

Quality Assurance & Quality Control

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giz

UN-REDD
PROGRAMME





Content



1. Introduction
2. Practical considerations
3. Elements
4. Roles & Responsibilities
5. QA/QC plan
6. QC procedures
7. QA procedures





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Introduction

- **GOAL:** a GHG inventory that can be readily assessed in terms of quality
 - Good practice to implement QA/QC procedures in GHG inventories
- **OBJECTIVE:** improvement of
 - Transparency
 - Accuracy
 - Comparability
 - Completeness
 - Consistency



Introduction

- QA/QC activities should be integrated in the inventory process
- Outcomes result in:
 - Reassessment of inventory
 - Subsequent improvements in GHG estimations



Definitions

- **Quality Control (QC):**
 - System of routine technical activities to **ASSESS** and **MAINTAIN** quality
 - Performed by personnel compiling inventory
 - System designed to:
 - Provide routine & consistent checks to ensure data integrity, correctness, & completeness
 - Identify & address errors
 - Document & archive inventory material



Definitions

- Quality Assurance (QA)
 - System of review procedures
 - Conducted by personnel not directly involved in inventory preparation
 - Reviews
 - Verify that measurable objectives were met
 - Ensure that the inventory represents the best possible estimates



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Practical considerations

- Achieve balance between

Quality control requirements,
Improved accuracy
Reduced uncertainty

Requirements for
timelines
Costeffectiveness



Practical considerations

- To help find that balance, judge on following parameters :
 - Resources
 - Time
 - Frequency
 - Level
 - Availability & access to information on Activity Data (AD), Emission Factors (EFs) & other data
 - Requirements for documenting & archiving information
 - Whether increased effort on QA/QC will result in improved estimates & reduced uncertainties



Practical considerations

- How to prioritise where to intensify QA/QC?
 - Is this source/sink a key category?
 - Considerable uncertainty
 - Significant changes in category?
 - Significant changes in trends?
 - Does methodology use complex modelling steps/large inputs from outside database?
 - Are EFs/other parameters, when estimated, significantly different from IPCC defaults?
 - How much time has passed when EFs/other parameters have been updated?



Practical considerations

- No difference between confidential & public available data → both need to be QA/QCed
- QA/QC procedures implemented need to be transparent & description available for review



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Elements of QA/QC

- Inventory compiler in charge for coordinating QA/QC
- Definition of roles & responsibilities
- QA/QC plan
- General QC procedures (tier 1)
- Category-specific QC procedures (tier 2)
- QA & review procedures
- Reporting, documentation, and archiving procedures



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Roles and Responsibilities

- QA/QC responsibilities may be passed on to external data suppliers
- QA/QC coordinator should be nominated
- Coordination of institutional & procedural arrangements for the inventory activities
(→ next slide)



Coordination of institutional & procedural arrangements

- Distribution of responsibilities and procedures for the planning, preparation, and management of inventory activities:
 - Data collection
 - Selection of methods, EFs, AD, & other parameters
 - Estimation of emissions & removals
 - Uncertainty assessment
 - QA/QC activities
 - Documentation & archiving



Germany: responsibilities in Emission Reporting (I)



1. Source specific expert (FV)
 - Data collection, data entry, estimations and making of NIR texts
2. QC responsible head of the section (QKV)
 - Approval of completed data and texts
3. Source specific contact person (FAP)
 - Mentoring and supervision of FV and QKV
 - Give assistance on the requirements and on the preparation of data & texts



Germany: responsibilities in Emission Reporting (II)



4. Coordinator for the National Inventory Reporting (NIRK)
 - Compilation of the NIR, overall QC on NIR texts
5. Coordinator for the CSE (ZSEK)
 - Maintain the data base, emission estimation and aggregation
6. Coordinator for the QSE (QSEK)
 - Maintain and improve the QSE (System, Checklists, IP, QA/QC plan, Handbook)
7. Coordinator for the NaSE (NaSEK)
 - Ensuring institutional arrangements and a timely reporting that is in accordance with the requirements



