1. SCOPE

THIS SOP HAS BEEN SUPERSEDED BY SOP376 PLEASE REFER TO OPSAF-16-376.

This document details the application of SOP 2009/0365/00 issued by the Energy Networks Association. This is applicable to GEC Alsthom T&D Type FMJL CTs at system voltages of 132kV, 275kV and 400kV and FMVG CT/VTs at 33kV, 132kV, 275kV and 400kV.

2. ISSUE RECORD

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Issue Date	Issue No	Author	Amendment Details
24 July 2009	1	Kevin Butter	First issue
4 September 2009	2	Alastair Ferguson	Update with actions for SOP removal
17 March 2010	3	Alastair Ferguson	Section 5 added to include actions taken to investigate/remove SOP at each site.
May 2011	4	Alan MacGregor	Amendment to reflect NGC update to include FMVG CT/VTs and winter oil test results.
January 2012	5	Mark Stewart	Revision to supersede SOP365 with SOP 376 due to changes by NGT.

3. ISSUE AUTHORITY

Author	Owner	Issue Authority
Alan MacGregor Lead Engineer	Alastair Ferguson Asset Risk Engineering Manager	Jeff Hunt Head of Asset Management  pp……

4. SOP DETAILS

Equipment Type:	GEC Alsthom T&D Type FMJL "live-tank" current transformers (132kV, 275kV & 400kV) and FMVG CT/VTs (33kV, 132kV, 275kV and 400kV)
Originating organisation:	National Grid
DATE:	7 July 2009
Number installed in SPEN (Scotland)	FMJL - 123 Total (41 x 3-phase sets) 21 x 400kV 51 x 275kV 51 x 132kV FMVG – 6 total (2 sets) 6 x 132kV
Number installed in SPEN (England & Wales)	FMJL - 69 Total (23 x 3-phase sets) 69 x 132kV FMVG – 33 total (11 sets) 33 x 132kV
Reason for SOP:	Disruptive failures of two FMJL CT's in National Grid: 1(i) 275kV FMJL CT at Cardiff East substation on 3/6/09 (DIN 2009/0046/00 refers) 1(ii) 400kV FMJL CT at Deeside substation on 29/6/09 (DIN 2009/0062/001 refers)
Status of SOP in initiating organisation:	2(i) A 75m exclusion zone has been applied around all FMJL CTs and 20m at 33kV FMVG CT/VTs where the measured moisture content is equal to or greater than 25ppm (when measured in Summer months >12^{o}C) or 16ppm (when measured in Winter months <12^{o}C). 2(ii) Entry into any exclusion zone is restricted to essential work only.
SPEN application of SOP:	3(i) An exclusion zone shall be applied to all FMJL CTs. This exclusion zone shall extend to 75m in all directions around the affected CTs (20m around 33kV FMVG CT/VTs) where the measured moisture content is equal to or greater than 25ppm (when measured in Summer months >12^{o}C) or 16ppm (when measured in Winter months <12^{o}C).

3(ii) In every case, entry into the exclusion zone shall be agreed with the OCC (Kirkintilloch) or NMC (Prenton) immediately before entering the exclusion zone.

3(iii) Entry into the exclusion zone shall be restricted to essential operational activities**.**

3(iv) In cases of severe weather (e.g. lightning, high winds, heavy rain etc.) due consideration shall be given to the increased risk of a system fault and how this may present a hazard to persons inside the exclusion zone.

3(v) When passing through any exclusion zone (e.g. access to control rooms, 33kV switchrooms etc.) the time spent in the exclusion zone shall be kept to a minimum.

3(vi) Work within an exclusion zone shall be agreed with the Transmission Operations Manager (or 132kV Operations Manager in England & Wales) or their authorised delegates. The time spent inside the exclusion zone, other than that managed under 3(vii) below shall be restricted to 30 minutes per day (maximum 2½ hours per week).

