The unquantified risk of pollution of waters during and after operation of the proposed Hume Coal mine. The multiple uncertainties

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Hume coal mine – the uncertainties

- My review of reports made by consultants on behalf of Hume Coal and on behalf of others gives rise to considerable uncertainties relating to pollution of groundwater and surface water, both during and after mining

- I am unable to quantify the uncertainties due to the paucity of data or, where presented, its reliability. Important aspect of data collection were not made using best available practice, which would have allowed a better understanding of long-term pollution of surface water and groundwater

- The uncertainties relate to issues that have long-term and serious consequences to the quality of groundwater and surface water over time, both during mining and after colliery closure. The seriousness of the issues are compounded by the ultimate receptor of water is ultimately Sydney's principal supply of domestic water

- My assessment of leaching characteristics of proposed coal washery rejects has been limited by Hume Coal not making available for review reports of testing by their principal hydrogeochemical consultant, RGS. My review has been made by reference to the report by Geosyntec that quotes results of RGS

- The program of monitoring of groundwater and surface water quality proposed by Hume Coal during and after mining is not sufficiently detailed, does not adopt best industry practice and is likely to not allow early identification of pollution of groundwater or surface water

Geological implications

My review of reports by consultants engaged by Hume Coal and by others and my inspection of bore logs indicates:

- Hawkesbury Sandstone overlying the coal measures in the proposed mining areas is substantially fractured and contains readily extractable groundwater and the impermeable claystone overlying the coal measures is not continuous
    - Consequence: The fractures within the Hawkesbury Sandstone will likely result in caving and will readily allow groundwater to migrate into the coal measures during and after mining to leach the coal measures in un-mined area and washery reject materials that have been placed in mined-out workings
- Hawkesbury Sandstone has eroded and is in contact with the coal measures in the western and southern-western parts of the Hume Coal land
    - Consequence: Groundwater will migrate from the Hawkesbury Sandstone into the coal measures during and after mining
- The coal measures themselves contain significant groundwater
    - Consequence: The coal measures will continue to transmit groundwater during and after colliery closure and pollutants will continue to be leached from the washery rejects and the coal measures. Un-mined parts of the coal measures beneath the voids filled with washery rejects are also likely to allow migration of groundwater from the filled voids

Leaching of washery reject materials

- Coal mine reject materials do not comprise “stone and rock”, as claimed by Hume Coal, but comprise fine-grained coal and rock fragments. NSW EPA define coal washery rejects to include “coal fines, soil, sand and rock” and state washery rejects for reuse may contain up to 40 % “combustible content”, i.e. coal fines

    - Consequence: The reject materials will have large surface areas that will allow increased leaching of heavy metals (e.g. zinc, nickel, chromium) and major ions (sulfate, chloride) much more readily than coarse grained “stone and rock ”

- Kinetic leach tests described in reports I have been provided with are not representative of conditions that are likely to evolve over time in the filed voids and pose uncertainty with respect to their reliability. More reliable tests using the Leaching Environmental Assessment Framework (LEAF) method. LEAF testing is readily commercially available in Australia and should have been used to better estimate the leaching potential of the washery reject materials. LEAF testing comprises four laboratory test regimes to assess the long-term leaching potential for ranges of plausible:
    - pHs over 9 target pH ranges to address the efficacy of limestone amendments
    - Liquid to solid ratios (L/S) over 9 specific L/S intervals
    - Physical forms of the materials
    - Rates of leaching over time

    - Consequence: the concentrations of leachable pollutants by groundwater from the washery reject materials over time has likely been underestimated by the kinetic leach tests reported to date.

- Further uncertainties arise because the leach tests did not consider either the short or long-term impacts of:
    - Potential changes in reduction/oxidation (redox potential) that can result in increasing solubility of pollutants in coal
    - Dissolved organic matter that can result in increasing solubility of metals
    - Biological activity that can result in changes of redox and pH to impact the solubility of pollutants in coal

Lack of detail in the proposed groundwater monitoring program

- A program of monitoring groundwater quality was proposed by Hume Coal, but details of the monitoring program were not provided in reports available to me

- The report by Geosyntec did not describe details of methodologies and quality control procedures to ensure the reliability of results of monitoring. Consequently, early identification of the onset and extent of of pollution of groundwater or surface water during and after mining was not likely to be achieved

- In my opinion, identification of the onset of pollution is required to be implemented by monitoring from a comprehensive bore array and the use of statistical procedures to assess results of monitoring, together with the use of control charts, as set out in the ANZECC Water Quality Guidelines (endorsed by NSW EPA). Monitoring of groundwater quality is required to be commenced before mining and to continue during and after mining has ceased

- The large number of bores required to sample groundwater and the statistical procedures used to identify trends in groundwater quality should have been commenced by now and results made available for review

Reuse of coal washery reject materials

- No information I have reviewed has presented data that conclusively demonstrated coal washery reject materials placed in mined-out voids of the proposed Hume Coal mine would not allow ingress and egress of groundwater and to thereby result in pollution of groundwater over the long term

- A guiding policy of NSW EPA's "Coal Washery Rejects Exemption 2014" for reuse of coal washery rejects is that reuse of rejects should be made only when these materials are "…not applied in or beneath water, including groundwater"

- Although the Exemption may be waived by terms of an Environmental Protection Licence, issued under the POEO Act, there is no certainty that the EPA would permit placement of washery rejects within groundwater located in an area within the catchment of Sydney's principal water supply and where groundwater is used beneficially by multiple users

Uncertainties

- The consequences of multiple uncertainties relating to short- and long-term leaching of pollutants from coal washery rejects have serious implications to the quality of groundwater and surface water both during and after mining operations

- In some closed collieries, pollution of groundwater has been identified to increase after closure

- Pollution of groundwater and surface water, once commenced, is not readily controlled − particularly after mine closure. For example, pollution has been demonstrated to continue for decades as shown by numerous mines, notably the nearby closed Berrima colliery

- The significant contamination of groundwater identified at a number of operational and closed coal mines within the Sydney water catchment area, including the nearby closed Berrima colliery, provides good indications of the likely pollution of surface water and groundwater from the proposed Hume Coal mine, both during and after mining operations. It is noted that pollution of groundwater and surface water occurs even when coal washery rejects were not placed into mined-out voids

Summary

- Many uncertainties remain in relation to pollution of groundwater and surface water both during and after completion of mining operations proposed by Hume Coal
- The results of testing available to me relating to pollution of groundwater and surface water, both during and after mining proposed by Hume Coal, have not been sufficiently comprehensive or reliable and result in a high level of uncertainty
- There is a low level of confidence that pollution of groundwater and surface water similar to that reported at many coal mines in the Sydney Basin (e.g. Berrima and Clarence collieries) would not occur by the mining operation proposed by Hume Coal
- Review of the proposed monitoring of groundwater and surface water quality does not provide confidence that pollution of groundwater or surface water would be identified at an early stage at which time it would be easier to control pollution
- Pollution of water identified at a late stage of mining, or worse when the proposed colliery has been closed, is much more difficult or even impossible to control because of the very high cost. Such pollution may become more widespread or more intense so as to increase the risk of harm to the environment and/or to human health