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QA/QC Plan: Key components

- Outlines QA/QC activities that will be implemented & responsibilities for those
- List of data quality objectives
 - Concrete targets to be achieved in the inventory & against which an inventory can be measured in a review
 - Quality objectives should be measurable and based & refined upon the following principles: *timeliness* , *completeness*, *consistency*, *comparability*, *accuracy*, *transparency*, & *improvement*



QA/QC Plan: Content

- Scheduled time frame for QA/QC activities
- Conclusions from previous reviews should be included for improvement of inventory
- Internal document for ensuring that the inventory is fit for purpose and allows improvement



Germany: Binding schedule



19 May	The Federal Environment Agency's national co-ordinating agency (Single National Entity) requests relevant responsible sections to submit data and report texts
31 July	Delivery of energy data of the Working Group on Energy Balances (AGEB), of statistical data of the Federal Statistical Office and of data provided under agreements with associations and companies, where such data serve as the basis for further calculations
by 1 September	Deliveries of ready-to-use inventory data from the Federal Environment Agency and from external institutions of the NaSE
as of 2 September	Validation / discussion of deliveries by section and quality managers, taking account of review results
as of 1 October	Preparation of CRF time series and of national trend tables; final editing by the Single National Entity within the Federal Environment Agency
2 November	Internal co-ordination within the Federal Environment Agency
as of 11 November	Final quality assurance by the QSE/CSE/NIR co-ordinator
16 November	Report of the Single National Entity to the Ministry, for commencement of inter-ministerial co-ordination relative to the CRF data
30 November	Report of the Single National Entity to the Ministry, for commencement of inter-ministerial co-ordination relative to the National Inventory Report
17 December	Approval via departmental co-ordination (initiated by the BMU)
2 January	Final editing by the Federal Environment Agency's national co-ordinating agency (Single National Entity)
15 January	Report (CRF and certain parts of the NIR) goes to the European Commission (in the framework of the CO ₂ Monitoring Mechanism) and to the European Environment Agency
15 March	Report (corrected CRF and complete NIR) goes to the European Commission (in the framework of the CO ₂ Monitoring Mechanism) and to the European Environment Agency
15 April	Report goes to the FCCC Secretariat
May	Initial check by the FCCC Secretariat
June	Synthesis and assessment report I (by the UN Climate Secretariat)
August	Synthesis and assessment report II (country-specific; by the UN FCCC Secretariat)
September - October	Inventory review by the FCCC Secretariat

→ Binding schedule for preparation of emissions inventories and of the NIR in the framework of the National System: for all relevant internal and external stakeholders (NIR, Germany, 2010)



QA/QC Plan: Development

- Once developed it can be used for subsequent inventories
- Necessity to periodically review and revise QA/QC plan
- Development of the QA/QC plan: useful to refer to relevant standards & guidelines published (e.g. ISO)
- To take into account national circumstances, specific details of QA/QC should be defined in plan



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General Inventory QC Procedures (I)

- Generic quality checks related to
 - calculations
 - data processing
 - completeness
 - documentation

that are applicable to all inventory source & sink categories

- Results need to be documented
- Not possible to check all aspects of inventory input data → checks may be carried out on selected sets of data and processes



General Inventory QC Procedures (II)

- If estimates/data are provided from outside → inventory compiler needs to ensure that providers are aware of QC procedures & that procedures are performed and recorded
- Special attention: on parts of the inventory where data derive from extern, including confidential data



General Inventory QC Procedures (III)

