

Electronic Greenhouse Gas Data Collection and Management: Some Key Insights

U.S. GHG Reporting Program



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U.S. EPA

World Bank Partnership for Market Readiness

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Presentation Outline



- U.S. GHG Data System Overview
- Key Business Challenges for the Data System
- Insights for System Design and Development
 - Architecture
 - Data collection
 - High quality data = high quality submissions
 - Coordination of software and regulation development
 - Electronic signature
 - Managing entity relationships

Overview of EPA Electronic Greenhouse Gas Data System



- Greenhouse Gas Data System Supports
 - Collection, verification and publication of GHG Data collected under the Mandatory Reporting of Greenhouse Gases Rule (40 CFR Part 98)
- Key Components
 - Electronic Greenhouse Gas Reporting Tool (e-GGRT)
 - Integrated Verification Process (iVP)
 - Publication Portal (FLIGHT)
 - Business Intelligence (Spago)
- Related
 - EPA EnviroFacts
 - EPA Central Data Exchange (CDX), Facility Registry Service (FRS)

Electronic Reporting Data Flow



EPA GHG Data System



Data Verification
(EPA)



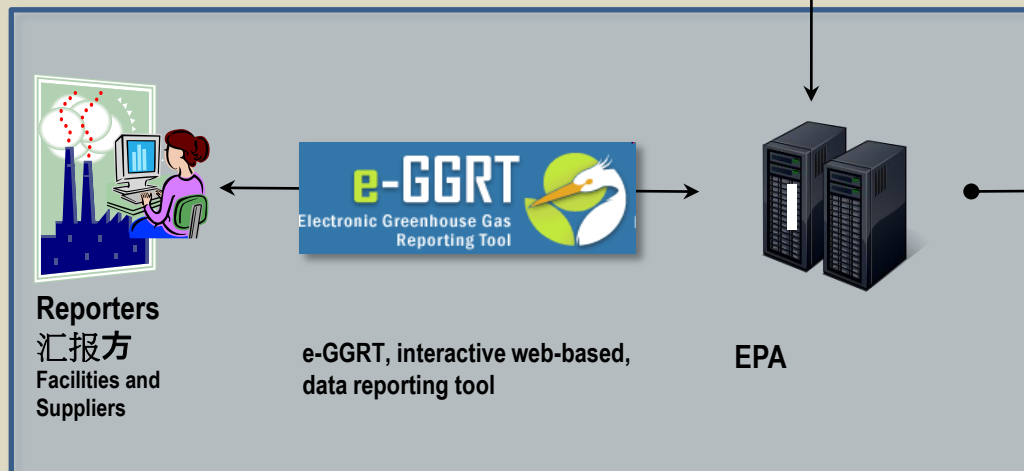
EPA EnviroFacts:
Serviceable, searchable and
separately hosted copy of non-CBI
dataset.



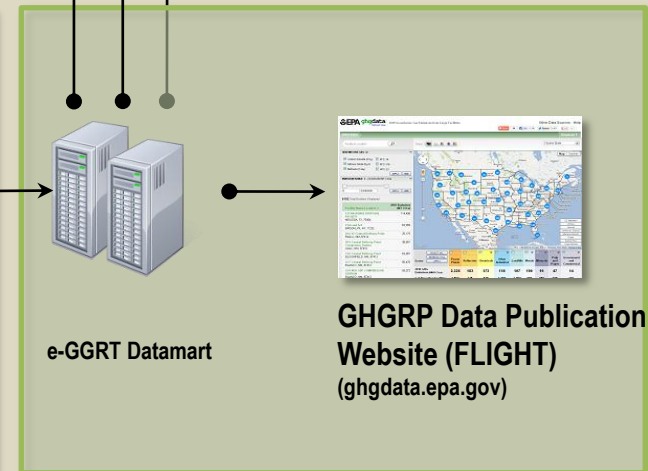
State-Specific Service
Oriented data flow using
EnviroFacts
API



Downloadable XLS, XML &
HTML Data Files



Data Collection



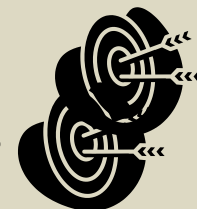
Data Publication

Key Development Challenges

The System Development Business Challenge



- **2007, December:** FY2008 Appropriations Act
- **2009, April:** GHG Reporting Rule Proposed
- **2009, October:** GHG Reporting Rule Finalized
 - Electronic reporting only (1st for EPA)
 - Collect GHG data across most sectors of economy
 - Over two dozen unique industry source categories
 - Multiple GHG measurement methodologies
 - Multiple tiers
 - Dozens of fuels and fuel types
 - Sensitive or confidential data
 - Thousands of expected reporters
 - Thousands of users, all new entrants with steep learning curve
 - Has to support EPA verification of the data
- **2010, October & December:** Technical corrections and clarifications
- **2010, December:** Proposal to defer collection of inputs to equations
- **2011, March:** (initial) First reporting deadline
- **2011, September:** (final) First reporting deadline



Data Collected under US GHG Reporting Program



- **Facility or supplier information includes:**
 - Name, address, latitude/longitude (in some cases)
 - North American Industrial Classification Codes (NAICS)
 - Parent company information
- **GHG emissions include:**
 - CO2 equivalent emissions (metric tons)
 - across all applicable sources
 - by each applicable subpart (source category) at the facility
 - excluding biogenic emissions
 - biogenic emissions
 - CO2 equivalent quantity from supplier categories (metric tons)
 - CH4, N2O emissions for the facility by subpart
 - Emissions of each fluorinated GHG (F-Gas)



