Corporate GHG Emission Inventory Lessons Learned:
Protocol Documents, Verification Programs, and Data Management Systems

Wiley Barbour, Director of Registry Services
Environmental Resources Trust, Inc.
www.ert.net

Kevin Johnson, GHG Services Group
URS Corporation

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Presentation Overview

- Protocol documents
- Data management systems
- Data quality management processes and controls
- Internal assurance and 3rd party verification programs
- Conclusions

Protocol Document Objectives

- Secure reliable/meaningful GHG data
- Establish baseline against which future performance can be measured
- Identify opportunities for continual improvement in reporting processes
- Provide basis for verification activities
- Ensure confidence that Corporate entity can place on GHG data for decision making & reporting moving forward

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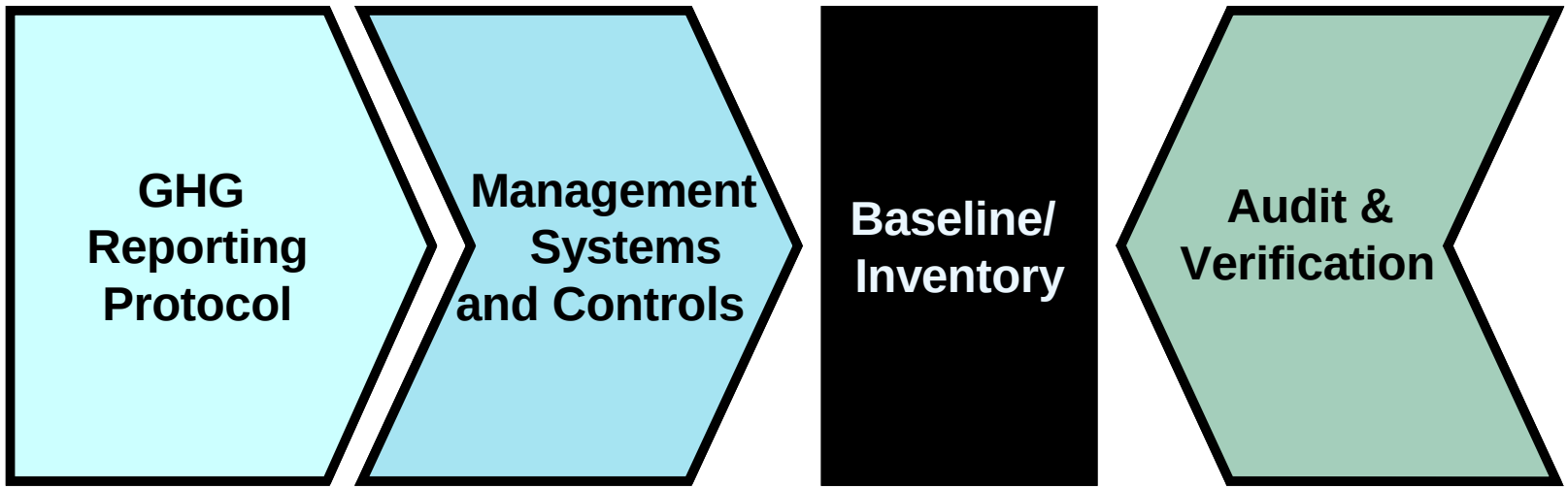
Elements of Credible Baseline/Inventory



Ensures consistency, completeness, accuracy

Ensures integrity of reported data

Identifies strengths, weaknesses, opportunities for improvement

Key Issues: Baseline/Inventory

Issues Impacting Baseline:

- Equity ownership
- Acquisitions and divestitures
- Boundary issues/scope of reporting
- Accounting basis
- Consistency in reporting
- Data management and control

Protocol Should Address:

- ✓ Equity accounting and operational control
- ✓ Baseline readjustment for acquisitions and divestitures
- ✓ Inclusions/exclusions, guidance on indirects
- ✓ Detailed guidance on:
  - ✓ Estimation methods
  - ✓ Quality control procedures

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Corporate GHG Inventory Development

- Define goals/objectives
  - From corporate position and strategy
  - Ultimate uses for data (e.g., internal vs. external reporting vs. carbon market)
  - System users/stakeholders
  - Sets overall scope/specifications of system
- Protocol development
  - Documentation to ensure consistent/accurate data collection and allow transparent reporting
  - Facilitate 3rd party verification and support reduction programs (and/or trading)
  - Operations-specific (e.g., customization of WRI/WBCSD protocol)

