Network Asset Secondary Deliverables (NASD) Rebasing

February 2017 re-submission

Electricity North West Limited

Contents

1. Introduction 3
2. Scope 4
3. Process 4
4. Data set establishment 6
5. Intervention methodology 15
6. PoF and CoF values 25
7. Summary of Tests 26

Appendix A Test Results 32

1. Asset Class – LV Switchgear and Other 32
2. Asset Class – EHV UG Cable (Gas) 33
3. Asset Class – EHV OHL Fittings - Tower 34
4. Asset Class – EHV OHL Conductor (Tower Lines) 35
5. Asset Class – 132kV OHL Support - Tower 36
6. Asset Class – 132kV Fittings (Tower Lines) 37
7. Asset Class – 132 kV Conductor (Tower Lines) 38
8. Asset Classes Not Used 39
9. Annex 1 - calibration 40
10. Annex 2 – Model date creation 42

1. Introduction

1.1. As part of our Well Justified Business Plan submission for RIIO-ED1, we submitted to Ofgem a copy of the Network Assets Workbook (NAW), which set out the associated Secondary Deliverable output targets for the RIIO-ED1 period. That document was based on our then-current methodology of Condition Based Risk Management (CBRM) and showed the movement in asset health and hence risk as a result of our proposed investment plans. In accordance with the requirements of Standard Licence Condition 51 we have subsequently worked to develop the Common Network Asset Indices Methodology and restate our original Network Asset Workbook using the Methodology (Version 1), as directed.

1.2. This commentary provides information as to the manner in which the restatement of the NAW (Network Asset Workbook) has been carried out and the results of the test regime to show that the licence requirement that the resubmission be equally stretching has been achieved.

1.3. Following the bilateral meetings between Ofgem and the DNOs held in early January 2017 a series of revisions have been agreed and implemented in the revised rebasing as instructed by Ofgem. In addition, Supplementary Question references ENWL-008, 009, 011, 013 and 014 are addressed and answered in this revised commentary.

1.4. As a result of the instruction to revise the methodology and notwithstanding the need for SLC 51 Part I change control process to be completed we have;

- Reviewed and corrected all references to Towers to match the RIGs Annex A definition in the resubmission (SQ ENWL-008);
- Incorporated the PoF and CoF value changes for Towers and Oil Filled Cables (SQ ENWL-009);
- Corrected the Average PoF and CoF values in the Network and Monetised Risk Asset workbooks to match the requirements of the Common Network Asset Indices Methodology Table 6 and accompanying text (SQ ENWL-011);
- Provided an explanation as to the application of Reliability Factors in our Restatement and the impact of these on Asset PoF (SQ ENWL-014);
- Generally revised the reporting of the equally stretching tests as a result of the required changes to PoF and CoF values. Further we have generally revised the format of the commentary test results as required in (SQ ENWL-013);
- More widely the overall commentary as required by the revised submission has been reviewed and amended; and
- We have also incorporated the responses to SQs ENWL-001 to ENWL-007 as previously provided into the commentary.

1.5. The following are covered in the commentary and include the outputs of this process:

a) A description of the generic manner in which we have approached the restatement;

b) An explanation of the rationale behind the use of a data set created in September 2016, rather than historic data or the 2014/15 equivalent;
c) The methodology used to adjust the original NAW volumes as set at the Final Determination;
d) An explanation of any variances to the generic methodology as stated on an asset type by asset type basis;
e) An explanation for assets where no asset risk delta has been declared as a result of the restatement;
f) An asset type by asset type description of any variance between the generic methodology and the methodology adopted;
g) Summary results of the impact of the restatement;
h) The Network Asset Workbook (NAW) rebasing of the RIIO-ED1 settlement based on CNAIM;
i) An updated version of the Monetised Risk Workbook; and
j) This document as the NAW supporting commentary.

In addition to the requirement to resubmit the Network Asset Workbook and associated supporting documentation, we are also required to resubmit the Secondary Deliverables Reporting Pack and associated supporting documentation. As this is covered by a separate licence condition and specified in Annex D of the RIGs, this is not included in this commentary.

2. Scope

2.1. This document provides a commentary to the rebasing of the Network Asset Workbook as directed by Ofgem to take place by 30 December 2016 and then corrected following Ofgem discussions for submission on 01 February 2017.

2.2. Scope covered:

a) The methodology to restate the NAW;
b) Selection of Interventions where these differ from the published NAW;
c) Results of the application of specified tests 1 to 3, including evidence to show compliance or otherwise;
d) Specific issues on the restated NAW and Secondary Deliverables Monetised Risk (SDMR) files; and
e) A commentary on the use and impact of the Reliability Factor and the use of Collars.

2.3. Scope not covered:

a) The Secondary Deliverables Reporting Pack (SDRP) and associated commentary.

3. Process

3.1. We have commissioned the 25 Common Network Asset Indices Methodology models within our IT system. This includes a data management element through which we are able to map our asset condition data (observed, measured and reliability) to the inputs of the Common Network Asset Indices Methodology incorporating the facility to calibrate (See Annex 1) the

strength of the input data in a many to one situation. In this way we are able to ensure that an input for a major or minor defect is treated in a manner which avoids the asset being intervened (replaced or refurbished) upon for a lesser issue which is best treated by repair.

3.2. We have prepared a data set based on a download of asset data created in the middle of September 2016. This provides us with the most complete data set available to use. The data set has been loaded into the model and forms the basis of our restatement. As the data set is one year, five months and two weeks newer than the 01 April 2015 start point, we have adjusted the age of the assets within the model to reflect the asset age that would have been observed at the beginning of the period. We have done this by adjusting the date created within the model, thus the modes calculation of age returns the asset age as at 31 March 2015. We have also 'aged' historic data points to the 31 March 2015 position, rather than the date of model creation in September 2016.

3.3. Once the data was used to populate our modelling suite we then carried out adjustments of the results so as to as accurately as possible reflect the starting position (1 April 2015) of RIIO-ED1 together with the mid and end-points of the RIIO-ED1 period, thus creating the "Without Intervention" profiles.

The figure below illustrates how we achieved the "without intervention position". The key positions are:

- Point A1 represents the risk value as a result of loading the data and adjusting for the assets' age to the start of RIIO-ED1 (1 April 2015).
- Point A2 represents point A1 adjusted for the actual number of assets connected to the network at FY16 total asset count (31/03/2016).
- Point A3 represents point A2 value post-adjustment for assets which have been replaced, refurbished, fully decommissioned (with no replacement or added to the network) since the beginning of RIIO-ED1 - FY15 total asset count (31/03/2015).

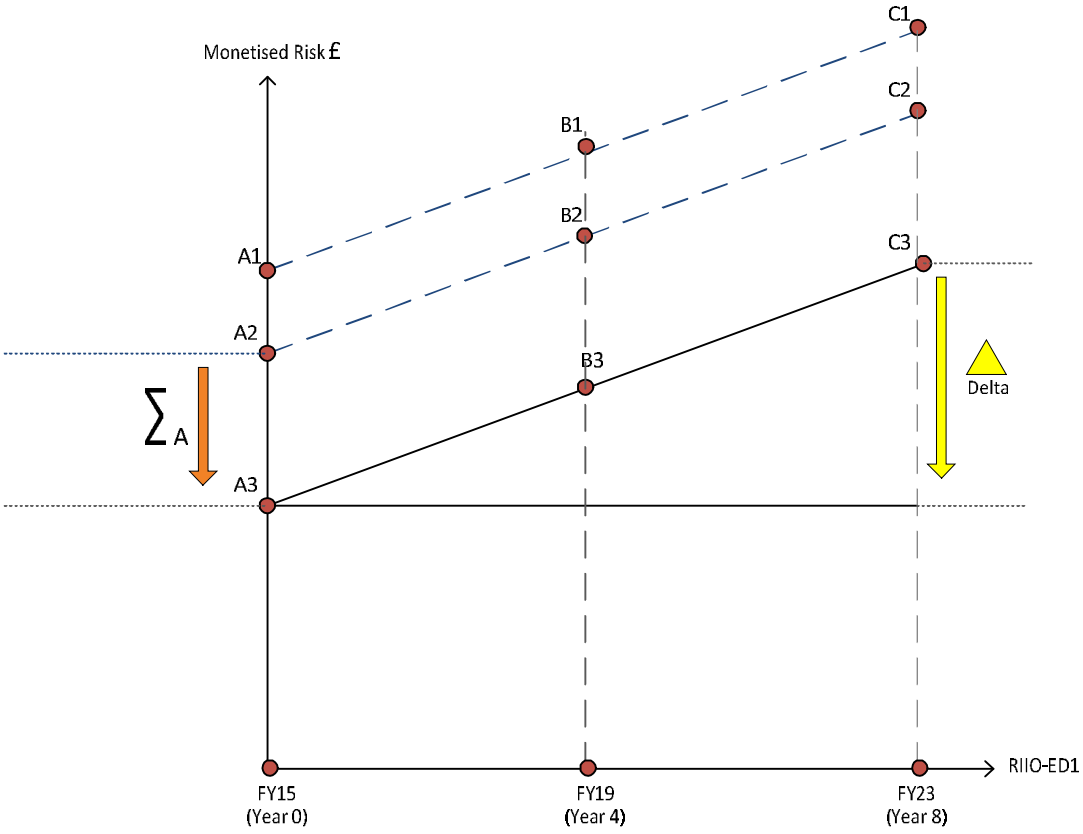


Figure 1 – Concept of asset volume adjustment for NAW restatement

The difference between the A1 and A3 points are a "constant" in the data volume variation and is therefore incorporated into the mid-point Year 4 (B1 – B2 – B3) and at the end of RIIO-ED1 year 8 (A3 – B3 – C3) and complete the "without intervention" line.