QC Activity	Procedures
Check that assumptions and criteria for the selection of activity data, emission factors, and other estimation parameters are documented.	<ul style="list-style-type: none"> • Cross-check descriptions of activity data, emission factors and other estimation parameters with information on categories and ensure that these are properly recorded and archived.
Check for transcription errors in data input and references.	<ul style="list-style-type: none"> • Confirm that bibliographical data references are properly cited in the internal documentation. • Cross-check a sample of input data from each category (either measurements or parameters used in calculations) for transcription errors.
Check that emissions and removals are calculated correctly.	<ul style="list-style-type: none"> • Reproduce a set of emissions and removals calculations. • Use a simple approximation method that gives similar results to the original and more complex calculation to ensure that there is no data input error or calculation error.
Check that parameters and units are correctly recorded and that appropriate conversion factors are used.	<ul style="list-style-type: none"> • Check that units are properly labelled in calculation sheets. • Check that units are correctly carried through from beginning to end of calculations. • Check that conversion factors are correct. • Check that temporal and spatial adjustment factors are used correctly.
Check the integrity of database files.	<ul style="list-style-type: none"> • Examine the included intrinsic documentation (see also Box 6.4) to: <ul style="list-style-type: none"> - confirm that the appropriate data processing steps are correctly represented in the database. - confirm that data relationships are correctly represented in the database. - ensure that data fields are properly labelled and have the correct design specifications. - ensure that adequate documentation of database and model structure and operation are archived.
Check for consistency in data between categories.	<ul style="list-style-type: none"> • Identify parameters (e.g., activity data, constants) that are common to multiple categories and confirm that there is consistency in the values used for these parameters in the emission/removal calculations.
Check that the movement of inventory data among processing steps is correct.	<ul style="list-style-type: none"> • Check that emissions and removals data are correctly aggregated from lower reporting levels to higher reporting levels when preparing summaries. • Check that emissions and removals data are correctly transcribed between different intermediate products.
Check that uncertainties in emissions and removals are estimated and calculated correctly.	<ul style="list-style-type: none"> • Check that qualifications of individuals providing expert judgement for uncertainty estimates are appropriate. • Check that qualifications, assumptions and expert judgements are recorded. • Check that calculated uncertainties are complete and calculated correctly. • If necessary, duplicate uncertainty calculations on a small sample of the probability distributions used by Monte Carlo analyses (for example, using uncertainty calculations according to Approach 1).
Check time series consistency.	<ul style="list-style-type: none"> • Check for temporal consistency in time series input data for each category. • Check for consistency in the algorithm/method used for calculations throughout the time series. • Check methodological and data changes resulting in recalculations. • Check that the effects of mitigation activities have been appropriately reflected in time series calculations.



General Inventory QC Procedures (IV)

QC Activity	Procedures
Check completeness.	<ul style="list-style-type: none"> • Confirm that estimates are reported for all categories and for all years from the appropriate base year to the period of the current inventory. • For subcategories, confirm that entire category is being covered. • Provide clear definition of 'Other' type categories. • Check that known data gaps that result in incomplete estimates are documented, including a qualitative evaluation of the importance of the estimate in relation to total emissions (e.g., subcategories classified as 'not estimated', see Chapter 8, Reporting Guidance and Tables).
Trend checks.	<ul style="list-style-type: none"> • For each category, current inventory estimates should be compared to previous estimates, if available. If there are significant changes or departures from expected trends, re-check estimates and explain any differences. Significant changes in emissions or removals from previous years may indicate possible input or calculation errors. • Check value of implied emission factors (aggregate emissions divided by activity data) across time series. <ul style="list-style-type: none"> - Do any years show outliers that are not explained? - If they remain static across time series, are changes in emissions or removals being captured? • Check if there are any unusual and unexplained trends noticed for activity data or other parameters across the time series.
Review of internal documentation and archiving.	<ul style="list-style-type: none"> • Check that there is detailed internal documentation to support the estimates and enable reproduction of the emission, removal and uncertainty estimates. • Check that inventory data, supporting data, and inventory records are archived and stored to facilitate detailed review. • Check that the archive is closed and retained in secure place following completion of the inventory. • Check integrity of any data archiving arrangements of outside organisations involved in inventory preparation.



Category-Specific QC Procedures

- Procedures require knowledge of specific category, specific data & parameter availability
- Performed additional to general QC
- Are applied on a case-by-case basis focusing on key categories as well as on categories w/ significant methodological and data changes
- If higher tier method is used for GHG estimations then category-specific QC should be applied



Emission Factor QC (I)

- IPCC Default EF
 - Assess applicability for national circumstances
 - If insufficient information on default EF → needs to be considered when assessing uncertainties
- QC EF
 - QC on background data , e.g. site-specific or source-level, deriving from literature?
 - QC on models



Emission Factor QC (II)

- Comparison country-specific EFs w/ IPCC default EFs
- Comparison EFs between countries
- Comparison country-specific EFs w/ plant-level or site-specific factors