- **Special Data Includes:**

- Explanation of calculation methodology changes during the reporting year
- Description of Best Available Monitoring Methods (BAMM) used during the reporting year
- Requests for extension of the use of Best Available Monitoring Methods
- Supporting documentation (document upload) for BAMM extension requests
- Identification of each data element for which a missing data procedure was used
- Total number of hours in the year that a missing data procedure was used for each element
- Geologic sequestration monitoring, reporting and verification plan (document upload under Subpart RR)

- **Source Specific Data Includes*:** (Example from Subpart Q, Iron and Steel)
 - Unit identification
 - Unit type (e.g. taconite indurating furnace, Electric Arc Furnace etc...)
 - Annual CO2 emissions for each unit
 - Annual quantity taconite pellets, coke, sinter, iron and raw steel for each unit
 - Method used (i.e. carbon mass balance or site-specific emission factor) for each unit
 - Annual mass of each process inputs and outputs to determine CO2 emissions
 - Annual volume of each type of gaseous and liquid fuel

**in some cases collection of specific data elements may have been deferred*

Special Challenge: Confidential Business Information (CBI)

Approach to Confidentiality Determinations (1)



- Case-by-case confidentiality determinations not practical, given the number of reporters (~8,000) and data elements (~2,000)
 - Would not result in timely release of data
 - Burden on reporters and the agency
- From 2010-2012, the EPA proposed confidentiality determinations for the data elements required to be reported using a notice and comment process.
- The confidentiality of each reported data element was determined using a two-step approach:
 1. Grouping data elements into 11 data categories (e.g., inputs to emission equations, emissions, and unit/process operating characteristics that are not inputs to emission equations for direct emitter source categories) and
 2. Making confidentiality determinations either categorically or on the basis of individual data elements.
- The EPA has now largely finalized confidentiality determinations for data elements except those in the “inputs to emission equations” category. (EPA proposed a rule addressing inputs in September 2013)

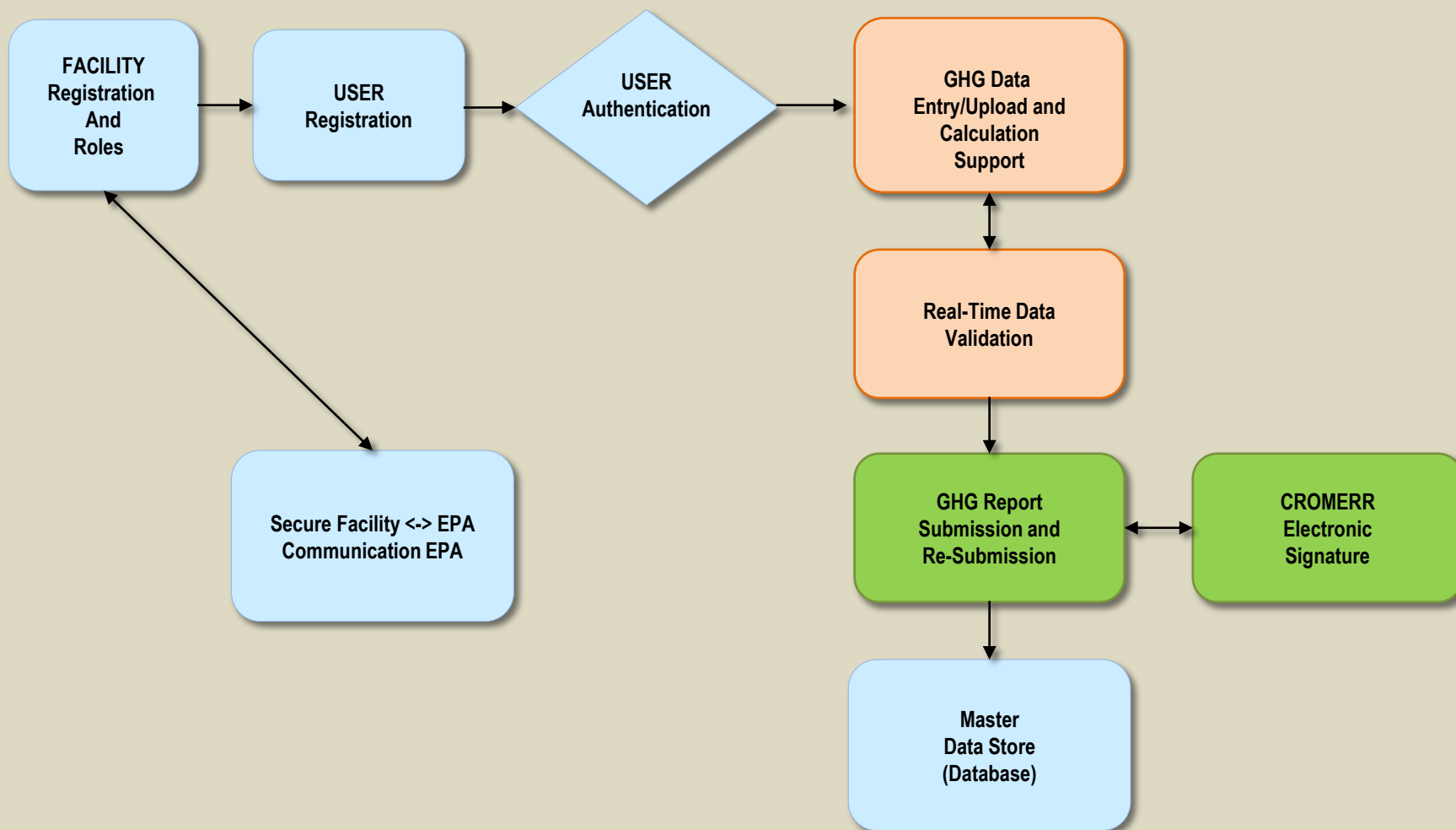
Examples



Source Category	Description of Data	Status (confidentiality determination as of 12/2013)
Q: Iron and Steel	Unit Identification Number	Emission Data
	Unit type	Emission Data
	Annual CO2 emissions for each unit	Emission Data
	Annual quantity taconite pellets, coke, sinter, iron and raw steel for each unit	CBI
	Method used	Emission Data
	Carbon content of each process input used to determine CO2 emissions	Input to Emission Equation Deferred Until 2015
C: Combustion	Unit ID number	Emission Data
	Maximum rated heat input capacity	Emission Data
	Types of fuel combusted during the report year	Emission Data
	Methodology (i.e. Tier) used to calculate emissions	Emission Data
	Annual CO2 mass emissions for each type of fuel combusted during the reporting year	Emission Data