The "with intervention" line is created by completing the NAW workbook (NAW tables NAW3, NAW4 and NAW7) which acts on the "without intervention" volumes and hence creates a risk delta, between the two positions. We have attempted to match the original intervention profiles in our original resubmission as close as possible as the revised asset profiles permit.

4. Data set establishment

4.1. In section 3 we outline the process by which we have restated the NAW and hence the SDMR. Below is a more detailed explanation of how we have made the necessary adjustments to our September 2016 data sets to achieve the values in the NAW and hence achieve the starting point for RIIO-ED1.

Calculation of the New 2015 Starting Position

4.2. In order to replicate the 2015 starting position, the CNAIM models were run in September 2016 with the model date set to 31 March 2015. This can only be enabled by EA Technology Limited (software supplier) as this is not an attribute that can be set by the user. Our assurance process for this activity is as below:

4.3. Within the CNAIM models, a ‘Properties’ function is provided which has appropriate security measures to prevent users making changes without proper authorisation. This is currently locked and only EA Technology Ltd has access due to the sensitivity of this parameter.

4.4. The field marked “Asset Base Data” is the date value from which all calculations associated with Age are made. The screenshot below illustrates that the data cut as at “September 2016” was loaded to the model in “November 2016”. Under normal operation, the Asset Base Data is equal to the Latest Date Data date, i.e. date of the data load.

4.5. As can be seen in Figure 2, the Asset Base Data has been set to the required date representing the end of DPCR5 in accordance with the requirement stipulated in the NASD Rebasing and Assessment Methodology Document.

4.6. The ‘Properties’ function for all models in the CNAIM software suite have been checked by two persons and verified that the Asset Base Date is set to 31 March 2015.

The screenshot below has been taken from our CM5 model HV Switchgear (GM) Primary model.

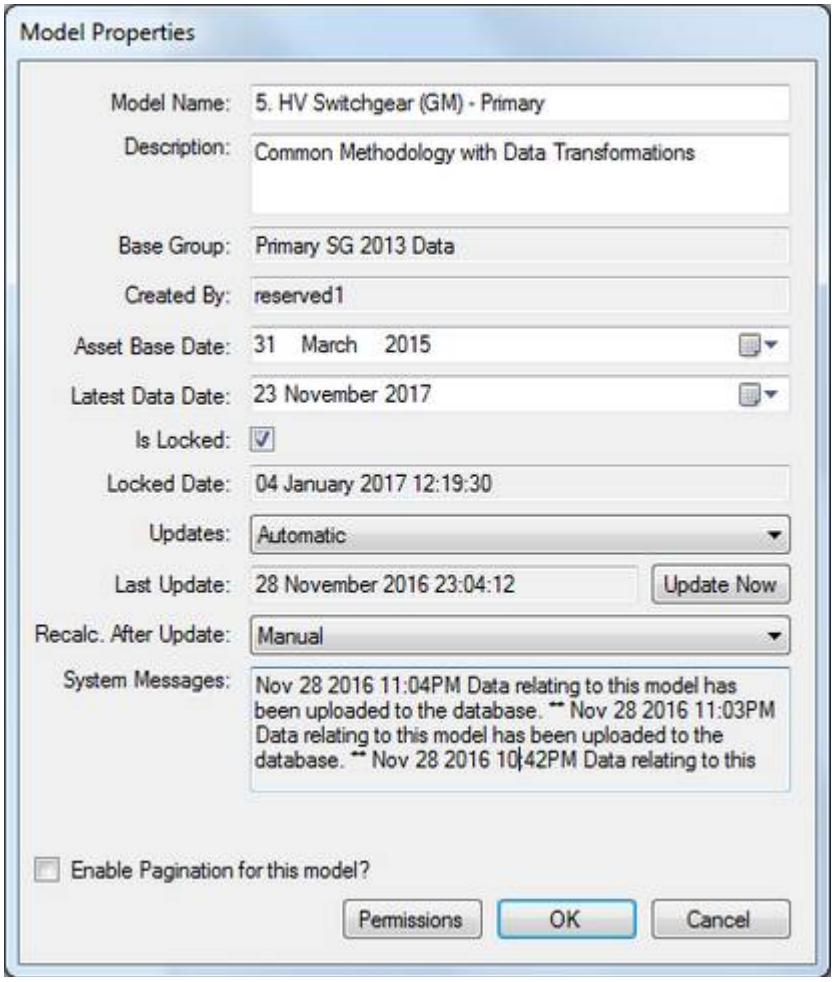


Figure 2 – Common Network Asset Indices Methodology Models Property, demonstrating the setting of the model age.

Data Age

4.7. For consistency, the data set fed into the model also needs to replicate how it would have presented itself at 31 March 2015, not September 2016.

4.8. At the time of any model creation, the condition data used is historic and so does not exactly represent the condition of the assets as they would present themselves on the date of model build (it will always be lower due to the time difference between data collection and model build – the assets will have deteriorated further in that time). As a consequence, the historic condition records have to be 'aged' (See Annex 2 for additional information) on this process to make them contemporary with the date of model construction.

4.9. CBRM practice is to identify the average age of the input condition data and use that to age the whole input data set. For example, the condition records for an asset set will range from days or weeks old to several years due to cyclic inspection practices. If the average age of the recorded condition data is three years old, then all condition data points will be aged by three years to represent the current 'as found' condition of the assets.

4.10. In order to replicate the asset data that we had as at 31 March 2015, the following process was followed:

- The average age of the data set was identified by asset type,
- This data was then adjusted to represent the asset data as at 31 March 2015, not September 2016.

4.11. In the example above (with average three year old data), the data set would be aged by 17 months, not three years.

Asset Inventory

4.12. As this data set will still include assets which have been added, replaced or decommissioned since 31 March 2015, these need to be adjusted for before a final base position can be established.

4.13. The matrices for the data set are generated using the model and then manually amended to take into account the issues as described below.

<u>Decommissioned Assets</u>

4.14. Any asset which has been decommissioned and not replaced since 31 March 2015 was added back into the matrix. We use the last known condition data in our CBRM model to inform the starting profile (off-line spreadsheet) used for calibration to determine the asset's position at the beginning of the period. These assets are added back into the data set of the 5x4 matrix. In many cases, it is not possible to determine the criticality band and a default assumption is that all decommissioned assets occupied Criticality Index (CI) band 2 this is further explained below.

4.15. The data required to complete the Common Network Asset Indices Methodology model and hence complete the NAW are held in two data systems, for point assets (circuit breakers, transformers etc.) our asset register is known as Ellipse and for linear assets we use a GIS system supplied by Autodesk.

Ellipse Process

4.16. The Ellipse database is a real-time system and we do not hold historical data beyond the time scales to overwrite one version to the standby version. This occurs several times per day. When an asset on our network where the data is held in Ellipse is decommissioned the base data associated with the asset is retained. This generally is associated with maintenance records and data required to ensure compliance with environmental and waste management. Even if the data required by CNAIM had been in existence at the time the asset was decommissioned, virtually all of it required to initiate a change in the Criticality score and banding beyond that of the average is lost as part of the routine for establishing the asset as decommissioned. As there is no data to modify the Criticality score, we have defaulted historic decommissioned assets to a C2 criticality score.

GIS Process

4.17. In our GIS system (which has a similar system for backing up data as that of Ellipse) we again retain the decommissioned asset in the database so that it's last known position can be shown on the visualised record. In the case of linear assets, we have not historically held data which has become a requirement for CNAIM, although we have in the last 12 months been undertaking the population of said data for active assets, mainly where this is held in off line data bases. As a consequence we have also defaulted historic movements to the C2 band in the absence of any other appropriate modifying data.

Asset Replacement

4.18. Any asset that has been replaced in the period has been identified in terms of its criticality band. The original asset has been assumed to occupy the same position at 31 March 2015.

4.19. In selecting which Health Index[1] (HI) Band the asset belonged to we used the last set of asset data pre-intervention to model the likely Health Score[2] of that asset pre intervention. This data was taken from our CBRM models and converted to the CNAIM inputs thus allowing an approximation of its position in the CNAIM matrix, pre-intervention to be made. We anticipate that the majority of these assets would originally have been in CNAIM HI band 4 and 5 positions and this permits an approximation of the asset position to be determined.

4.20. We then populate the total asset intervention number to the matrix based on a conversion factor from their position in our CBRM models to that of the CNAIM and remove the corresponding volumes from the HI1 band of the matrix.

4.21. The Common Network Asset Indices Methodology uses the same methodology to calculate asset health as CBRM. By adjusting the CBRM health calibrations of the K and C factor together with the Expected life of the asset it is possible to approximate the value of Health Score in the Common Network Asset Indices Methodology tool to that in CBRM. This technique was used to convert the asset position between Common Network Asset Indices Methodology and CBRM, using the HI bandings in the Common Network Asset Indices Methodology rather than the bandings in our original NAW submission.

[1] The Health Index is the value assigned to the asset when grouped into the 5x4 reporting matrix as used in the NAW and associated reporting documents. The asset's Health Index is dependent upon its Health Score. The expression 'Health Index' is defined in the DNO Common Network Asset Indices Methodology glossary, page 10.

[2] The Health Score is generated by the Common Network Asset Indices Methodology model and is as defined in the glossary of the DNO Common Network Asset Indices Methodology V1 on page 10

4.22. In essence, we model the asset movement of the replaced asset in the CBRM model and then translate this across to the relevant cell in the CNAIM matrices.