Activity Data QC

- National level AD
 - QC checks of reference source for national AD
 - Evaluate & document QA/QC activities from secondary data (AD that is used but was generated for other purposes)
 - If necessary reassess uncertainties
 - Comparison w/ independently compiled data
 - E.g. governmental statistics w/ FAO data
 - Comparison w/ samples
 - Extrapolate plant specific data and then compare w/national AD
 - Trend checks



Germany: QA/QC checklists



- List all individual objectives in the emissions-reporting process, in keeping with the pertinent quality control and quality assurance plans
- Facilitate review of achievement of individual objectives
- Are made available to all persons responsible for QA/QC
- Record execution of measures for QA/QC
- Where individual objectives are not achieved and direct correction is not possible, a pertinent entry must be made in the improvement plan



Germany: QA/QC checklists



Main process: 1. Data collection

1.1	Definition of requirements	The requirements pertaining to data reflect the information and indications from the inventory plan and the inventory reviews (for example, S&A Report, Centralized Review).
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Process No.	Sub-process name	Individual goal	Optional goal
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1.3	The relevant specialised department requests the data from the pertinent data provider(s)	The requirements pertaining to QC and data formats have been forwarded to the data suppliers and/or contracting entities, and such forwarding has been duly documented. Note: Where data suppliers are involved via NaSE agreements, this objective has been achieved.	The data supplier (for example, an association) carries out its own routine quality controls, and the results have been duly documented.
1.4	Receipt of data	The data provider or contracting entity has carried out the required quality controls and made proper records of such action.	The data supplier (for example, an association) carries out its own routine quality controls, and the results have been duly documented.
1.4	Receipt of data	The received data are complete, without any gaps.	All data gaps in the time series as of 1990 have been closed, in accordance with the IPCC Good Practice Guidance, via extrapolation/interpolation (Chapter 7.3.2.2) and duly documented and justified. Note: Continued use of the same value is not extrapolation
1.4	Receipt of data	The data received are consistent with the previous year's data, and they have been properly described.	Any marked discrepancies with the previous year's data have been duly documented and justified.
1.4	Receipt of data	The order of magnitude of the received data is in line with that of comparable data from other sources (such as ETS data, IEA, EPER, etc.). The result of the review has been duly documented.	The reasons for any discrepancies have been clearly and logically explained and duly documented.

Example of a general checklist for the responsible expert role (NIR, Germany, 2010)