Entry into the exclusion zone for longer durations than 30 minutes per day (maximum 2½ hours per week) shall only be authorised by the Transmission Operations Manager (or 132kV Operations Manager in England & Wales) or his authorised delegate. In such circumstances, **Risk Management Zone** procedures shall be implemented in accordance with OPSAF-04-026 and appropriate risk mitigation measures shall be taken. Such measures may include de-energisation of affected equipment, provision of protective barriers or additional testing regimes to verify the health of all FMJL CTs and FMVG CT/VTs as considered appropriate.

ADDITIONAL INFORMATION

The following sites are affected by this SOP:

Scotland

- Easterhouse (1 set)
- Glenlee (11 sets)
- Kilmarnock South (2 sets)
- Mossmorran (4 sets)
- Newarthill (3 sets)
- Newton Stewart (2 sets)
- Smeaton (10 sets)
- Strathaven (5 sets)
- Wishaw (1 set)
- Fife Energy (1 set FMVG)

England & Wales

- Bootle (1 set)
- Burlington Street (1 set)
- Chester Main (1 set)
- Connahs Quay A (13 sets)
- Shell Thornton (5 sets)
- Shotton Paper (2 sets FMJL and 4 sets FMVG)
- Salt Union (1 set FMVG)
- Carrington (4 sets FMVG)
- ICI Wade (1 set FMVG)

- Cellarhead (1 set FMVG)

Risk Assessments have been completed on a site-per-site basis to evaluate the risk to SPEN staff, contractor, members of the public and other third parties. Warning notices have been posted at the entry to all sites to alert authorised persons that this SOP is in force and that OCC shall be notified to seek permission to enter the site.

UPDATE:

8th September 2009. Following investigation, the reasons for the NGC failures are now understood and in line with information published in ENA DIN 2009/0062/02 this SOP may be removed from affected FMJL CTs provided the following checks have been completed and the results are satisfactory;

- Pressure gauge indications show no significant change and the gauges shall be at or lower than the values stated below:-
  - 0.47b(g) for 400kV
  - 0.42b(g) for 365kV (EERH, NEAR, WISH)
  - 0.35b(g) for 275kV
  - 0.25b(g) for 132kV
- Oil samples have satisfactory DGA results as detailed in the table below extracted from NGC Document TGN(E) 111,
- Oil level indicator in the normal range,
- Visual inspection of the CT termination box earth connection shows the connection to be sound. (PF Test Terminal)

REMEDIAL ACTION: As detailed above.

Category	Hydrogen (H_2) /ppm	Acetylene (C_2H_2) /ppm	Ethane (C_2H_6) /ppm	Methane (CH_4) /ppm	Ethylene (C_2H_4) /ppm	Moisture (H_2O) /ppm
Category 1	> 1000	> 10	-	-	-	Under consideration Inform Asset Engineering
Category 2	500 to 1000	2 to 10	> 500	> 200	> 100	
Category 3	300 to 500	0.3 to 2	50 to 500	30 to 200	10 to 100	
Category 4	< 300	< 0.3	< 50	< 30	< 10	> 40
The result with the worst category should be taken						

Table 3: Action Required Following Oil Sampling of Oil Impregnated Paper Instrument Transformers

Category 1: Remove From System

Equipment that falls into Category 1 has dissolved gas analysis results that indicate a major fault is highly likely and that the equipment should be removed from service and replaced. If for urgent operational reasons, the equipment needs to be returned to service prior to replacement then a risk management zone should be considered.

Category 2: Controlled Maintenance

Equipment that falls into Category 2 has dissolved gas analysis results that cause concern. For equipment that only has one gas that falls into category 2 limits, the basic maintenance interval will be reduced from 6 years to 3 years and oil sampling will be performed every 3 years.

If more than one gas value falls into category 2, it is recommended as a minimum that the equipment will have RFI and thermovision surveys every three months and oil re-sampled after one year. After the second sampling, an assessment of the instrument transformer condition should be made as to the appropriate maintenance requirements. At this point it may be necessary to consult a technical specialist.

