1   Q.   **References: Tab 6; Volume II: Terminal Station Asset Management Overview –**

2   **Version 3**

3   Page 19 of the report entitled *Terminal Station Asset Management Overview*

4   references moisture content within transformer oil.

5

6   When moisture is discovered in transformer oil samples is an investigation

7   undertaken to determine the likely cause of the moisture content. If so, please

8   describe the process.

9

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11 A.   A transformer typically contains a small amount of moisture when manufactured

12   and the amount increases as the transformer ages. This increasing moisture with

13   age is caused by the degradation of a transformer's cellulose-based insulation,

14   which is a chemical reaction that produces water.[1]

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16   If an abnormal amount of moisture is discovered in an oil-filled transformer the

17   corrective actions conducted depend on the suspected reason for the abnormal

18   amount. If moisture is suspected to have entered the transformer from the

19   environment, then corrective actions consist of a visual inspection of the

20   transformer to identify the moisture source and subsequent elimination of the

21   source. Examples of moisture sources are gasket leaks and saturated desiccant

22   breathers. If the moisture is suspected to be as a result of degradation of the

23   transformer cellulose-based insulation, corrective actions consist of identification of

24   the insulation degradation mechanism and execution of the appropriate mitigating

25   technique such as improved cooling, oil refurbishment, and moisture reduction.

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[1] The chemical respiration of cellulose produces water as per the following chemical equation: $C_6H_{12}O_6 + 6O_2 \rightarrow 6H_2O + 6CO_2$ where $C_6H_{12}O_6$, O_2, H_2O, & CO_2 is cellulose, oxygen, water, and carbon dioxide, respectively.

1   Moisture reduction, such as that achieved through the use of an online dehydration

2   unit or kidney loop system, is an appropriate corrective action as lowering the

3   moisture concentration slows the insulation degradation.