Germany: QA/QC checklists



Example of a checklist for 5.A Forest Land, ABM, CO2, for FV, QKV, FAP, NIRK

Code	Einzelziel	Einzelziel erreicht	Optionales Ziel	Optionales Ziel erreicht	Dokumentationsort	Erläuterung, Handlungsbedarf, Terminvorschlag
<p>Checkliste 2010 (2008)</p> <p>Rolle: FV Schadstoff: CO2</p> <p>Name: Dünger Brennstoff:</p> <p>Quellgruppe: 5.A Forest Land</p> <p>Subquellgruppe Ergänzungen: Pool: oberirdische Biomasse</p> <p>Aspekt: EF, ED</p> <p>Bearbeiter: Stümer</p> <p>Neu Schadstoff:</p> <p>Neu Brennstoff:</p> <p>Freigabe</p>						
<p><i>Hauptprozess:</i> 0. Festlegung der Berechnungsgrundlagen</p> <p><i>Teilprozess:</i> 0.1 Überprüfung und ggf. Änderung der Methoden</p>						
12.01.01	Die Berechnungsmethode steht im Einklang mit der aktuellen Hauptquellgruppenanalyse.	Ja			NIR, IB	
12.01.02	Die Auswahl der Berechnungsmethode ist nach dem Entscheidungsbaum der IPCC-Good Practice Guidance erfolgt, bzw. stimmt mit diesen überein.	Ja	Abweichungen vom Entscheidungsbaum der IPCC-Good Practice Guidance sind fachlich und nachvollziehbar begründet und dokumentiert.		NIR, IB	
12.01.03	Die Auswahl der Berechnungsmethode hat die Anforderungen aus dem Inventarplan berücksichtigt.	Ja	Abweichungen vom Inventarplan wurden fachlich und nachvollziehbar begründet und dokumentiert.		NIR, IB	
12.01.04	Die ausgewählte Berechnungsmethode kann für die gesamte Zeitreihe ab 1990 angewendet werden oder wird bereits konsistent angewandt.	Ja	Bei Methodenwechsel in der Zeitreihe(n) ist die Durchführung einer Rekalikulation gemäß QSE-Handbuch (Anhang 2) und die Erstellung einer nachvollziehbaren Dokumentation sichergestellt.		NIR, IB	
12.01.05	Abweichungen von den durch 0.1.01-0.1.04 geforderten Zielen sind fachlich und nachvollziehbar begründet und dokumentiert.	keine Abweichungen			dD	
<p><i>Hauptprozess:</i> 0. Festlegung der Berechnungsgrundlagen</p> <p><i>Teilprozess:</i> 0.2 Überprüfung und ggf. Änderung der Datenquellen</p>						
12.02.00	Würden neue Datenquellen verwendet?	Ja			dD	Es wurde eine Inventurstudie 2008 auf BM-Basis durchgeführt, um aktuelle Daten zum Anfang der Berichtsperiode des KP zu haben
12.02.01	Die Datenquelle(n) ist/sind für die Zukunft langfristig verfügbar (z.B. auf Basis gesetzlicher Grundlagen, Vereinbarungen mit längerer Laufzeit [> 3 Jahre] etc.).	Nein			IB	Einmalige Aufnahme
12.02.02.a	Aus der/den Datenquelle(n) ist eine/mehrere vollständige Zeitreihe(n) ab 1990 verfügbar.	Nein	Lücken in der Datenverfügbarkeit für Zeitreihe(n) ab 1990 wurden nachvollziehbar begründet und dokumentiert.	Ja	IB	im NIR
12.02.02.b	Aus der/den Datenquelle(n) ist eine/mehrere vollständige Zeitreihe(n) ab 1990 verfügbar.	Nein	Für den Umgang mit Datenlücken wurde gemäß der IPCC Good Practice Guidance (Kap. 7.3.2.2) ein fachlich geeignetes Vorgehen (Inter-/Extrapolation) festgelegt und nachvollziehbar dokumentiert. Hinweis: Fortschreibung ist keine Extrapolation!	Ja	IB	im NIR
12.02.02.c	Aus der/den Datenquelle(n) ist eine/mehrere vollständige Zeitreihe(n) ab 1990 verfügbar.	Nein	Nach der Schließung von Datenlücken ist, wo notwendig, eine Rekalikulation der Zeitreihe(n) gemäß QSE-Handbuch (Anhang 2) erfolgt und diese nachvollziehbar in NIR und CRF dokumentiert.	Ja	IB	im NIR
12.02.03	Die Datenquelle(n) deckt/decken die Quellgruppe vollständig ab.	Ja	Die unvollständige Abdeckung wurde in einer Hochrechnung und in der Unsicherheitenberechnung berücksichtigt. Alle Schritte sind nachvollziehbar dokumentiert.		NIR, IB	
12.02.04	Für die Datenquelle(n) liegen Angaben von Unsicherheiten (Höhe und	Ja			IB	im NIR



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QA Procedures

- Review & audits to
 - assess quality of the inventory
 - determine conformity of procedures taken
 - identify areas for improvement
- Additional to general & category-specific QC
- Inventory can be reviewed in parts or completely
- Key categories should be given priority



QA Procedures: Expert Peer Review

- Review of calculations & assumptions by experts in relevant technical fields
- Reviewing the documentation associated w/ methods & results
- Objective: assure that inventory's results, assumptions, & methods are reasonable
- No standard tools
- Review process of UNFCCC should be considered as overall improvement of the QA process