Design and Development Insights

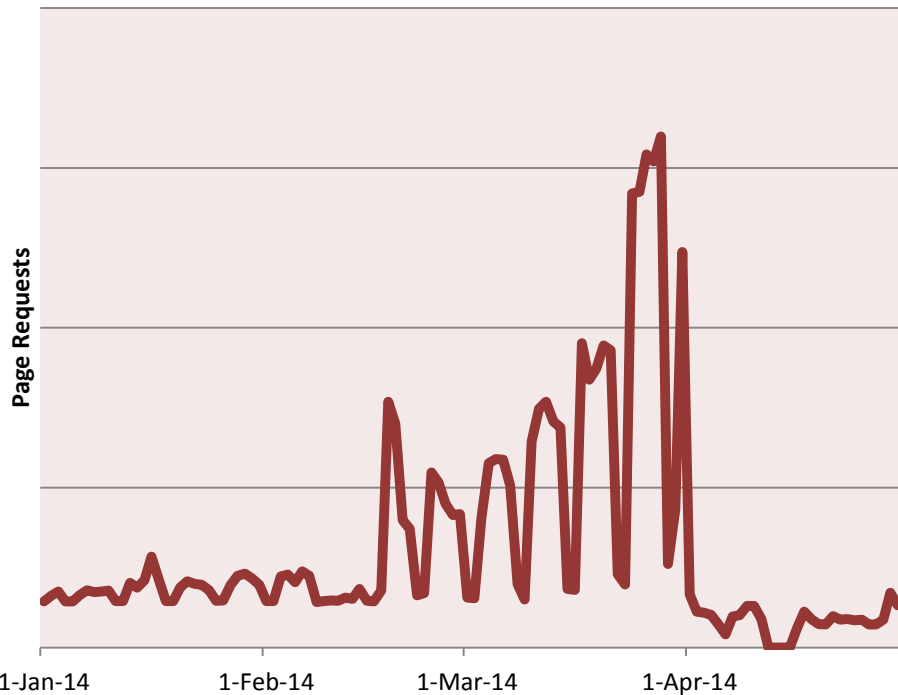
Include Key Electronic Reporting Functions