Asset Refurbishment

4.23. For these volumes we will use the same approach as asset replacement above to determine the magnitude of the CI and HI values, except that the assets may have been removed from the whole profile.

New Assets

4.24. These will be identified and removed from the appropriate cells in the created matrix.

2015 Outputs return cross-check

4.25. The final check is to ensure that the total inventories by Health Index category align to those reported as the DPCR5 closing position in the 2014/15 Network Outputs return. This takes account of any data cleanse or other similar adjustments.

4.26. After adjusting for the data age and reconciling post 31 March 2015 movements, copies of the matrices generated by the modelling software are copied to the NAW hence creating the new 2015 starting position. An example screenshot from the CNAIM software is shown in the figure below.

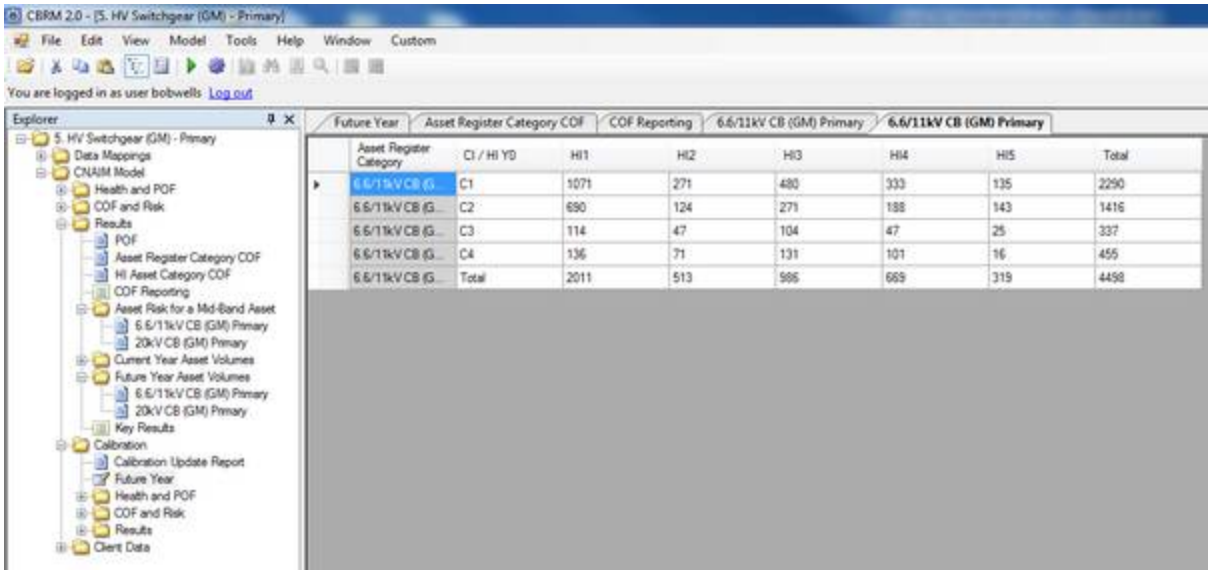


Figure 3 - Typical year 0 (RIIO-ED1 origin) data matrix generated by the CNAIM models

4.27. Having established the start point for the RIIO-ED1 period we have then used the following methodology to establish the future year's profiles "without Interventions".

Projection of 2023 Positions Without Investment

4.28. To generate the predicted 2019 and 2023 positions, the models are aged by an appropriate value. As the data age has already been adjusted to determine the origin for the RIIO-ED1 period (1 April 2015) these aging values are as follows:

2019 $Y_n = 4$ and for 2023 $Y_n = 8$.

4.29. Once the data has been aged, this produces the appropriate forecast matrices, with a representative view of deterioration. However, these matrices will also still contain the replaced, refurbishment and decommissioned assets discussed in item 4.1 above which need to be separately removed from the matrices.

4.30. In addition, we also need to correct for the deterioration of the assets included in the data set which have been already identified as being created since the start of RIIO-ED1. These effects are adjusted for using the same process as outlined above.

Asset Deterioration

4.31. Where New or Decommissioned assets are removed from the matrix at 2019 and 2023, the effect of deterioration will be negligible and we have ignored their effect.

4.32. For assets which have already been refurbished in the RIIO-ED1 period, ageing the models forward to 2023 will impact on the overall deterioration rate seen by the model as the assets are being deteriorated from their post- rather than pre-intervention state. We have adjusted for this where appropriate in the models.

4.33. Matrices generated by the CNAIM modelling software and adjusted in accordance with the methodology above are used in NAW hence creating the 2019 and 2023 without investment values. Screen shot examples are shown in the figures below.

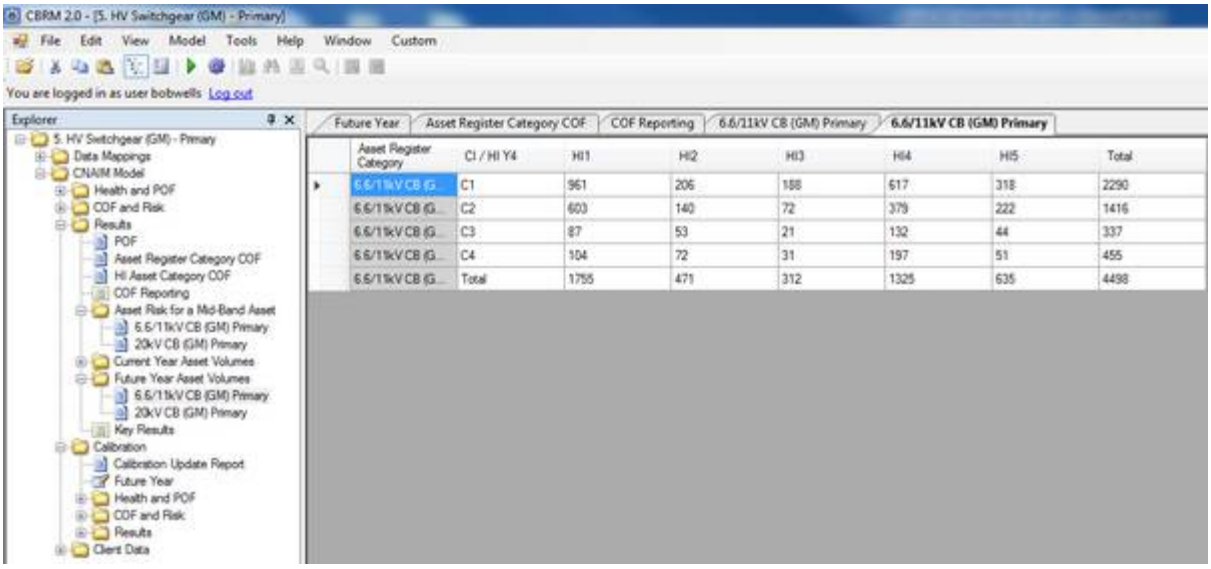


Figure 4 - Typical year 4 (2019) data matrix generated by the CNAIM models

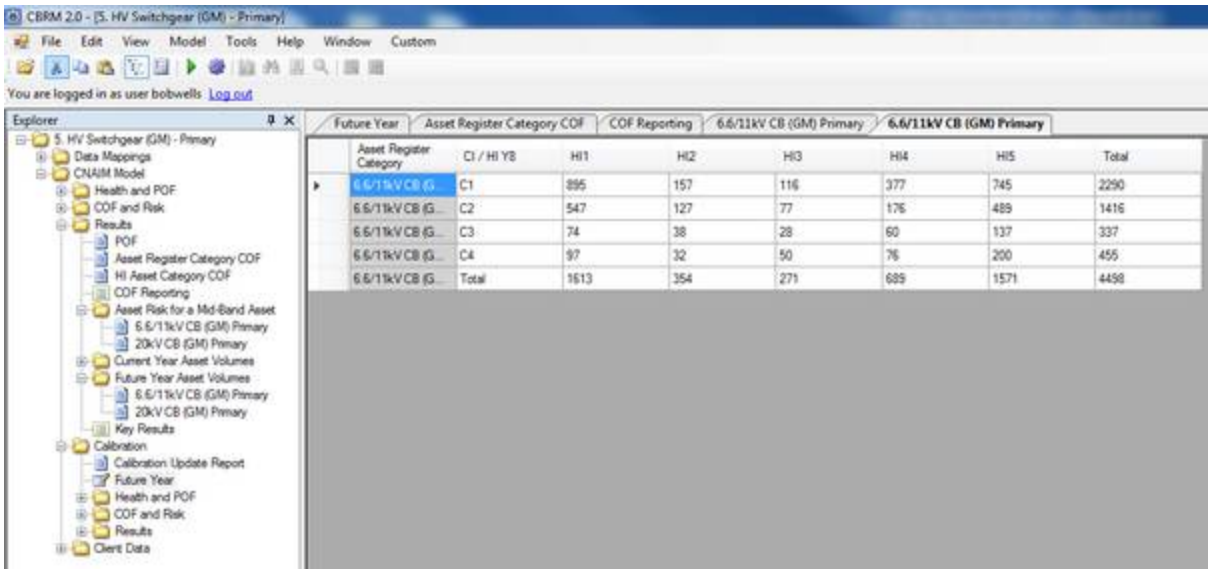


Figure 5 - Typical year 8 (2023) data matrix generated by the CNAIM models

Application of Reliability Factor and Collars

4.34. We have applied reliability factors and/or collars to assets associated with switchgear and transformers as appropriate. The specific asset groups where these have been applied are shown in figure 6. We have adopted our approach to Reliability factors as developed and used in our CBRM models since 2008, but adapted to match the Common Network Asset Indices Methodology scaling. In CBRM our scale is 1.0 to 2.0. In Common Network Asset Indices Methodology the scale is 0.6 to 1.6. We have chosen to adopt a scale of 1 to 1.6 as none of the reliability factors used in CBRM would produce an improvement in the PoF of the assets. We have applied a straight line conversion factor such that 1 = 1 and 2 = 1.6. This is applied by asset family type to the entire affected populations.

