

1 Q. Reference PUB-NLH-231: Please explain how the equipment at the neutral of the
2 converter station is protected from surge voltages resulting from lightning strikes to
3 the electrode line, particularly at Soldiers Pond. In the response, include:

- 4 • The risk of a breakdown across converter station insulation in such event
- 5 • The consequence of sustained arcing to ground from the neutral busbars
- 6 • How such a breakdown would be detected by the protection system
- 7 • The protective action that would be taken
- 8 • Whether the HVDC control system has been designed to automatically
- 9 minimise the current flow in the ground connection if the scheme is
- 10 operated with the neutral point connected to the ground mat.

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13 A. The protective levels of the equipment within the converter station are greater
14 than those on the electrode line. As a result, the electrode line should flashover
15 before the voltage gets to the protective level of the neutral bus.

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17 Comprehensive protection is provided at the neutral of the converter station - both
18 in terms of surge arresters and also control and protection. Converter neutral
19 equipment and equipment affected by these overvoltage protection levels are
20 selected to ensure a sufficient margin between the protective levels of the surge
21 arresters and the equipment itself. This is based on comprehensive fault studies
22 and not just catalogue selection of surge arresters.

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24 Any resulting fault, such as arcing to ground from neutral busbars, will be detected
25 by the converter's Common Neutral Area Protection (CNAP).

- 1 This protection acts by detecting differences in neutral area currents and then the
2 following actions occur:
- 3 a. Closing the Neutral Bus Ground Switch (NBGS) in bipole mode to allow
4 continued operation. Once the fault clears the NBGS can be reopened.
5 Whilst the NBGS is closed the converters are controlled to minimise the
6 injection of current into the ground mat to within acceptable limits.
 - 7 b. Transferring to monopole metallic return operation.