Manage Load through Architecture



**Reporting Activity During 6-week
Reporting Timeframe**

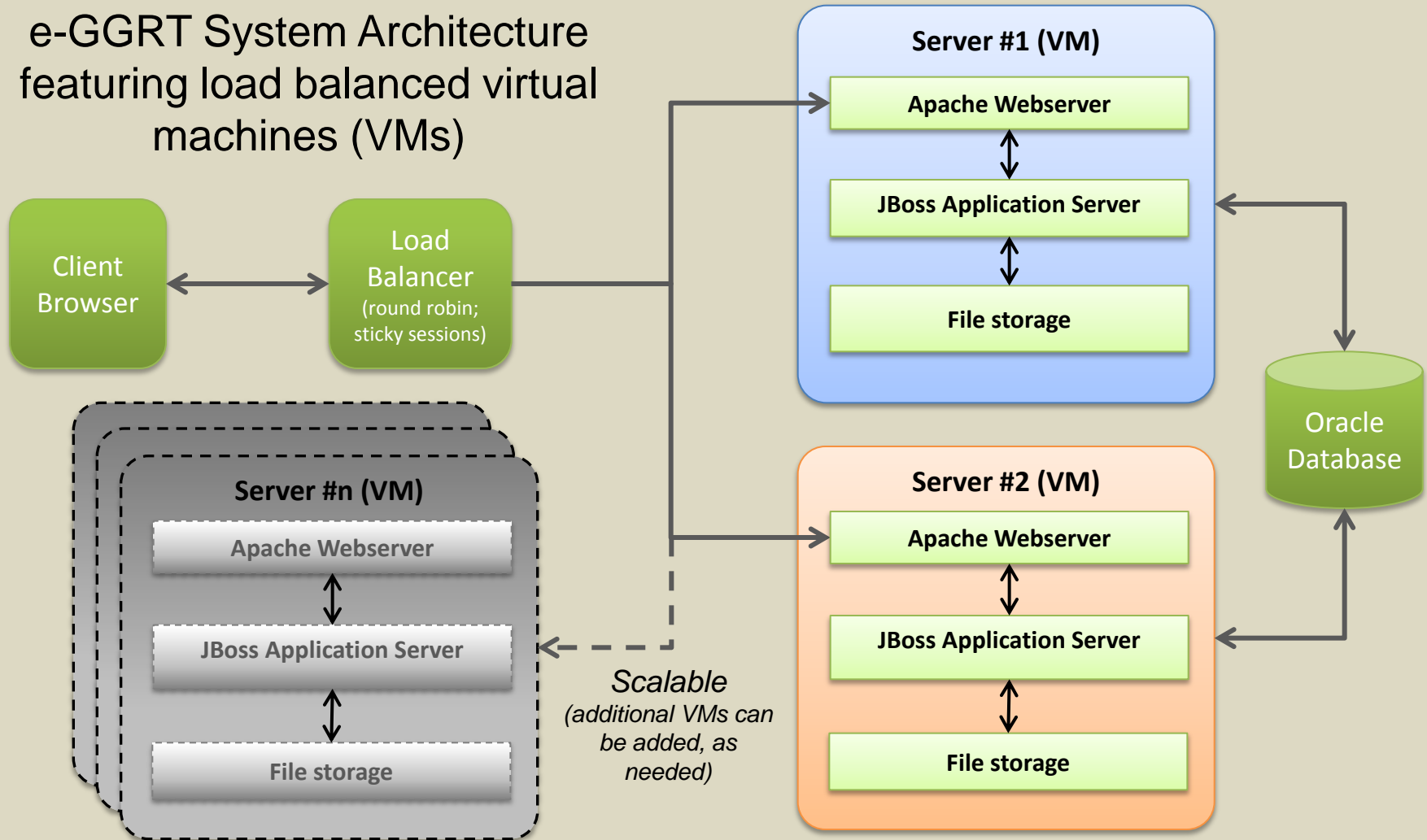


- Scalability
- Annual reporting deadline results in spikes in usage
- Architecture permits addition/removal of servers without disruption

Scalable Architecture



e-GGRT System Architecture
featuring load balanced virtual
machines (VMs)



Support Different Electronic Data Formats



Data Format	Used For
Numerical data, via web-form	Emissions and activity data, entered directly into e-GGRT web-form fields
Free text, via web-form	Explanations of exceptions and special circumstances, entered directly into e-GGRT web-form
Documents (PDF, XLS, Doc, ZIP etc)	MRV plans under subpart RR, Supporting information under subpart W BAMMs
Numerical/text via XLS smart form	Used in certain subpart modules to ingest facility's GHG data, compatible with verification module
Numerical/text via XML file	Used in lieu of web-forms to upload GHG annual report into e-GGRT

High Quality Data begins with High Quality Submissions



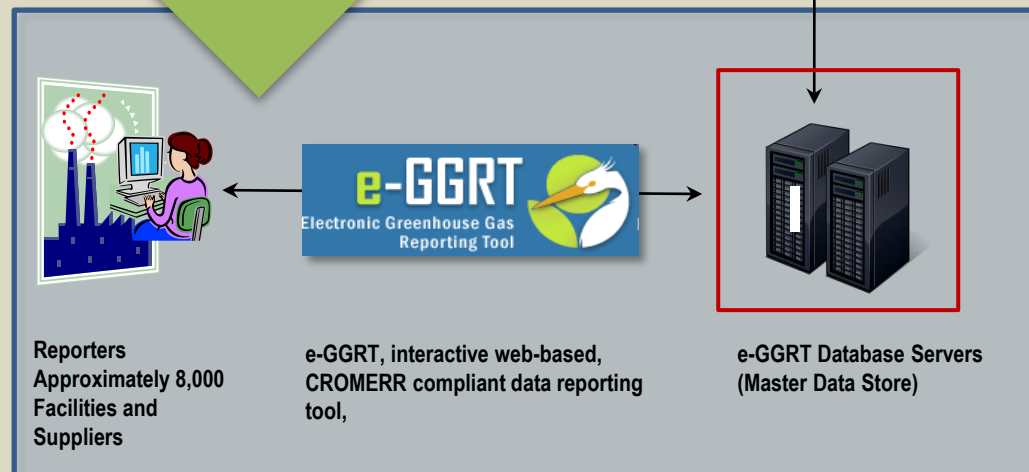
Design software and system to improve data quality before user submits it to EPA

Improve data quality *before* it is submitted to EPA

- Intuitive Interface
- Comprehensive Help
- Real-Time Data Quality Feedback



Data Verification & Compliance Management



High Quality Submissions (cont'd)



- Intuitive User Interface (Table C-1)

Hello, Kong Chiu | My Profile | Logout

e-GGRT Help

Using e-GGRT for Subpart D reporting

Chiu Industries (2010)

Subpart D: Electricity Generation

[Subpart D Overview](#) » [Add a Fuel](#)

ADD A FUEL

Use this page to select a fuel combusted in this electricity-generating unit. Repeat this process for each fuel consumed by this electricity-generating unit over the course of the reporting year. If the fuel you wish to add is not on the list, click "ADD an Other Fuel or Blend" to add a new fuel type. For additional information about reporting fuel information, please use the e-GGRT Help link(s) provided.

COAL AND COKE HIDE	PETROLEUM PRODUCTS SHOW
<input type="radio"/> Mixed (Industrial sector)	OTHER FUELS - SOLID SHOW
<input type="radio"/> Mixed (Industrial coking)	
<input type="radio"/> Mixed (Commercial sector)	OTHER FUELS - GASEOUS HIDE
<input type="radio"/> Coke	<input type="radio"/> Propane Gas
<input type="radio"/> Mixed (Electric Power sector)	<input type="radio"/> Blast Furnace Gas
<input type="radio"/> Subbituminous	<input type="radio"/> Fuel Gas
<input type="radio"/> Bituminous	<input type="radio"/> Coke Oven Gas
<input type="radio"/> Anthracite	SHOW
<input type="radio"/> Lignite	
NATURAL GAS HIDE	BIOMASS FUELS - GASEOUS SHOW
<input type="radio"/> Natural Gas (Weighted U.S. Average)	BIOMASS FUELS - LIQUID SHOW
	SOLID PARTIALLY BIOGENIC FUEL SHOW

[i](#) If a fuel is not found among those listed, you can add it to the other fuels and blends list below.