4.35. We have only applied collars to specific switchgear families associated with Distribution plant. by adopting the following approach:

- If the asset can be refurbished so as to remove the reliability issue, Health Score collar is set to 6.5 (HI=4).
- If the asset **cannot** be refurbished such that the only possible intervention to remove the identified problem is to replace the asset, the Health Score collar is set to 8 (HI=5)

4.36. Figure 6 shows the impact of the application of reliability factors on the Probability of Failure when an asset has a reliability factor applied. The impact of the application depends on the value of Health Score calculated prior to the application of that factor. As ann example, without the factor the asset might have a score in HI Band 1, but as a collar of 8 is applied the asset will move to HI Band 5. The impact of the application of the reliability factor is to impact the position in the matrix by moving the asset from a lower value of HI to a higher value and hence increasing the value of monetised risk.

4.37. As stated in the methodology, the order of calculation is key to the process of calculating the Health Score and hence PoF with the reliability factor being applied last in this calculation series. The calculation produces a Health Score which is then used to calculate the PoF using equation 1 of the methodology.

4.38. The actual PoF assigned to an asset post application of the reliability factor and any collar will be dependent upon the Health Score as calculated prior to its addition to the calculation. It is therefore possible for an asset with a very low PoF (HI1) if no Reliability Factor is used becoming a HI5 if a Reliability collar of 8 is applied. Conversely, for an asset with a high Health Score, the application of the Reliability factor results in no change. Figure 6 illustrates for the six asset classes how the assets move within the matrix where a reliability factor is used and as such the impact on the monetised risk values can be seen.

4.39. Reliability factors represent an increased probability of failure due to knowledge associated with the asset type. This data is collated from sources such as the Electricity Networks Association Defects data base, Issue of Dangerous Notifications; National Defect Reports; Suspension of Operational Practice notices; Manufacturer's defect reports, Post incident investigation reports and internal defects found during maintenance. These data sources are assessed by an expert internal panel of engineers to determine the severity of the potential failure and a reliability factor appropriately assigned.

4.40. Collars are only assigned to assets where there is a programme of defect rectification required. We currently have programmes associated with three asset families. Of these, two asset family types have collars of 8 applied; one due to the nature of the failure which can only be remedied by the replacement of the circuit breaker element of the device and one where it has been shown to be cost effective to replace the plant rather than refurbish it due to the nature of the refurbishment requiring the removal of the plant from site to a factory environment.

4.41. One family of assets has a collar of 6.5 applied as it is possible to carry out a refurbishment which will remove the higher levels of in service failure risk. This is akin to a full factory refurbishment although due to the design of the plant it can be accomplished on site.

4.42. In the case of the assets collared at 8, the installation of the new plant removes the old asset and hence creates a delta in Common Network Asset Indices Methodology. In the case of the assets collared at 6.5 the refurbishment activity triggers the Common Network Asset Indices Methodology model (through our data mapping software) to remove the collar for that individual asset.

6.6/11kV CB (GM) Primary	HI1	HI2	HI3	HI4	HI5	Total
WITHOUT	2831	1254	227	61	79	4452
With	1944	500	788	755	465	4452
Asset Movement Due to Reliability	-887	-754	561	694	386	0

HV Switchgear (GM) - Distribution	HI1	HI2	HI3	HI4	HI5	Total
WITHOUT	20983	7144	999	173	897	30196
With	14342	6237	1509	6554	1554	30196
Asset Movement Due to Reliability	-6641	-907	510	6381	657	0

EHV Switchgear (GM)	HI1	HI2	HI3	HI4	HI5	Total
WITHOUT	1420	288	50	23	15	1796
With	887	519	260	88	42	1796
Asset Movement Due to Reliability	-533	231	210	65	27	0

132kV CBs	HI1	HI2	HI3	HI4	HI5	Total
WITHOUT	137	28	3	7	3	178
With	128	19	17	6	8	178
Asset Movement Due to Reliability	-9	-9	14	-1	5	0

33kV Transformer (GM)	HI1	HI2	HI3	HI4	HI5	Total
WITHOUT	467	141	70	28	7	713
With	314	172	109	61	57	713
Asset Movement Due to Reliability	-153	31	39	33	50	0

132kV Transformer (GM)	HI1	HI2	HI3	HI4	HI5	Total
WITHOUT	97	27	23	7	8	162
With	89	24	22	18	9	162
Asset Movement Due to Reliability	-8	-3	-1	11	1	0

Figure 6 – Impact of the use of Reliability Factor on the Asset Risk position as at 31 March 2015

5. Intervention methodology

5.1. In producing the rebased Network Assets Workbook we have taken into account a number of factors when developing our submission, which constitute a significant change from the original submission. These are:

- Changes to the HI bandings and associated values of the 5x4 matrix cells mid points;
- Changes to the method of calculating the distribution of Criticality as a result of adopting the Common Network Asset Indices Methodology over our previous CBRM method;
- Replicating the original intervention strategies as closely as possible, whilst applying the specified equally stretching Test 1;
- The requirement to meet Test 3 and therefore target assets in the HI3 -5 bands whilst not overly targeting the HI2 band; and
- The requirements of Test 2 – volumetric test.

5.2. As a result of these changes we have adopted an intervention strategy which permits Test 1 to be passed for both asset replacement and refurbishment independently of each other. This has resulted in our passing the test for all assets except as detailed in section 7 of the commentary. In adopting this revised strategy we also needed to ensure that we met Test 2 (volumetric test).

5.3. In selecting our assets for intervention we have adopted a sequential approach to asset volume selection and therefore overall we have not double targeted assets. This means that if the number of assets in a HI cell is 100 and we have targeted 60 as asset replacement we have not exceeded a value of 40 in the asset refurbishment tables, and hence we have adopted a sequential intervention strategy as outlined in the original NAW submission.

5.4. We have not targeted any assets with a Health Score of 1 for intervention.

5.5. As a result of the adoption of some intervention strategies there is a possibility that some movements within the matrix could be masked. Below are summary tables (as required by section 1.18 of the rebasing methodology) showing the movements planned as a result of our intervention strategy. These tables demonstrate the movements which we anticipate will occur as a result of the delivery of our programme through the RIIO-ED1 period. These demonstrate that there are no hidden asset movements as a result of our resubmission.

5.6. For pressure cable assets the additions volume is zero because when replacing these assets we use non-pressurised (solid type) cable for which we have not submitted a volume within the original or restated NAW.

5.7. As a result of these changes we have been able to pass the vast majority of Tests 1, 2 and 3 and develop a Network Assets Workbook which we believe is at least as challenging as the published NAW.

5.8. For the original NAW reconciled as part of the FD, if Test 1 is applied to the entire workbook, this generates an intervention value of 67% of the maximum that could have been submitted (excluding Conductors and Fittings due to the subsequent splitting of this category). Applying the same test to the rebased NAW, this overall value is retained.

5.9. The tables below are included to comply with the requirements of the NASD Rebasing Requirements and Assessment Methodology section 1.18.

Asset Replacement – Disposals and Additions

Original NAW Submission – Asset Replacement

Asset Replacement	FY19 (Mid RIIO-ED1)												
Asset Class	**Additions**							**Disposals**					
	HI1	HI2	HI3	HI4	HI5	Total		HI1	HI2	HI3	HI4	HI5	Total
LV Network													
LV Switchgear and Other	928					928		0	0	133	0	795	928
LV UGB	876					876		0	0	0	0	876	876
LV OHL Support	2226					2226		0	0	0	668	1558	2226
HV Network													
HV Switchgear (GM) - Primary	427					427		0	21	13	40	353	427
HV Switchgear (GM) - Distribution	3172					3172		0	164	556	664	2685	4068
HV Transformer (GM)	356					356		0	79	0	0	281	360
HV OHL Support - Poles	636					636		0	0	0	191	445	636
EHV Network													
EHV Switchgear (GM)	33					33		0	0	0	4	29	33
EHV Transformer	31					31		0	0	0	0	31	31
EHV UG Cable (Gas)	0					0		0	0	0	8	0	8
EHV UG Cable (Oil)	0					0		0	0	0	11	11	23
EHV OHL Support - Towers	100					100		0	0	0	0	100	100
EHV OHL Support - Poles	246					246		0	0	0	74	172	246
EHV OHL Fittings and Conductors (Tower Lines)	3					3		0	1	2	0	0	3
132kV Network													
132kV CBs	20					20		0	0	0	0	22	22
132kV Transformer	6					6		0	0	0	0	6	6
132kV UG Cable (Gas)	0					0		0	0	0	0	0	0
132kV UG Cable (Oil)	0					0		0	0	0	6	0	6
132kV UG Cable (Non Pressurised)	0					0		0	0	0	0	0	0
132kV OHL Support - Tower	100					100		0	0	0	0	100	100
132kV OHL Fittings and Conductors (Tower Lines)	44					44		0	9	35	0	0	44

