissions
- DPC-ERD will review and collectively respond to all submissions
- DPC-ERD will forward submissions and its own comments to LCK
- LCK to submit its responses and revised EIR/SEO if necessary
- DPC-ERD will assess and decide on approval or otherwise of SEO
- If substantial changes made, revised EIR and SEO re-consulted on
- If decision is made to approve SEO it will be gazetted
- LCK will then proceed to Stage 3 of approval process
STAGE 3 – ACTIVITY NOTIFICATION AND APPROVAL

Activity Notification includes:

- Detailed activity information
- Site Specific Environmental Assessment against the objectives of a relevant SEO
- Landholder information (Notice of Entry)
- Fitness for purpose assessments
- Risk assessment documentation
- Work Area Clearance
- Any other material required by DPC to ensure it has comprehensive information on the proposed activities.
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