OTHER FUELS AND BLENDS [HIDE](#)

No other fuels or blends present.

[+ ADD an Other Fuel or Blend](#)

[CANCEL](#) [SAVE](#)

Easy to find and select multiple Fuels/types

Lists Expand and Contract

High Quality Submissions (cont'd)



- Real-Time Data Quality Feedback

The screenshot displays the EPA e-GGRT (Electronic Greenhouse Gas Reporting Tool) interface for the 'Chiu Demo Facility (2010)'. The top navigation bar includes links for HOME, FACILITY REGISTRATION, FACILITY MANAGEMENT, and DATA REPORTING. The user is logged in as 'Hello, Kong Chiu' with options for 'My Profile' and 'Logout'.

The main content area is titled 'FACILITY-LEVEL VALIDATION MESSAGES' and contains a table with the following data:

Validation Type ¹	ID ²	Message ³
Data Quality	HH026	Landfill capacity. The value you have provided is outside the EPA estimated range for this data element. Please double check this value and revise, if necessary. If you believe it to be correct, please submit the value as is.
Data Quality	HH078	Annual average methane concentration of landfill gas collected for destruction. The value you have provided is outside the EPA estimated range for this data element. Please double check this value and revise, if necessary. If you believe it to be correct, please submit the value as is.
Data Completeness	HH187	Surface area of area with daily soil cover and active gas collection (square meters). This data element is required.
Data Completeness	HH193	Surface area of area with a final soil cover and active gas collection (square meters). This data element is required.
Data Quality	HH313	Methane emissions from the landfill gas collection system (Equation HH-6). The value you have provided is outside the EPA estimated range for this data element. Please double check this value and revise, if necessary. If you believe it to be correct, please submit the value as is.
Data Quality	HH315	Methane emissions from the landfill gas collection system (Equation HH-6). The value you have provided is outside the EPA estimated range for this data element. Please double check this value and revise, if necessary. If you believe it to be correct, please submit the value as is.

Below the table is a section for 'HISTORICAL AND AERATION DATA VALIDATION MESSAGES' with one entry:

Validation Type ¹	ID ²	Message ³
Data Completeness	HH202	Decay rate (k). This is a required field.

A green arrow points from the 'Validation Report' text to the 'View Validation' link in the 'Subpart D: View Validation' button. Another green arrow points from the 'View real-time report' text to the 'View Validation' link.

Validation Report

View real-time report

Subpart D: View Validation

Validation Messages

Validation Types: e-GGRT generates a variety of validation types, defined below:

- Data Completeness: data required for reporting is missing or incomplete.
- Data Quality: data is outside of the range of expected values. The value you have provided is outside the EPA estimated range for this data element. Please double check this value and revise, if necessary. If you believe it to be correct, please submit the value as is.
- Screen Error: a data value or combination of data values prevents e-GGRT from continuing to the next page. Typically, this will not appear on the Validation Report, but instead will be displayed on the data entry page at the time the error was created.

Hybridize Data Entry



- Challenge: Short timeline, changing business requirements
- Web form data entry
 - User friendly
 - Significant development and testing effort
 - Direct parsing of entered data
- Spreadsheet Reporting form (Microsoft XLS)
 - Faster development and testing
 - Harder to parse data

EQ. Q-1: CO₂ EMISSIONS CALCULATION

Use equation Q-1 to calculate annual CO₂ mass emissions for this Taconite Indurating Furnace.

EQUATION Q-1 SUMMARY AND RESULT

$$CO_2 = \frac{44}{12} \times [(F_s) \times (C_{sf}) + (F_g) \times (C_{gf}) \times \frac{MW}{MVC} \times 0.001 + (F_l) \times (C_{lf}) \times 0.001]$$

Hover over argument in the equation above to reveal

Annual CO₂ mass emissions (metric tons)

Use Q-1 spreadsheet to calculate

INPUT: SOLID FUEL - FUEL 1

Annual mass or volume is based on one or more substitute monthly data values ☐

Number of months that missing data procedures were followed, if applicable (months)