Asset Replacement	FY23 (End of RIIO-ED1)												
Asset Class	**Additions**							**Disposals**					
	HI1	HI2	HI3	HI4	HI5	Total		HI1	HI2	HI3	HI4	HI5	Total
LV Network													
LV Switchgear and Other	1856					1856		0	0	266	0	1590	1856
LV UGB	1752					1752		0	0	0	0	1752	1752
LV OHL Support	4162					4162		0	0	0	1249	2913	4162
HV Network									0	0	0	0	
HV Switchgear (GM) - Primary	866					866		0	42	27	81	716	866
HV Switchgear (GM) - Distribution	6328					6328		0	326	1110	1325	5359	8120
HV Transformer (GM)	1408					1408		0	310	0	0	1102	1412
HV OHL Support - Poles	1272					1272		0	0	0	382	890	1272
EHV Network									0	0	0	0	
EHV Switchgear (GM)	69					69		0	0	0	8	61	69
EHV Transformer	87					87		0	0	0	0	87	87
EHV UG Cable (Gas)	0					0		0	0	0	16	0	16
EHV UG Cable (Oil)	0					0		0	0	0	23	23	45
EHV OHL Support - Towers	200					200		0	0	0	0	200	200
EHV OHL Support - Poles	494					494		0	0	0	148	346	494
EHV OHL Fittings and Conductors (Tower Lines)	3					3		0	1	2	0	0	3
132kV Network									0	0	0	0	
132kV CBs	31					31		0	0	0	0	33	33
132kV Transformer	17					17		0	0	0	0	17	17
132kV UG Cable (Gas)	0					0		0	0	0	0	0	0
132kV UG Cable (Oil)	0					0		0	0	0	12	0	12
132kV UG Cable (Non Pressurised)	0					0		0	0	0	0	0	0
132kV OHL Support - Tower	200					200		0	0	0	0	200	200
132kV OHL Fittings and Conductors (Tower Lines)	90					90		0	18	72	0	0	90

Asset Replacement	FY19 (Mid RIIO-ED1)												
Asset Class	**Additions**							**Disposals**					
	HI1	HI2	HI3	HI4	HI5	Total		HI1	HI2	HI3	HI4	HI5	Total
LV Network													
LV Switchgear and Other	928					928			0	678	213	38	928
LV UGB	876					876			0	225	389	263	876
LV OHL Support	2081					2081			0	0	1306	775	2081
HV Network													
HV Switchgear (GM) - Primary	433					433			0	0	233	200	433
HV Switchgear (GM) - Distribution	3164					3164			0	315	772	2974	4060
HV Transformer (GM)	704					704			22	57	144	485	706
HV OHL Support - Poles	636					636			0	50	206	380	636
EHV Network													
EHV Switchgear (GM)	35					35			0	0	22	14	35
EHV Transformer	44					44			0	4	23	17	44
EHV UG Cable (Gas)	0					0			1	2	6	0	8
EHV UG Cable (Oil)	0					0			0	2	7	14	23
EHV OHL Support - Towers	100					100			0	0	96	4	100
EHV OHL Support - Poles	247					247			0	0	67	180	247
EHV OHL Fittings (Tower Lines)	212					212			0	0	0	212	212
EHV OHL Conductors (Tower Lines)	2					2			0	0	0	2	2
132kV Network													
132kV CBs	16					16			0	2	8	7	17
132kV Transformer	9					9			0	2	2	6	9
132kV UG Cable (Gas)	0					0			0	0	0	0	0
132kV UG Cable (Oil)	0					0			0	1	3	1	6
132kV UG Cable (Non Pressurised)	0					0			0	0	0	0	0
132kV OHL Support - Tower	100					100			0	0	23	78	100
132kV OHL Fittings (Tower Lines)	772					772			2	561	151	59	772
132kV OHL Conductors (Tower Lines)	45					45			0	4	8	33	45

Asset Replacement	FY23 (End of RIIO-ED1)												
Asset Class	**Additions**							**Disposals**					
	HI1	HI2	HI3	HI4	HI5	Total		HI1	HI2	HI3	HI4	HI5	Total
LV Network													
LV Switchgear and Other	1856					1856		0	0	1355	426	75	1856
LV UGB	1752					1752		0	0	450	777	525	1752
LV OHL Support	4162					4162		0	0	0	2612	1550	4162
HV Network													
HV Switchgear (GM) - Primary	866					866		0	0	0	466	400	866
HV Switchgear (GM) - Distribution	6327					6327		0	0	630	1543	5947	8120
HV Transformer (GM)	1408					1408		0	43	113	287	969	1412
HV OHL Support - Poles	1272					1272		0	0	100	412	760	1272
EHV Network													
EHV Switchgear (GM)	69					69		0	0	0	42	27	69
EHV Transformer	87					87		0	0	7	46	34	87
EHV UG Cable (Gas)	0					0		0	2	3	11	0	16
EHV UG Cable (Oil)	0					0		0	0	4	13	28	45
EHV OHL Support - Towers	200					200		0	0	0	192	8	200
EHV OHL Support - Poles	494					494		0	0	0	134	360	494
EHV OHL Fittings (Tower Lines)	423					423		0	0	0	0	423	423
EHV OHL Conductors (Tower Lines)	3					3		0	0	0	0	3	3
132kV Network													
132kV CBs	31					31		0	0	4	15	14	33
132kV Transformer	17					17		0	0	3	3	11	17
132kV UG Cable (Gas)	0					0		0	0	0	0	0	0
132kV UG Cable (Oil)	0					0		0	0	2.306	6.951	2.313	12
132kV UG Cable (Non Pressurised)	0					0		0	0	0	0	0	0
132kV OHL Support - Tower	200					200		0	0	0	45	155	200
132kV OHL Fittings (Tower Lines)	1543					1543		0	3	1121	302	117	1543
132kV OHL Conductors (Tower Lines)	90					90		0	0	8	16	66	90

Asset Refurbishment - Health Indices pre and post Intervention

Original NAW Submission – Asset Refurbishment

It should be noted that as a result of a refurbishment the asset is generally not disposed of and hence we refer to the interventions as pre and post intervention.

Asset Refurbishment	FY19 (Mid RIIO-ED1)												
Asset Class	**Target Score Post Intervention**							**Target Intervention Pre Refurbishment**					
	HI1	HI2	HI3	HI4	HI5	Total		HI1	HI2	HI3	HI4	HI5	Total
LV Network													
LV Switchgear and Other	0	1723				1723				0	0	1723	1723
LV UGB	No Refurbishment Programme Proposed that generates an SDI												
LV OHL Support													
HV Network													
HV Switchgear (GM) - Primary	0	131				131				0	0	131	131
HV Switchgear (GM) - Distribution	No Refurbishment Programme Proposed that generates an SDI												
HV Transformer (GM)													
HV OHL Support - Poles													
EHV Network													
EHV Switchgear (GM)	0	44				44				0	0	44	44
EHV Transformer	0	27				27				27	0	55	82
EHV OHL Support - Towers	0	142				142				70	54	18	142
EHV UG Cable (Gas)	No Refurbishment Programme Proposed that generates an SDI												
EHV UG Cable (Oil)													
EHV OHL Support - Poles													
EHV OHL Fittings (Tower Lines)													
EHV OHL Conductors (Tower Lines)													
132kV Network													
132kV CBs	0	4				4				0	4	0	4
132kV Transformer	0	7				7				0	0	7	7
132kV OHL Support - Tower	0	653				653				389	198	66	653
132kV UG Cable (Oil)	No Refurbishment Programme Proposed that generates an SDI												
132kV UG Cable (Non Pressurised)													
132kV OHL Fittings (Tower Lines)													
132kV OHL Conductors (Tower Lines)													

Asset Refurbishment	FY23 (End of RIIO-ED1)												
Asset Class	**Target Score Post Intervention**							**Target Intervention Pre Refurbishment**					
	HI1	HI2	HI3	HI4	HI5	Total		HI1	HI2	HI3	HI4	HI5	Total
LV Network													
LV Switchgear and Other	0	3445				3445				0	0	3445	3445
LV UGB	No Refurbishment Programme Proposed that generates an SDI												
LV OHL Support													
HV Network													
HV Switchgear (GM) - Primary	0	262				262				0	0	262	262
HV Switchgear (GM) - Distribution	No Refurbishment Programme Proposed that generates an SDI												
HV Transformer (GM)													
HV OHL Support - Poles													
EHV Network													
EHV Switchgear (GM)	0	88				88				0	0	88	88
EHV Transformer	0	55	55			55				0	0	109	109
EHV OHL Support - Towers	0	287				287				141	109	36	287
EHV UG Cable (Gas)	No Refurbishment Programme Proposed that generates an SDI												
EHV UG Cable (Oil)													
EHV OHL Support - Poles													
EHV OHL Fittings (Tower Lines)													
EHV OHL Conductors (Tower Lines)													
132kV Network													
132kV CBs	0	8				8				0	8	0	8
132kV Transformer	0	14				14				0	0	14	14
132kV OHL Support - Tower	0	1306				1306				776	397	132	1306
132kV UG Cable (Oil)	No Refurbishment Programme Proposed that generates an SDI												
132kV UG Cable (Non Pressurised)													
132kV OHL Fittings (Tower Lines)													
132kV OHL Conductors (Tower Lines)													