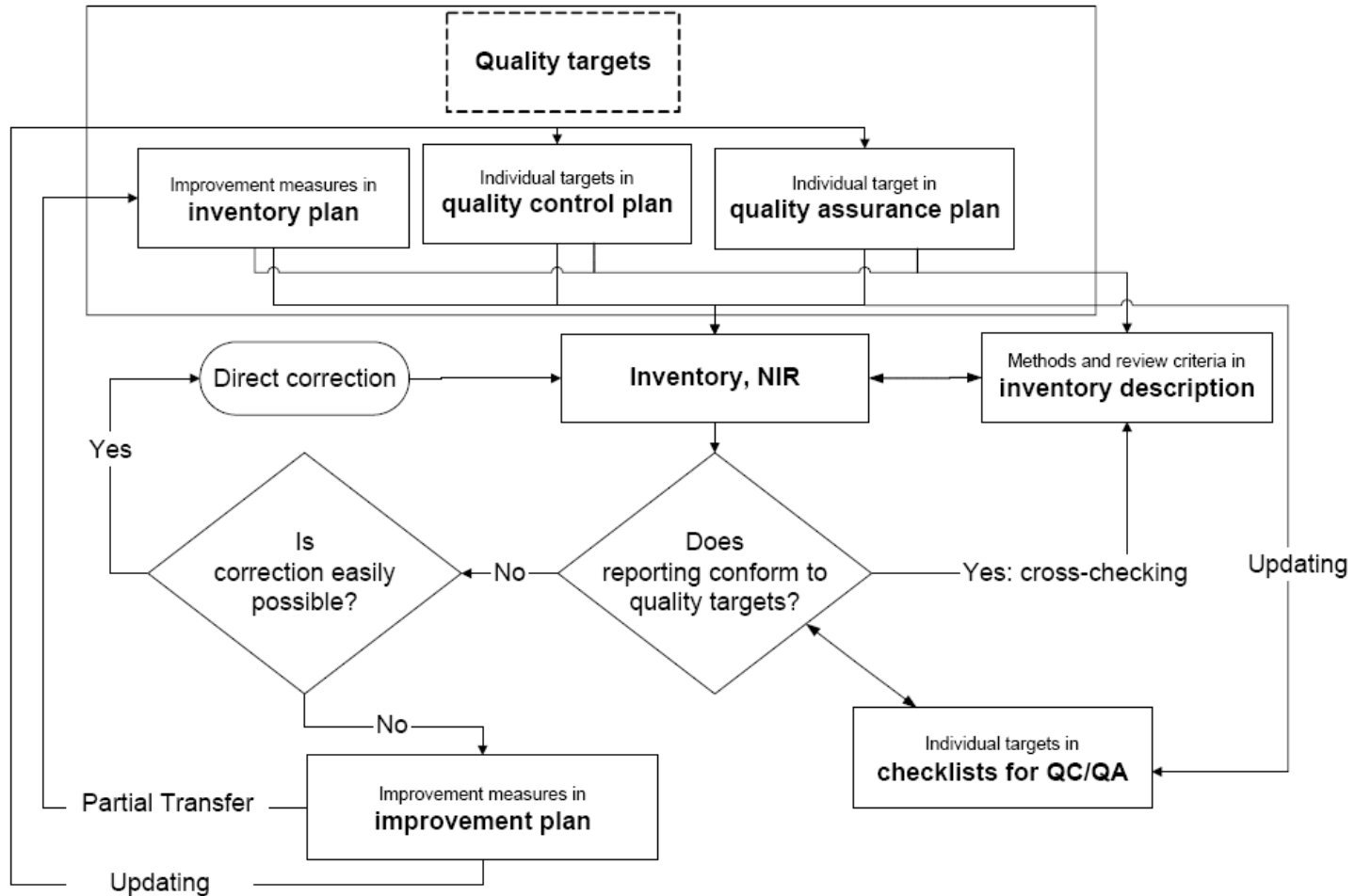


QA Procedures: Audits

- Evaluate how effectively the inventory compiler complies w/ QC specification outlined in QC plan
- Useful when new estimation methods are adopted or significant changes in methods occur
- Provide in-depths analysis of respective procedures taken to develop an inventory and on documentation available



Germany: QA/QC-System



A scenic landscape featuring a dirt road that curves through a lush green environment. On the left, a large, moss-covered rock formation stands prominently. The road is flanked by dense green vegetation and trees. In the background, a dense forest of evergreen trees covers a hillside under a clear blue sky. To the right, a small stream flows over a rocky bed. The overall scene is bright and natural.

**Thank you for your attention!
Any questions?**

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