Subpart U - Miscellaneous Uses of Carbonate

COMPLETE REQUIRED INFORMATION AND UPLOAD SPREADSHEET TO E-GGR

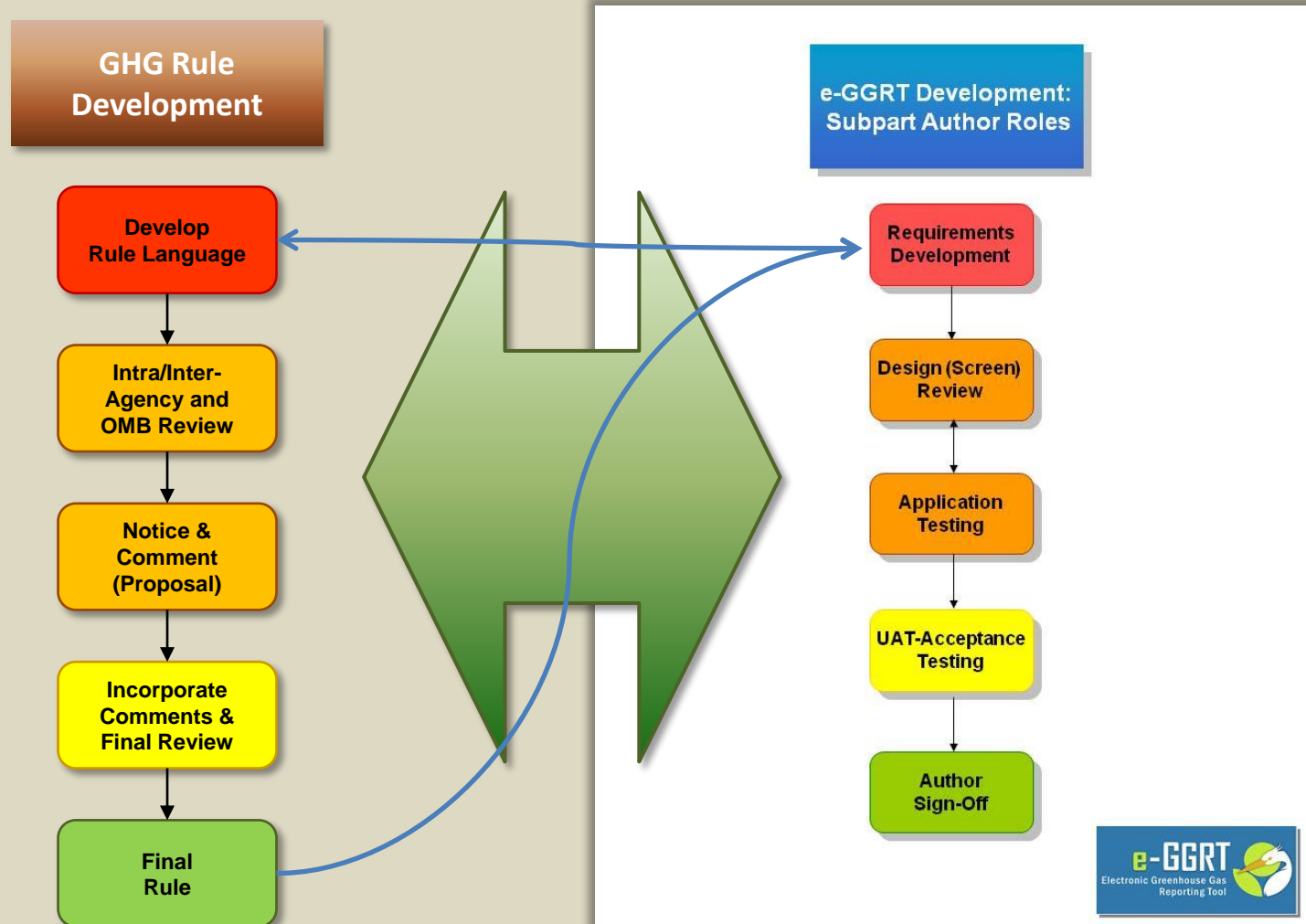
Version R.02
Today's date 2/15/2013

Facility Name:	
GHGRP ID:	
Reporting Period:	
Comments:	2011 2012 2013 2014 2015 2016 2017 2018
Calculation Method (98.216(d)):	

Instructions: Complete if you are using a spreadsheet to calculate

Carbonate Type	Calcination Fraction Measurement Method (98.216(e)(3))	Method
Limestone - (CaCO ₃)		
Magnesite - (MgCO ₃)		
Dolomite - (CaMg(CO ₃) ₂)		
Siderite - (FeCO ₃)		
Ankerite - (Ca(Fe, Mg, Mn)(CO ₃) ₂)		