Resubmitted NAW February 2017 Refurbishment

Asset Refurbishment	FY19 (Mid RIIO-ED1)												
Asset Class	**Target Score Post Intervention**							**Target Intervention Pre Refurbishment**					
	HI1	HI2	HI3	HI4	HI5	Total		HI1	HI2	HI3	HI4	HI5	Total
LV Network													
LV Switchgear and Other	No Refurbishment Programme Proposed that generates an SDI												
LV UGB													
LV OHL Support													
HV Network													
HV Switchgear (GM) - Primary	131					131		0	0	0	38	94	131
HV Switchgear (GM) - Distribution	No Refurbishment Programme Proposed that generates an SDI												
HV Transformer (GM)													
HV OHL Support - Poles													
EHV Network													
EHV Switchgear (GM)	44					44		0	0	2	28	14	44
EHV Transformer	55					55		0	0	0	31	24	55
EHV OHL Support - Towers	144					144		0	2	107	35	0	144
EHV UG Cable (Gas)	No Refurbishment Programme Proposed that generates an SDI												
EHV UG Cable (Oil)													
EHV OHL Support - Poles													
EHV OHL Fittings (Tower Lines)													
EHV OHL Conductors (Tower Lines)													
132kV Network													
132kV CBs	4					4		0	0	2	2	1	4
132kV Transformer	7					7		0	0	3	2	3	7
132kV OHL Support - Tower	653					653		0	26	420	208	0	653
132kV UG Cable (Oil)	No Refurbishment Programme Proposed that generates an SDI												
132kV UG Cable (Non Pressurised)													
132kV OHL Fittings (Tower Lines)													
132kV OHL Conductors (Tower Lines)													

Asset Refurbishment	FY23 (End of RIIO-ED1)												
Asset Class	**Target Score Post Intervention**							**Target Intervention Pre Refurbishment**					
	HI1	HI2	HI3	HI4	HI5	Total		HI1	HI2	HI3	HI4	HI5	Total
LV Network													
LV Switchgear and Other	No Refurbishment Programme Proposed that generates an SDI												
LV UGB													
LV OHL Support													
HV Network													
HV Switchgear (GM) - Primary	262					262		0	0	0	75	187	262
HV Switchgear (GM) - Distribution	No Refurbishment Programme Proposed that generates an SDI												
HV Transformer (GM)													
HV OHL Support - Poles													
EHV Network													
EHV Switchgear (GM)	88					88		0	0	4	56	28	88
EHV Transformer	109					109		0	0	0	61	48	109
EHV OHL Support - Towers	287					287		0	4	214	69	0	287
EHV UG Cable (Gas)	No Refurbishment Programme Proposed that generates an SDI												
EHV UG Cable (Oil)													
EHV OHL Support - Poles													
EHV OHL Fittings (Tower Lines)													
EHV OHL Conductors (Tower Lines)													
132kV Network													
132kV CBs	8					8		0	0	4	3	1	8
132kV Transformer	14					14		0	0	5	3	6	14
132kV OHL Support - Tower	1306					1306		0	52	839	415	0	1306
132kV UG Cable (Oil)	No Refurbishment Programme Proposed that generates an SDI												
132kV UG Cable (Non Pressurised)													
132kV OHL Fittings (Tower Lines)													
132kV OHL Conductors (Tower Lines)													

5.10. We have taken a programme-level view of re-basing by asset type and used Test 1 as the key indicator of comparability with the original published NAW. This we believe is consistent with the aims of the RIIO-ED1 price control in which Ofgem did not approve specific asset volumes and any envisaged forecast projects or programmes were a means to the end of a set of allowances with associated Outputs.

5.11. We deliberately did not highlight specific schemes to Ofgem in the submission and we believe that using named schemes for the re-basing confuses the means with the end.

5.12. As such, our re-basing does not include any specific named schemes and therefore all our proposed intervention strategies are generic work. The only exception to this is 132kV CBs where we have included so far as possible the circuit breakers we originally planned to replace in our original submission due to the low volumes included.

5.13. The Named Scheme approach is of course appropriate for High Value Projects but we did not include any of these in our submission.

6. PoF and CoF values

6.1. The range values for Probability of Failure were created on the DNOs' collective behalf by UK Power Networks and agreed with Ofgem. They have been copied directly into the worksheet.

6.2. Where the presented values are weighted averages of components (eg for the LV Switchgear and Other category), our specific asset volumes have been used in the UKPN template to create the specific values for these categories.

6.3. In terms of the specific lookup PoF values for each HI category included within the Monetised Risk Workbook, these have been revised to meet the requirements of the Common Network Asset Indices Methodology table 6 and not as previously reported. This has been applied to all HI bands.

6.4. Values for Consequences of Failure (CoF) are created in the modelling software and have been inputted directly into the NAW following internal validation and review. The values for Towers have been updated in the Common Network Asset Indices Methodology model for coincident faults (changed from 1% to 0.05%) as agreed with Ofgem. We have also rechecked all values of CoF in the submission.

6.5. As a result of the changes instructed to the methodology we have also reviewed all our intervention strategies and where appropriate made changes to ensure we continue to meet the Equally Stretching tests, section 7 applies.

6.6. During the review of EHV switchgear interventions, it was noted that there was a discrepancy in the CoF values due to an arithmetic error and these have been corrected in the 9 February revision.

7. Summary of Tests

7.1. As part of the requirement for the rebasing of the NAW it is essential that each DNO performs a series of tests on the outputs from the above process to establish if the CNAIM creates an equally challenging output when compared to the original published NAW. To facilitate this requirement, Ofgem has provided a published document, Network Asset Secondary Deliverables Rebasing Methodology, following a series of meetings involving all DNOs as part of the Reliability Working Group. This section details the results of our application of the tests specified.

7.2. Following the bilateral meeting on 6 January 2017 and the subsequent issuing of the Ofgem derived test sheet we have adopted this to conduct our revised tests.

7.3. Following completion of our restatement of the NAW, we have completed a further series of tests to take into account the changes to calibration of oil cables and towers as well as the realignment of the PoF values more generally in the submission. These tests now show that our restatement is equally stretching to that agreed as a result of the Final Determination for the RIIO-ED1 period. The results of these tests are provided in tables 2.1 and 2.2 below covering Asset Replacement and Asset Refurbishment. We have no High Value Projects and therefore we have not provided any numbers in the NAW table 7 – HVP – ENWL, although the table has been retained for completeness. This is reflected in the completion of table 2.3 below.

7.4. In Test 1 we seek to demonstrate that the selection of assets for intervention as a result of the implementation of the Common Network Asset Indices Methodology provides an equivalent target to that in the published NAW and hence meets the equally stretching criteria. As will be seen from the results (table 2.1) the following asset groups have failed to meet the required criteria:

- LV Switchgear and Other – Asset Refurbishment
- 132kV Support (Towers) – Asset Refurbishment

Explanations as to the reasons for the failures are provided in Appendix A.

7.5. In Test 2 we seek to demonstrate that the selection of asset volumes for intervention as a result of the restatement is equal to those used in the original submission of the NAW. Table 2.2 shows that we have passed this test in all asset categories except for:

- LV Switchgear and Other – Asset Refurbishment

In addition, as part of the restatement of the NAW we have separated out the asset categories of EHV and 132kV Fittings and Conductor into four areas rather than two. When we stated the NAW originally we only used the conductor volumes and hence in stating we have passed this test for the Conductor assets we have aligned the previous Fittings and Conductor volumes to the Conductor volumes in the restatement. For Fittings we have used the volumes as agreed in the Final Determination and as such therefore the volumes match and hence the test is deemed to have been passed.

For LV Switchgear and Other, an explanation of the variance is provided in Appendix A.

7.6. In Test 3 we seek to demonstrate that we have selected our asset interventions in a manner which ensures we equally do not disproportionately identify assets in lower HI bands for

intervention. To show this we have compared the number of interventions in the bands HI 1–3 in the original NAW to those in bands HI 1–2 in the resubmission.

Our results show that we have passed all the tests in each asset group with the exception of:

- EHV UG Cable (Gas) – Asset Replacement

An explanation for the variance is provided in Appendix A.

Table 7.1 – Ofgem criteria test summary – Asset Replacement

We have rerun all three tests against our restatement return. The content of the tests are as documented in Ofgem's publication "*Network Asset Secondary Deliverables Rebasing Requirements and Assessment Methodology"* published on 6 December 2016. A summary of the test results is presented below with a detailed explanation as to the reason for any failed tests provided in Appendix A.

In this section we have failed one test associated with EHV UG Cable (Gas).

Licence Area	CNAIM model number and asset category	Test 1	Test 2	Test 3	Evidence
		Pass / Fail	Pass / Fail	Pass / Fail	
	LV Switchgear				
ENWL	CM3 LV Switchgear and Other	Pass	Pass	Pass	
ENWL	CM2 LV UGB	Pass	Pass	Pass	
ENWL	CM1 LV OHL Support	Pass	Pass	Pass	
	HV Network				
ENWL	CM5 HV Switchgear (GM) - Primary	Pass	Pass	Pass	
ENWL	CM6 HV Distribution Switchgear	Pass	Pass	Pass	
ENWL	CM7 HV Distribution Transformers	Pass	Pass	Pass	
ENWL	CM4 HV OHL Support - Poles	Pass	Pass	Pass	
	EHV Network				
ENWL	CM16 EHV Switchgear (GM)	Pass	Pass	Pass	
ENWL	CM17 EHV Transformers	Pass	Pass	Pass	
ENWL	CM12 EHV UG Cable (Gas)	Pass	Pass	Fail	Appendix 1 section 2, Test 3
ENWL	CM14 EHV UG Cable (Oil)	Pass	Pass	Pass	
ENWL	CM13 EHV UG Cable (Non Pressurised)	N/A	N/A	N/A	Not Reported in ED1
ENWL	CM11 EHV OHL Support - Towers	Pass	Pass	Pass	
ENWL	CM8 EHV OHL Support - Poles	Pass	Pass	Pass	
ENWL	CM9 EHV OHL Fittings	Pass	Pass	Pass	Appendix 1 section 3
ENWL	CM10 EHV OHL (Tower Lines) Conductor	Pass	Pass	Pass	Appendix 1 section 4
	132kV Network				
ENWL	CM24 132kV Circuit Breakers	Pass	Pass	Pass	
ENWL	CM25 132kV Transformers	Pass	Pass	Pass	
ENWL	CM21 132kV UG Cable (Gas)	N/A	N/A	N/A	No asset Population
ENWL	CM23 132kV UG Cable (Oil)	Pass	Pass	Pass	
ENWL	CM22 132kV UG Cable (Non Pressurised)	N/A	N/A	N/A	Not Reported in ED1
ENWL	CM20 132kV OHL Support - Tower	Pass	Pass	Pass	

Licence Area	CNAIM model number and asset category	Test 1	Test 2	Test 3	Evidence
		Pass / Fail	Pass / Fail	Pass / Fail	
ENWL	CM18 132kV OHL Fittings	Pass	Pass	Pass	Appendix 1 section 3
ENWL	CM19 132kV OHL (Tower Line) Conductor	Pass	Pass	Pass	Appendix 1 section 4
	Other				
ENWL	CM15 Submarine Cables	N/A	N/A	N/A	Not reported in ED1

Table 7.2 – Ofgem criteria test summary – Asset Refurbishment

We have rerun all three tests against our restatement return. The content of the tests are as documented in Ofgem's publication "*Network Asset Secondary Deliverables Rebasing Requirements and Assessment Methodology"* published on 6 December 2016. A summary of the test results is presented below with a detailed explanation as to the reason for any failed tests provided in Appendix A.