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Auditable Protocol Elements

- Operations boundaries/source identification
- Root data characterization (e.g., test/CEM, measurement techniques, instrumentation systems/calibration, etc.)
- Emission factor documentation/supporting data
- Estimation methodology/example calculations
- Level of accuracy/data uncertainty
- Data quality assurance/internal audit procedures
- Specifications for direct and indirect emissions
- Reporting guidelines (format, supporting documentation, frequency, etc.)
- Baseline determination analysis
- Benchmarking bases
- Discussion of any key boundary issues
- Data management procedures description

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Data Management Approach

- Data sources (production records, financial data, monitoring data, test data, literature values, etc.)
- Spreadsheet-->database platform
- Present and future needs
- Existing data systems available
- Frequency of update (annual, quarter, month)
- Manual vs. automated
- Other pollutants (in addition to CO_2 and CH_4 core)
- Data normalization
- Benchmarking
- QA/QC procedures

Effective Data Management and Control

- Investigation of root sources of data and controls over that data
- Evaluation of level of accuracy for key material sources
- Data review processes in place at each level of data aggregation (facility→BU→Corporate)
- Automation of data flow
  - Ensures accuracy
  - Maintains reporting flexibility
  - Allows higher level review and control, and business analysis

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Corporate GHG Inventory Data Handling

- Data collection
  - Plant-/unit-specific information needs list
  - Survey templates (electronic automated loading)
  - Corporate and site contacts/follow-up
  - Much information available from Title V operating permit and other reporting programs
- Database
  - Design/set-up
  - Semi-static data population (e.g., E.F.s, calculation algorithms, protocol rules, etc.)
  - Facility/BU records data compiled/loaded via input forms/collector tool
  - Data entry/algorithm quality checks

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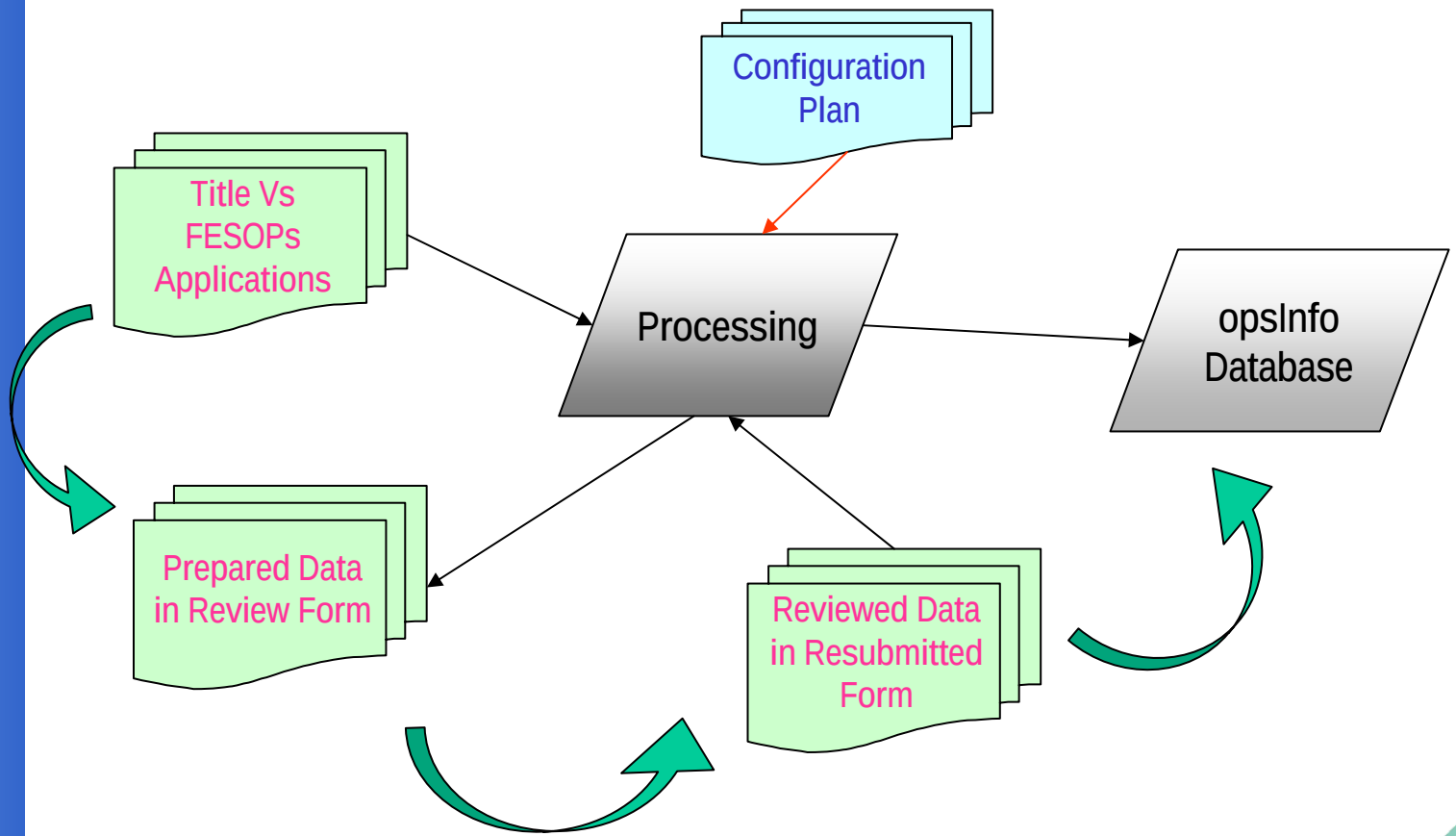
Data Gathering Process EMIS Example