Coordinate Regulation and Data System Development

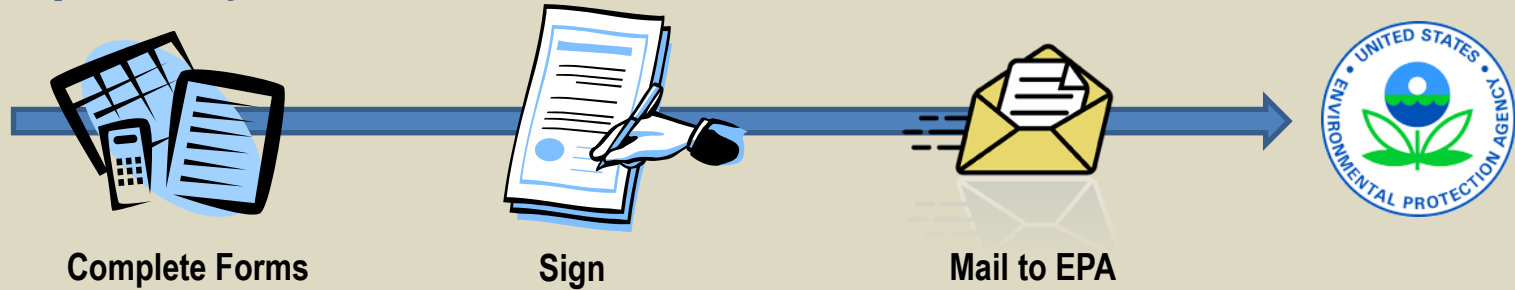


Electronic Signatures

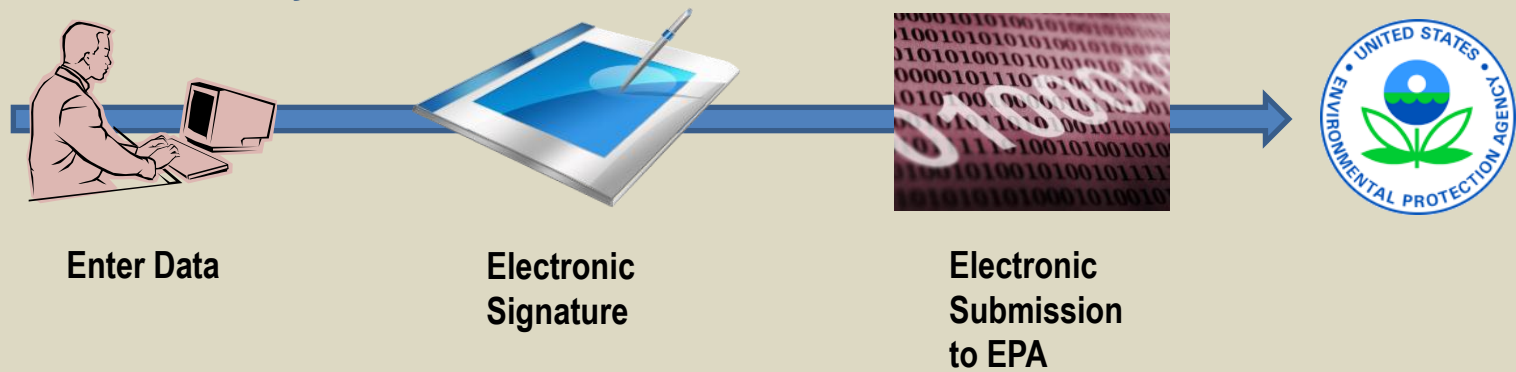
Paper vs Electronic Reporting



Paper workflow



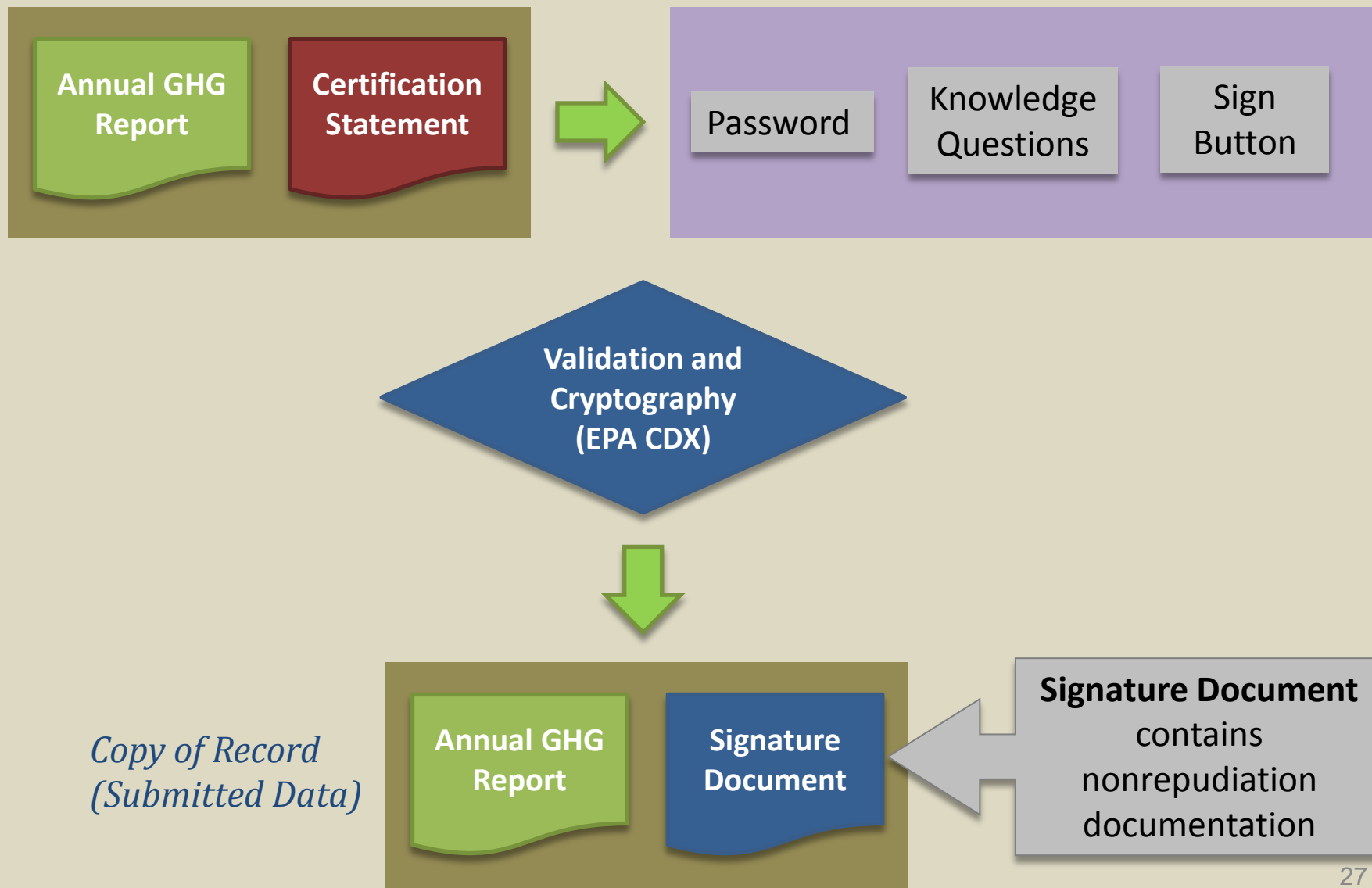
Electronic workflow





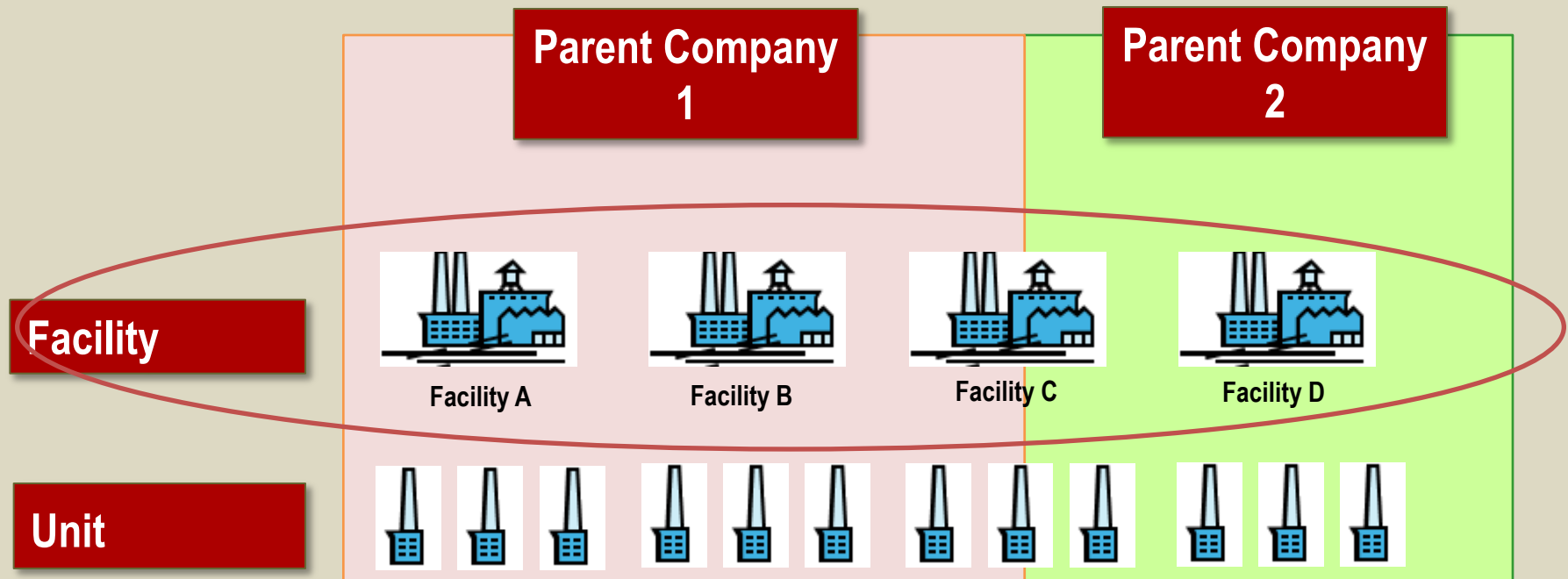
- Cross Media Electronic Reporting Rule (CROMERR)
- Electronic documents must have valid electronic signature if paper version requires signature
- The electronic document receiving system must be able to prove, legally that:
 - The electronic document was not altered without detection during transmission or after receipt