In this section we have failed two tests associated with LV Switchgear and Other and one with 132kV OHL Support - Tower.

Licence Area	CNAIM model number and asset category	Test 1	Test 2	Test 3	Evidence
		Pass / Fail	Pass / Fail	Pass / Fail	
	LV Switchgear				
ENWL	CM3 LV Switchgear and Other	Fail	Fail	Pass	Appendix 1 Section 1 Tests 1 and 2
ENWL	CM2 LV UGB	N/A	N/A	N/A	No Planned Work
ENWL	CM1 LV OHL Support	N/A	N/A	N/A	No Planned Work
	HV Network				
ENWL	CM5 HV Switchgear (GM) - Primary	Pass	Pass	Pass	
ENWL	CM6 HV Distribution Switchgear	N/A	N/A	N/A	No Planned Work
ENWL	CM7 HV Distribution Transformers	N/A	N/A	N/A	No Planned Work
ENWL	CM4 HV OHL Support - Poles	N/A	N/A	N/A	No Planned Work
	EHV Network				
ENWL	CM16 EHV Switchgear (GM)	Pass	Pass	Pass	
ENWL	CM17 EHV Transformers	Pass	Pass	Pass	
ENWL	CM12 EHV UG Cable (Gas)	N/A	N/A	N/A	No Planned Work
ENWL	CM14 EHV UG Cable (Oil)	N/A	N/A	N/A	No Planned Work
ENWL	CM13 EHV UG Cable (Non Pressurised)	N/A	N/A	N/A	Not Reported in ED1
ENWL	CM11 EHV OHL Support - Towers	Pass	Pass	Pass	
ENWL	CM8 EHV OHL Support - Poles	N/A	N/A	N/A	No Planned Work
ENWL	CM9 EHV OHL Fittings	N/A	N/A	N/A	Appendix 1 section 3
ENWL	CM10 EHV OHL (Tower Lines) Conductor	N/A	N/A	N/A	Appendix 1 section 4
	132kV Network				

Licence	CNAIM model number and asset	Test 1	Test 2	Test 3	Evidence
ENWL	CM24 132kV Circuit Breakers	Pass	Pass	Pass	
ENWL	CM25 132kV Transformers	Pass	Pass	Pass	
ENWL	CM21 132kV UG Cable (Gas)	N/A	N/A	N/A	No asset Population
ENWL	CM23 132kV UG Cable (Oil)	N/A	N/A	N/A	No Planned Work
ENWL	CM22 132kV UG Cable (Non Pressurised)	N/A	N/A	N/A	Not Reported in ED1
ENWL	CM20 132kV OHL Support - Tower	Fail	Pass	Pass	Appendix 1 Section 5 Test 1
ENWL	CM18 132kV OHL Fittings	N/A	N/A	N/A	Appendix 1 section 3
ENWL	CM19 132kV OHL (Tower Lines) Conductor	N/A	N/A	N/A	Appendix 1 section 4
	Other				
ENWL	CM15 Submarine Cables	N/A	N/A	N/A	Not Reported in ED1

Appendix A Test Results

1. Asset Class – LV Switchgear and Other

Test 1

Asset Replacement – The test results shows that we have passed the requirements of the test.

Asset Refurbishment – The test results show that we have failed this test. In our original submission we added significant volumes of interventions associated with the need to refurbish a particular type of LV board. We assumed that this would generate a SDI value.

After the RIGs document Annex A was agreed and accepted the intervention matrix for this asset type indicated that the intervention planned could not be reported as SDI but is to be reported as No SDI. As this intervention will now generate no SDI value we have removed the volumes of refurbishments from the NAW and hence the test is failed as a consequence of the RIGs change deeming the planned interventions as being outside the scope of CNAIM.

Test 2

Replacement – The volumes in each of the submissions are equal and hence this test is passed

Refurbishment – The volumes in each of the submissions are not equal and hence this test is failed. Our original NAW assumed that the refurbishment of LV Boards in each of the sub categories would count as Refurbishment with a Health Score improvement. The requirements of the RIIO-ED1 RIGs Annex A are that the refurbishments do not improve the Health Score and therefore have no SDI value as a consequence of the intervention. As a result of this requirement we have removed the original volume of board refurbishments resulting in a fail of the test in this area.

Test 3

Asset Replacement – The volumes in HI1 and 2 of the resubmission are less than, or equal to those in HI 1, 2 and 3 in the published NAW and hence this test is passed

Asset Refurbishment – All volumes have been removed from this category for the reasons explained above. As there were no volumes in the original intervention strategy in HI 1, 2 and 3 this is a technical pass of the test although in reality as there are now no volumes this test is effectively void.

2. Asset Class – EHV UG Cable (Gas)

Test 1

Asset Replacement – The test results shows that we have passed the requirements of the test.

Asset Refurbishment – We have not made a submission for this activity and therefore the test is not required.

Test 2

Asset Replacement – The volumes in each of the submissions are equal and hence this test is passed

Asset Refurbishment – The volumes in each of the submissions are equal and hence this test is passed

Test 3

Asset Replacement – The intervention volumes in HI1 and 2 categories of the resubmission are more or equal to those in HI 1, 2 and 3 in the published NAW and hence this test is failed.

The reason for the failure is that after the application of Common Network Asset Indices Methodology to the asset base, the distribution of the volumes across the HI bands means that there are insufficient assets in bands 3 - 5 to meet this test. The published NAW includes 16km of interventions in RIIO-ED1; however the new CNAIM profiles only deliver 14km of asset in the HI3-5 bands. As a consequence, we have had to assume the replacement of 2km of cable at HI2. As there are no equivalent removals from the HI1-3 bands in the published NAW, this test is failed, even though the intervention profile in the re-submitted NAW is as stretching as possible.

Asset Refurbishment – The volumes in HI1 and HI2 of the resubmission are less than, or equal to those in HI 1, 2 and 3 in the published NAW and hence this test is passed.

3. Asset Class – EHV OHL Fittings - Tower

This asset class was not submitted as a discrete category in the original Well Justified Business Plan (WJBP), and has been created after discussion and agreement as part of the rebasing discussions. In our original WJBP the EHV OHL Fittings and Conductor submission was based solely on the intervention plan for conductor only and as such therefore this is a new table for the NAW.

Test 1

As there were no volumes submitted in the WJBP these are additional to the published NAW, hence there is no baseline for comparison.

For Asset Refurbishment it is not possible to refurbish this asset type and hence the test is not appropriate.

Test 2

We have used the volume of assets which was agreed as a result of the Final Determination. For Asset Replacement, the volume of interventions matches this volume and hence this test is passed for asset replacement.

For Asset Refurbishment it is not possible to refurbish this asset type and hence the test is not appropriate.

Test 3

This test cannot be applied to the original submission but the test has been applied to the resubmission. There are no disposals targeted in HI2 and hence for asset replacement the test is deemed passed.

For Asset Refurbishment it is not possible to refurbish this asset type and hence the test is not appropriate.

4. Asset Class – EHV OHL Conductor (Tower Lines)

This asset class was not submitted as a discrete item, but as EHV Fittings and Conductor in the original Well Justified Business Plan (WJBP), and has been created after discussion and agreement as part of the rebasing discussions. The numbers in this submission are the same as those in our original WJBP where the EHV OHL Fittings and Conductor submission was based solely on the intervention plan for conductor only.

In applying these tests we have compared the category with the EHV Conductor and Fittings (Tower) of the WJBP.

Test 1

Asset Replacement – The test results shows that we have passed the requirements of the test.

Asset Refurbishment – We have not made a submission for this activity and therefore the test is not valid.

Test 2

Asset Replacement – The volumes in each of the submissions are equal and hence this test is passed.

Asset Refurbishment – The volumes in each of the submissions are equal and hence this test is passed.

Test 3

Asset Replacement – The volumes in HI1 and 2 of the resubmission are less than, or equal to those in HI 1, 2 and 3 in the published NAW and hence this test is passed.

Asset Refurbishment – The volumes in HI1 and 2 of the resubmission are less than, or equal to those in HI 1, 2 and 3 in the published NAW and hence this test is passed.

5. Asset Class – 132kV OHL Support - Tower

This asset class was not submitted as a discrete category in the original Well Justified Business Plan (WJBP), and has been created after discussion and agreement as part of the rebasing discussions. In our original WJBP the 132kV OHL Fittings and Conductor submission was based solely on the intervention plan for conductor only and as such therefore this is a new table for the NAW.