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Example EMIS Phase I Activities

- Configuration plan
- Material facilities & sources
- Historic annual inventories
- Baseline determination
- All characterization data (system descriptors) collected
- Default E.F.'s
- Readily available CEMs data
- ~Manual activity (i.e., transaction) data collection
  - Client spreadsheets
  - URS custom templates
- Pilots (2) and turnkey enterprise-wide EMIS implementation

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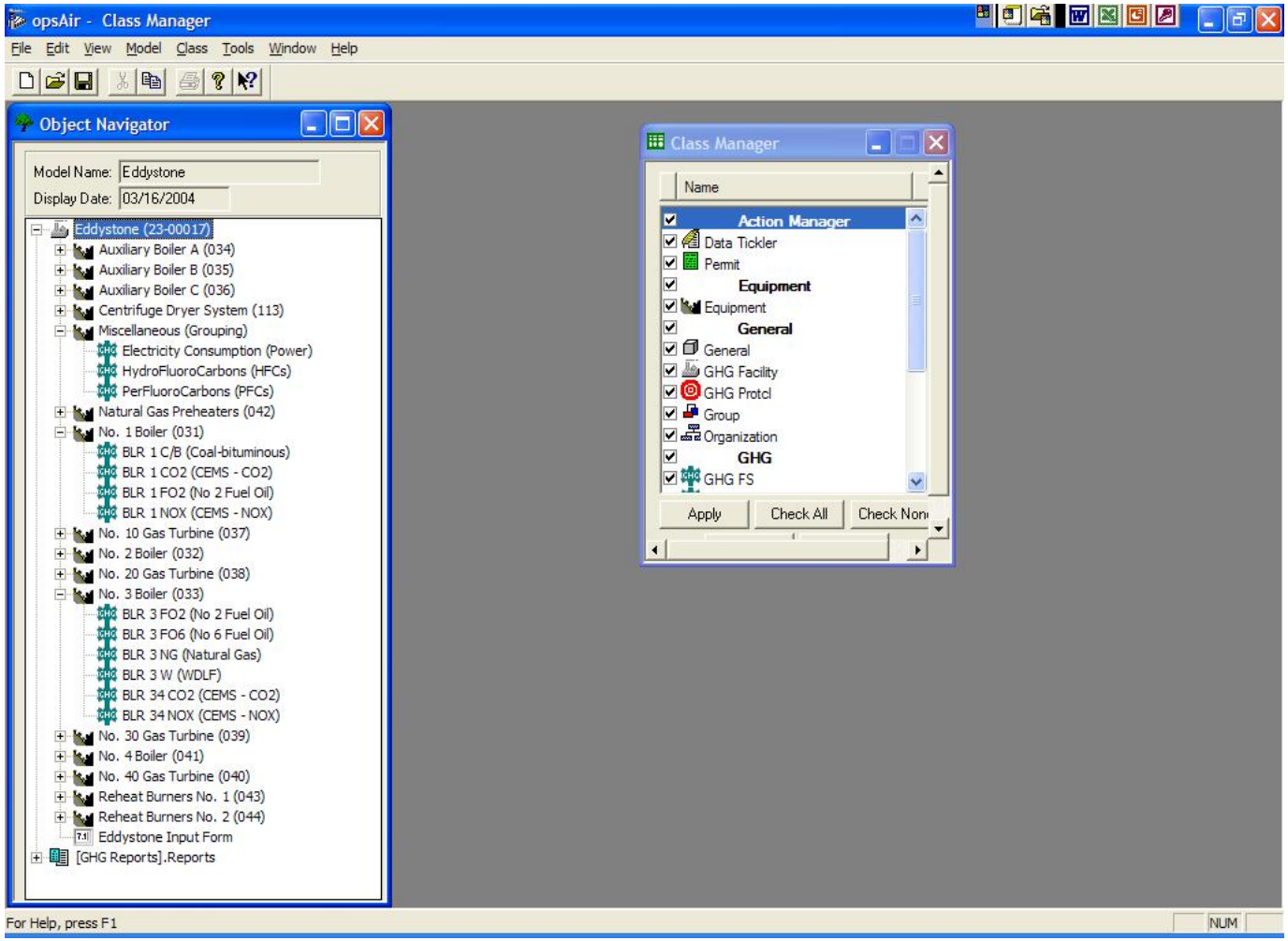
Example EMIS Phase II Activities

