National Atmospheric Emissions Inventory

QA/QC in the United Kingdom National Atmospheric Emissions Inventory (NAEI)

Task Force for Emissions Inventories and Projections – QA/QA Workshop, Krakow, Poland, 10TH May 2017

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What we will cover

- An overview the approach and themes for QA/QC in the UK National Atmospheric Emissions (NAEI)
- Balancing QA/QC activities with resources available
- Enhancing QA/QC for the NAEI – a new QA/QC framework
- QC and QA activities within the NAEI
- Some practical examples/areas of QC activities within the NAEI

UK National Atmospheric Emissions Inventory (NAEI) QAQC Themes

- *Scientific QA/QC* – ensuring that the scientific methodology and data sources underpinning the NAEI are robust, understood and meet requirements.
- *Implementation QA/QC* – ensuring that the NAEI's suite of models, databases and processes that implement the methodologies are developed, tested and maintained in a rigorous and effective manner.
- *Reporting QA/QC* – maximising the accuracy, consistency and completeness of all NAEI outputs.

NAEI Quality Plan

- Roles and responsibilities across the project team
- Annual cycle – tasks, milestones, overview of deliverables
- QA/QC activities overview
  - How data quality objectives are addressed within the NAEI system
  - Links to relevant files
- Checks on specific deliverables
  - Summary of the types of checks, where these are documented
- Records of QA activities completed / planned
  - Expert reviews
  - Bilateral or peer reviews

The scale of the QA/QC task each year

874 data source references, 504 for EFs

DUKES – 60,000 data points

1300 raw data files in 180 folders

306,789 records from 7,387 PI authorisations

>1000 EUETS installations

600+ bespoke models, 90 RT spreadsheets

59,215 activity data records

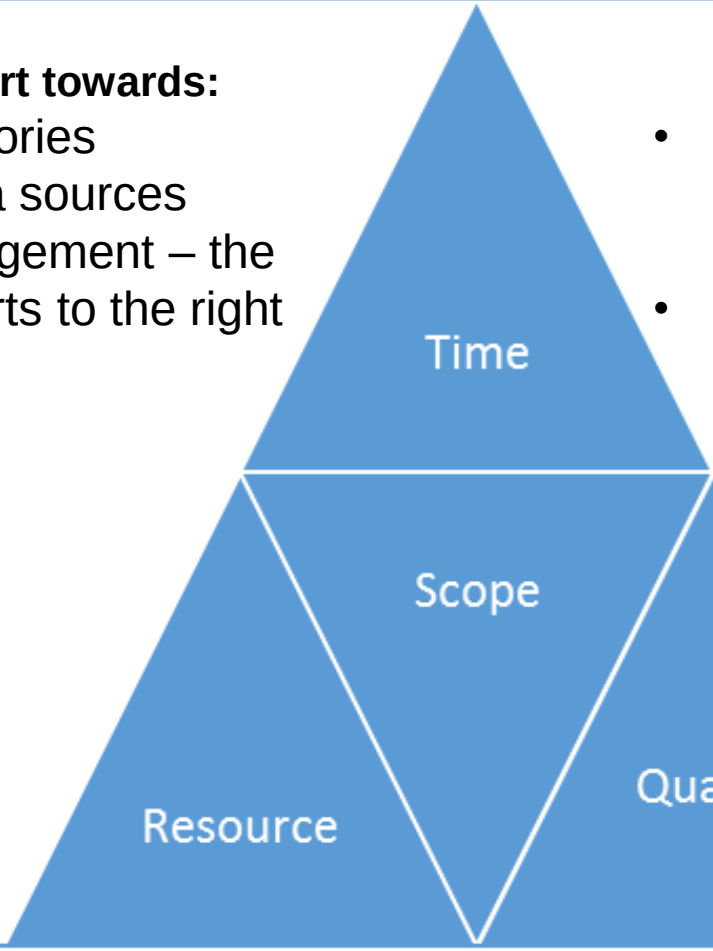
547,626 emission factors

>2500 source/activity/pollutant combinations

Managing QA/QC within resource/budget constraints

Prioritise Effort towards:

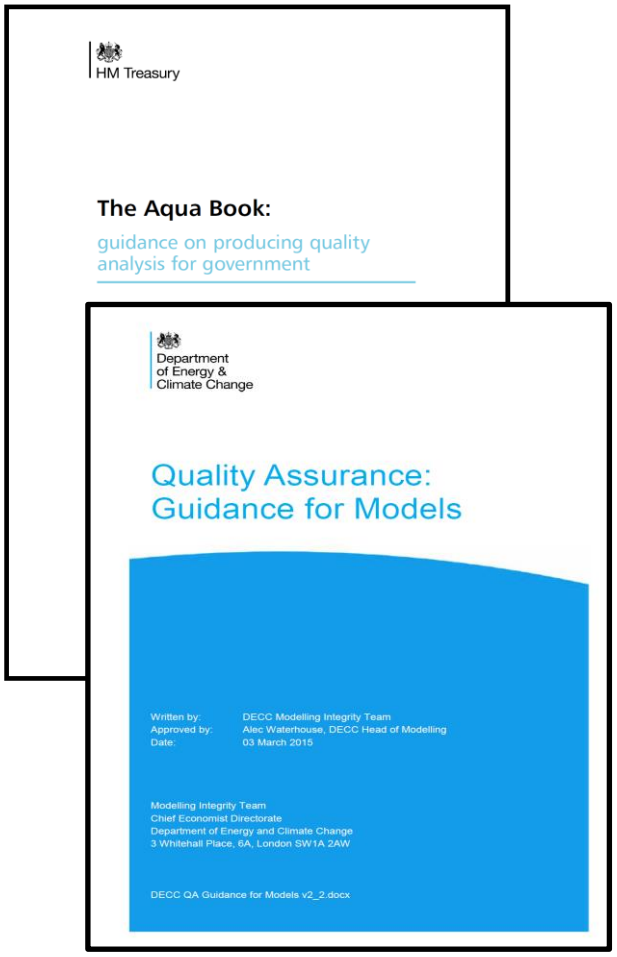
- Key categories
- Major data sources
- Expert judgement – the right experts to the right sectors



- Increasing efficiency – e.g. automating QC checks
- Policy sensitivity

Working with new (more comprehensive) UK Government QA/QC Guidelines

- UK Government *AQUA Book: Guidance on producing quality analysis for government* and associated *Quality Assurance: Guidance for Models*
- A 'model' can be as simple as an Excel spreadsheet than incorporates a calculation to a complex input-output calculation tool (the NAEI has both)
- Requires us to scrutinise our data, models and processes against ~30 criteria across 5 thematic areas
- The NAEI must move towards compliance with this guidance and ensure effective integration with existing (*TCCCA* based) QA/QC
- Using this as an opportunity to review, develop and enhance the QA/QC procedures for the UK Inventory