Test 1

Asset Replacement – The test results shows that we have passed the requirements of the test.

Asset Refurbishment – The test results shows that we have failed the requirements of the test. The failure has occurred due to the interaction of the asset data with the model and our intervention strategy. Generally assets beyond HI4 under CNAIM are not suitable for refurbishment as this represents a condition where there is considerable loss of steel section, mandating a replacement activity. Refurbishment is a mix of painting and structural changes of steelwork.

When this is superimposed on the modelled result the test is failed.

Test 2

Asset Replacement – The volumes in each of the submissions are equal and hence this test is passed.

Asset Refurbishment – The volumes in each of the submissions are equal and hence this test is passed.

Test 3

Asset Replacement – The volumes in HI1 and 2 of the resubmission are less than, or equal to those in HI 1, 2 and 3 in the published NAW and hence this test is passed.

Asset Refurbishment – The volumes in HI1 and 2 of the resubmission are less than, or equal to those in HI 1, 2 and 3 in the published NAW and hence this test is passed.

6. Asset Class – 132kV Fittings (Tower Lines)

This asset class was not submitted as a discrete category in the original Well Justified Business Plan (WJBP), and has been created after discussion and agreement as part of the rebasing discussions. In our original WJBP the 132kV OHL Fittings and Conductor submission was based solely on the intervention plan for conductor only and as such therefore this is a new table for the NAW.

Test 1

As there were no volumes submitted in the WJBP these are additional to the published NAW, hence there is no baseline for comparison.

For Asset Refurbishment it is not possible to refurbish this asset type and hence the test is not appropriate.

Test 2

We have used the volume of assets which was agreed as a result of the Final Determination. For Asset Replacement the volume of interventions matches this volume and hence this test is passed for asset replacement.

For Asset Refurbishment it is not possible to refurbish this asset type and hence the test is not appropriate.

Test 3

This test cannot be applied to the original submission but the test has been applied to the resubmission. There are no disposals targeted in HI2 and hence for asset replacement the test is deemed passed.

For Asset Refurbishment it is not possible to refurbish this asset type and hence the test is not appropriate.

7. Asset Class – 132 kV Conductor (Tower Lines)

This asset class was not submitted as a discrete item, but as 132kV Fittings and Conductor in the original Well Justified Business Plan (WJBP), and has been created after discussion and agreement as part of the rebasing discussions. The numbers in this submission are the same as those in our original WJBP where the 132kV OHL Fittings and Conductor submission was based solely on the intervention plan for conductor only.

In applying these tests we have compared the category with the 132kV Conductor and Fittings (Tower) of the WJBP.

Test 1

Asset Replacement – The test results shows that we failed to meet the required equally stretching test. This is due to the mix of available populated cells in the Common Network Asset Indices Methodology model when compared to that used in the CBRM WJBP, which we originally submitted. In our resubmission we have targeted our worse performing conductors but although the volumes match there is a failure to meet the required percentage of maximum intervention. The main reason for this mismatch is the lack of data to unpack the criticality C2 band as a result of the introduction of CNAIM.

Asset Refurbishment – We have not made a submission for this activity and therefore the test is not valid.

Test 2

Asset Replacement – The volumes in each of the submissions are equal and hence this test is passed.

Asset Refurbishment – The volumes in each of the submissions are equal and hence this test is passed.

Test 3

Asset Replacement – The volumes in HI1 and 2 of the resubmission are less than, or equal to those in HI 1, 2 and 3 and hence this test is passed.

Asset Refurbishment – The volumes in HI1 and 2 of the resubmission are less than, or equal to those in HI 1, 2 and 3 and hence this test is passed.

8. Asset Classes Not Used

The following asset classes are part of the Common Network Asset Indices Methodology but have not been populated as part of the NAW restatement as they were excluded from the original NAW scope. We do not intend to report against these asset classes in the RIIO-ED1 period.

1. EHV UG Cable (Non Pressurised)
2. 132kV UG Cable (Non Pressurised)
3. 132kV UG Cable (Gas)
4. Submarine Cables

9. Annex 1 - calibration

The following is a clarification of the manner in which we have calibrated our submission.

The software suite used to calculate the values from the Common Network Asset Indices Methodology requires the data sources to be managed so appropriate values are returned to the model. We have added a module to the front end of the software to permit this management to occur. This software is known as the Data Mappings Module.

Within the methodology there are a limited number of condition modifiers which can be applied to the asset. However, due to the manner in which different DNOs collect data there are different volumes of data points to be mapped against the data inputs required for the common methodology. This is carried out in the Data Mappings Module, in which we have used the word “calibrated” to describe this specific process.

Example:

HV Transformer External Condition (Table 73) is the one factor which modifies the transformer condition from the “as found” data.

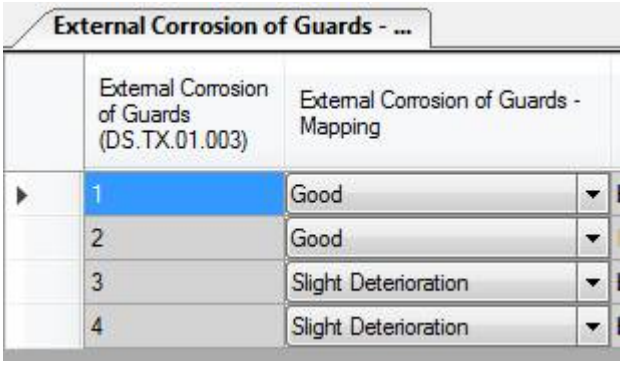
We collect four data points to describe the condition as follows:

- External Corrosion of Main Tank
- External Corrosion of Radiators
- External Corrosion of Guards
- External Condition of Cable Boxes

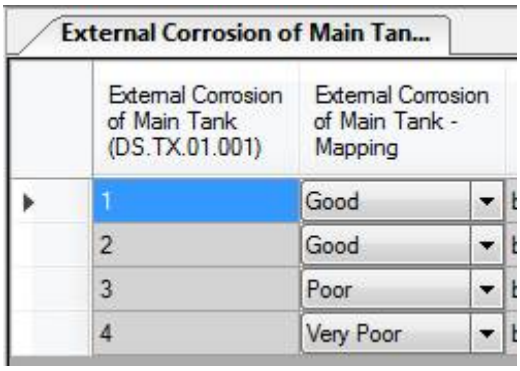
The data is collected on a scale of 1 (no visible defect) to 4 (rust and delaminated) which aims to provide an observation on the condition of the assets.

In order to use the existing data we need to set the equivalent value in the common methodology to our existing condition data from the scale of 1 to 4. We also need to ensure appropriate weightings have been applied to the model. A calibration example for two data points is shown below:

- Data mapping for Corrosion of Guards



- Data mappings for Main Tank



- Individual data points are then mapped into CNAIM Table 73 forming the concept of many-to-one relationship.

Asset Category	CDC Reference	Title	Observed
HV Transformers (GM)	DS.TX.01.001	External corrosion of main tank	73
HV Transformers (GM)	DS.TX.01.002	External corrosion of radiators	73
HV Transformers (GM)	DS.TX.01.003	External Corrosion of Guards	73
HV Transformers (GM)	DS.TX.01.004	External Condition of Cable Boxes	73
HV Transformers (GM)	DS.TX.01.006	Oil Leaks	73
HV Transformers (GM)	DS.TX.01.010	Tapchanger Unsatisfactory	73

This ensures that if as an example the external condition of the main tank, radiator and cable box were all good but the cable guard was very poor, the model will not apply a condition collar (Health Score of 10) and hence return HI5 banding for what is relatively minor defect. Whilst impacting on the health of the unit, the appropriate intervention is usually a repair or maintenance.

This has been carried out for all Observed and Measured conditions within the methodology where a many to one relationship exists. The calibrations in the model are retained and can be inspected within our Data Mapping Module. We believe three other DNOs have purchased the add-on “Data Mapping Module” from EA Technology Ltd (the software supplier).

10. Annex 2 – Model date creation

As part of the data set used to create the Common Network Asset Indices Methodology models, we not only prepare the asset condition data for use in the model but we also download from our asset data the date on which the inspection took place. Once the data report is created (a “csv” file in a configuration which the data loading software can input the data set to the modelling suite), it is possible to open the data set after converting to an Excel file with a file extension such as .xlsx. The data collection dates are represented in a column for each asset and using the “average” function in the Excel function suite the average date of the inspection set can be calculated. This average date is then converted to the period of time between the date of the model creation and the average data collection date.

Example

Model Created	01/04/2015
Average Data collection date	01/04/2012

The data collection date is three years older than the model. To resent the data to better represent the asset condition at the time of model build or Yn = 0 the model is aged via its function by three years. To age the model to a period in the future the value used would be appropriately increased by three years.

We first adopted this technique at the beginning of DPCR4 and it has been included in all our CBRM work including our DPCR5 reporting since.

We have previously discussed the possibility of aging each data line in CBRM to reflect the actual date that the data collection has occurred. As multiple data sets are used to inform the Health Index in CBRM it was judged difficult and costly to achieve. We therefore dropped the proposal.

In the Common Network Asset Indices Methodology there is one aging function for each of the models which simply accept an integer by which to age the model. As all the Common Network Asset Indices Methodology models for all the DNOs are common it is equally not possible to achieve the individual aging of data without a revision to the methodology and a far more complex modelling set being developed and deployed.

It should be noted that we use the same base software tool to deliver both Common Network Asset Indices Methodology and CBRM values.