- Acceptance testing
- Training
- Uncertainty analysis
- Materiality assessment
- Inventory management plan
- Fill in missing data
- Transaction data updates; forward going inventory
- Baseline tracking & adjustments
- Reduction projects and offsets
- Site-specific data (E.F.’s and CEMS)
- Automated interfaces (operations performance, CEMS)
- Verification

EMIS Facility Model Example



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EMIS Lessons Learned (1)

- Need “ownership” of datasets/origin of data sources clearly and distinctly determined:
  - Avoid multiple sources for same data
  - Engage with correct data owner or coordinator, efficient collection and ease of data flow
- Don’t underestimate data gathering LOE:
  - Volume of data for enterprise, historical inventory
  - Internal time resources/external budgets
  - Major project schedule and cost driver
- “Punt” small stuff/missed data into follow-on :
  - Schedule and budget impacts of delays and/or repeat work
  - Re-visit in materiality/uncertainty assessments

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EMIS Lessons Learned (2)

- Flexibility on how data are collected and reported (e.g., UOM, aggregation level, etc.)
- Consistent nomenclature (UOM, source type labels) across multiple facilities→often no internal standard
- For new systems under development, implementation team needs to work closely with software developer
  - Cons:
    - Raises LOE to system owner
    - Could result in rework as system evolves
  - Pros:
    - Provides incorporation of flexibility in software configuration/design
    - Provides opportunity to influence development process

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EMIS Lessons Learned (3)

- Project needs for system owner:
  - Strong project champion
  - Early planning/coordination between implementer and owner's IT dept. (project schedule and cost input to owner's PjM)
  - Going forward system "roll-out" plan:
    - Incorporate database analysis/benchmarking task prior to acceptance testing by owner
    - Adequate staff: corporate, operations, IT
    - Training $/time
    - Funding $ for external support as needed
    - Back-up for owner personnel turnover

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Verification Process/Steps (1)

- Establish Verification Approach & Procedures
  - Define goals and objectives of client (Corporate, Business Unit, facility, and project)
  - Evaluate appropriate level of rigor: project type, target end user market, and reduction volume determine data quality objectives of verification
  - Establish appropriate materiality guidelines: level of acceptable error/uncertainty; detail of audit; emissions threshold for source inclusion
  - Specify scope of audit: project, facility, entity, and data system boundaries

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Verification Process/Steps (2)

- Develop/Review Project Documentation
  - Supporting Data: sales records, process data, utility invoices, etc.
  - Calculation Methodology: good engineering practices used, consistency with emerging industry/international practices
  - Documentation: transparency (i.e., clear data trail, example calculations, etc.); completeness; referenced sources of emission factors and methodology bases

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Verification Process/Steps (3)

- Analyze data deviations in reporting period
- Benchmarking
  - Normalize data: other periods, similar sources/sites
  - Check sales/fuel meter data with engr. calculations
- Assess material risks/uncertainty
- Field audits/on-site reviews:
  - Meter calibration, QA/QC activities, maintenance
  - Monitoring and data management systems
  - Databases, calculations, root data
- Review supporting documentation
  - Purchasing records/business data
  - Composition analytical data

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Verification Process/Steps (4)

- Audit - evaluation of quality of evidence
  - Accuracy: estimation algorithms appropriate and correctly implemented; input data reasonable based on QA/QC results, benchmarking of other similar sources/projects, engineering judgment
  - Uncertainty: reliability of data; availability and appropriateness of key meter calibration records
  - Data Trails: supporting data completeness
  - Data Management Systems/Controls: appropriate quality processes in place to ensure data reliability
- Verification statement
  - Statement of data reliability (accuracy, completeness, consistency) and evaluation against criteria

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Corporate GHG Inventory Verification Lessons Learned

- Problems in initial effort:
  - Much higher uncertainty
  - Protocol guidance not detailed enough, and inconsistently applied across entity
  - Insufficient quality management measures
  - Documentation lacking
- Progress after several efforts:
  - Enhanced data management systems
  - Lower deviations/misstatements
  - Pilot verifications and internal assurance process
  - Post-closeout misstatements reduced to 1-2% of total entity emissions reported

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Conclusions

- Corporate GHG Emission Inventory Elements Critical to Credibility:
  - Protocol document
  - Data quality management and controls processes
  - Data management system
  - Internal assurance and 3rd party verification programs