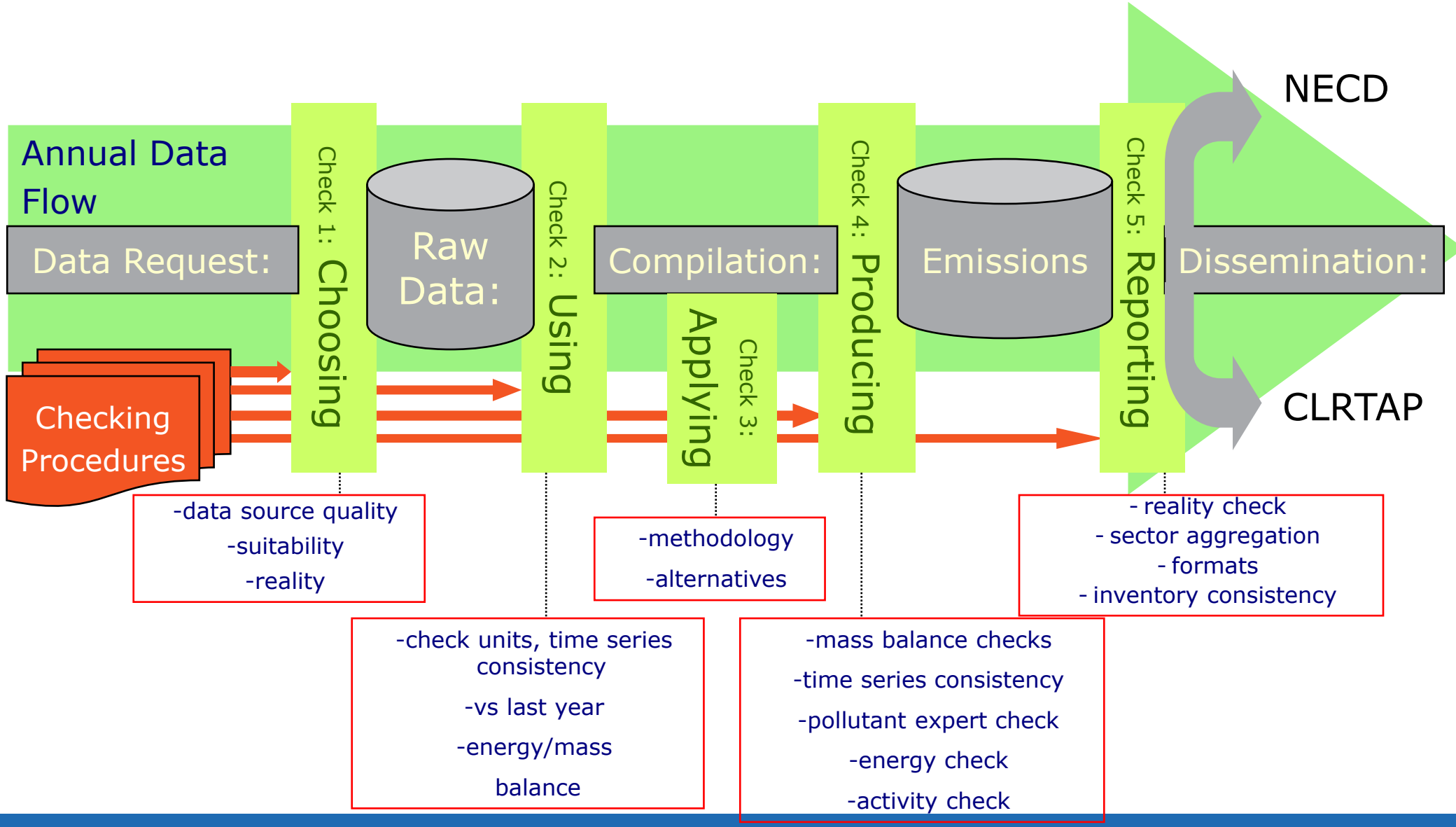


Aqua Book: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/416478/aqua_book_final_web.pdf
QA Guidance for Models: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/465785/DECC_QA_Guidance_for_Models_v2_2.pdf

UK Government model QA guidance – 5 thematic areas

- **Documentation**
  - *Model specification, scope and limitations*
  - *Is there a user guide, or at least clear in-model instructions?*
- **Structure & Clarity**
  - *Is the model clearly structured – overall and each worksheet?*
  - *Units, comments, assumptions – all clearly noted?*
- **Verification**
  - *Are the model calculations correct, in line with specification?*
  - *Have all formulae been checked?*
  - *Are links to other models robust, e.g. using named ranges?*
- **Validation**
  - *Checks on model outputs, e.g. EFs within EMEP-EEA ranges?*
- **Data and assumptions**
  - *All data source references and key assumptions logged and assessed. Best available data? Assumptions agreed with industry?*

Quality Control: data flow and checks



QA Activities

- Expert reviews (UNFCCC, UNECE, EU)
- Bilateral reviews. (i) QAQC with Germany, Netherlands, Denmark, France; (ii) new GLs compliance with Denmark.
- Peer reviews
- Model audits Desk studies (e.g. benchmarking against other countries)
- Stakeholder feedback (air quality modellers, energy statisticians, government and industry analysts, trade associations..)
- *Internal QA experts (i.e. not inventory experts) included within the NAEI team to undertake periodic review of specific processes, models and QA/QC setup/arrangements*

Some example QC checks applied in the NAEI

- **Raw data checks.**
- *Completeness? Revisions to data inputs? Scope of data applicable for the method to be applied? Assumptions applied?*
  - Completeness
  - Any major revisions since last iteration (time series check)?
  - Assumptions?
  - Data supplier QA/QC?
  - New emissions factors research (particularly country specific)
- **Reconciling energy and emissions data.**
  - Especially on energy statistics versus bottom-up industry data.
  - Involves a lot of consultation and also expert judgement.
  - Time-series consistency is a key challenge.

Some example QC checks applied in the NAEI

- **Cross-cutting quality checks**
  - Mass balance checks for most fuels
  - Inventory vs industry-reported data checks, by sector
  - Specific pollutant QC, e.g. PM_{10} > $PM_{2.5}$ (EFs)

- **Pollutant-Specific QC on draft outputs**
  - Gaps
  - New sources
  - Changes to EFs and check vs. Guidebook
  - Trend checks – whole time series and previous-latest year emissions
- **Output checks**
  - UK totals, sector totals, trends check, reasons for changes checks (*do we understand where things have changed why this is and have we documented it?)*

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