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COUNTRY :	GB	PREF. SUBJECT :	PS1
REGISTRATION NUMBER :		QUESTION N° :	Q4

HVDC transformers are typically installed outdoors adjacent to the main building, housing the HVDC converters and controls etc. Connections from the transformer to the converters are typically made using bushings mounted in the horizontal position in long turrets projecting through the wall of the main building. The same also applies to oil-immersed smoothing reactors used on some older HVDC interconnectors.

An alternative design, used on some HVDC interconnectors, is for the transformer to be positioned further away from the main building with the dc (valve) bushings in the vertical position. The connection to the converters is made using a short length of overhead line or busbar and a through wall bushing. This arrangement is slightly more complicated, requiring additional components and also more space. It does not seem to be as widely used as the arrangement described in the first paragraph

Recent operational experience has exposed a major risk with the use of bushings in the horizontal position in long turrets projecting through the wall of the building. In case of a bushing failure there is a significant risk of uncontrolled loss of oil from the transformer (or reactor) into the main building. Given the bushing failure will provide a source of ignition, there is a high probably of a fire inside the main building which will be difficult to control and extinguish.

Figure 1 shows a smoothing reactor, which experienced a bushing failure. The bushing failure resulted in uncontrolled loss of a large quantity of oil from the smoothing reactor into the main building. The oil caught fire, causing serious damage to the main building. Figure 2 shows some of the fire damage. Note that smoke damage was more extensive, resulting in the destruction of two of the converters.

Figure 1 Smoothing Reactor with Failed Bushing

Figure 2 Fire Damage to Main Building

Based on this experience, it is recommended that:

- This risk is eliminated from new HVDC interconnectors by using transformers with bushings in the vertical position and wall bushings to connect the transformer (or reactor) to the equipment inside the main building.
- On existing HVDC interconnectors the risk is reduced by use of bushing monitoring on the transformers. Owing to the lack of a significant ac voltage on the bushing, monitoring may not be as useful for smoothing reactor bushings.
- On existing HVDC interconnectors the risk is reduced by use of dissolved gas monitoring. Experience suggests that progressive failure of bushings results in a characteristic change in dissolved gas signature and can therefore also be detected in this way. Dissolved gas monitoring is especially useful for smoothing reactor bushings, where progressive failure is otherwise difficult to detect.