Category 3: Enhanced Maintenance

Equipment that falls into category 3 has been placed in this category as there is a concern with the equipment. Oil sampling on the equipment shall be reduced to 6 yearly intervals. The basic maintenance interval will remain at the normal 6 years.

Category 4: Normal Maintenance

Equipment that falls into this category is considered normal. If the equipment has passed its early life period, an oil sampling interval of 12 years for equipment will apply and the basic maintenance interval shall be 6 years. The maintenance pattern in this category should line up with that shown in the maintenance interval database (TP110).

5. SOP INVESTIGATION / REMOVAL DETAILS

SITE STATUS:

- **Easterhouse (1 set)** **Access restrictions to be removed**

  Oil sampling completed – results checked. One of the CT''s falls into category 2 due to one high level gas. The other two are in Category 3. With only one gas in category 2 the CT's require to be oil sampled every 3 years as per SOP365.

  Gauge checks to be carried out prior to commencement of work on the site.

- **Glenlee (11 sets)** **Access restrictions to be removed**

  Oil sampling completed – results checked. Nine of the CT''s fall into category 2 due to one high level gas. The others are in Category 3 / 4. With only one gas in category 2 the CT's require to be oil sampled every 3 years as per SOP365.

  Gauge checks to be carried out prior to commencement of work on the site.

- **Kilmarnock South (2 sets)** **Access restrictions to be removed**

  Oil sampling results indicate the CT's fall into Category 3.
  Gauge checks to be carried out prior to commencement of work on the site.

- **Mossmorran (4 sets)** **Access restrictions to be removed**

  Oil sampling results indicate the CT's fall into Category 4.
  Gauge checks to be carried out prior to commencement of work on the site.

- **Newarthill (3 sets)** **Access restrictions to be removed**

  Oil sampling results indicate the CT's fall into Category 3.
  Gauge checks to be carried out prior to commencement of work on the site.

• **Newton Stewart (2 sets)**	**Access restrictions to be removed** Oil sampling results indicate the CT's fall into Category 3. Gauge checks to be carried out prior to commencement of work on the site.
• **Smeaton (10 sets)**	**Access restrictions to be removed** Oil sampling results indicate the CT's fall into Category 4. Gauge checks to be carried out prior to commencement of work on the site.
• **Strathaven 275kV (2 sets)**	**Access restrictions to be removed** Oil sampling results indicate the CT's fall into Category 3. Gauge checks to be carried out prior to commencement of work on the site. *(there is a set of FMJL CT's associated with L25 which are switched out at present following de-commissioning of the Linnmill circuit – these CT's have not yet been sampled)*
• **Strathaven 400kV (5 sets)**	**Access restrictions to be removed** Oil sampling results indicate the CT's fall into Category 3 and category 4. Gauge checks to be carried out prior to commencement of work on the site.
• **Wishaw (1 set)**	**Access restrictions to be removed** Oil sampling completed – results checked. One of the CT"s falls into category 2 due to one high level gas. The other two are in Category 3. With only one gas in category 2 the CT"s require to be oil sampled every 3 years as per SOP365 Gauge checks to be carried out prior to commencement of work on the site.

6. SOP HEADER

Field Name	Field Value	
Name (SOP369)	**SOP365 GEC Alstom FMJL CTs and FMVG CT/VTs**	
The reason for the Operational Restriction	**Disruptive failure of CTs**	
Nature of the Operational Restriction	**Risk Management Zone Applied to CTS**	
Comments	Failure of CTs due to moisture. RMZ applied where moisture levels found to be equal to or greater than 25ppm (measured at >12^{o}C) or 16ppm (measured at <12^{o}C)	
Restricted Access to Substation Flag	Yes	
Search Criteria	Switch type = FMJL Current Tx type = FMVG Trans Voltage Tx type = FMVG Wound Trans	