 - The electronic document was submitted knowingly
 - Any identified submitter or signatory had the opportunity to review the copy of record in a human-readable format
 - Each electronic signature was valid at the time of signing
 - Each signatory has signed an **electronic signature agreement**
 - The Identity of every individual using an electronic signature device has been determined with legal certainty

e-GGRT CROMERR Workflow



Managing Facilities and Users Electronically

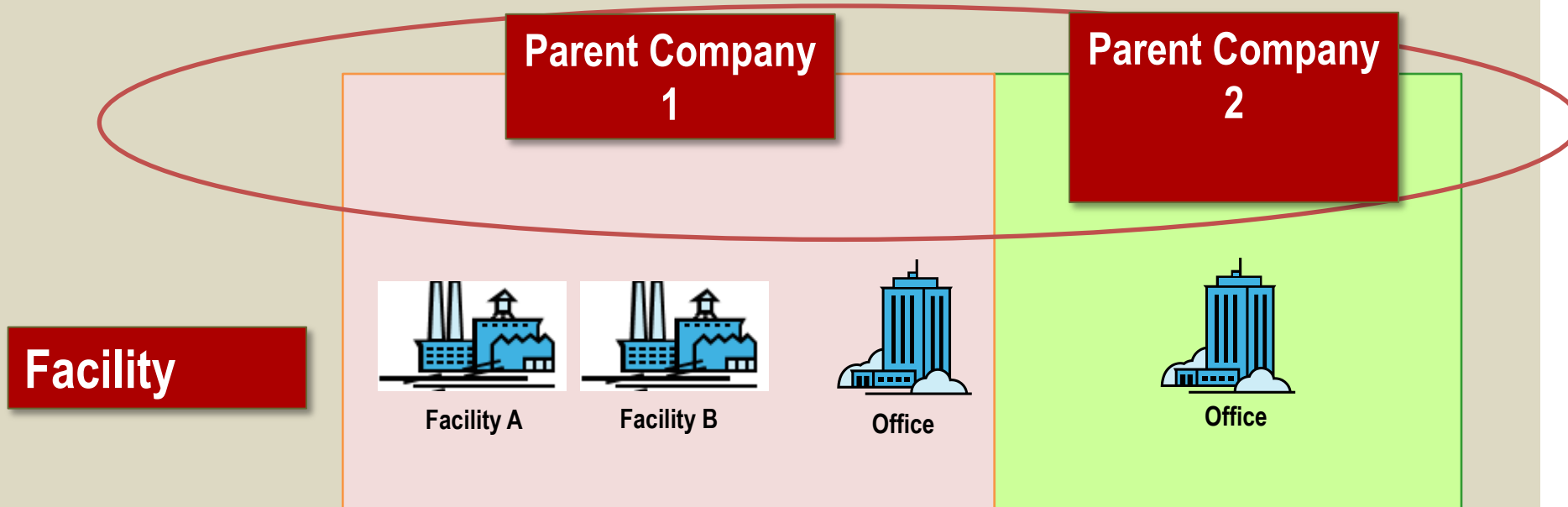
Reporting Level: Direct Emissions



- **Examples:** Iron and Steel, Power Generation, Cement Production

Reporting Level: Suppliers

汇报级别:

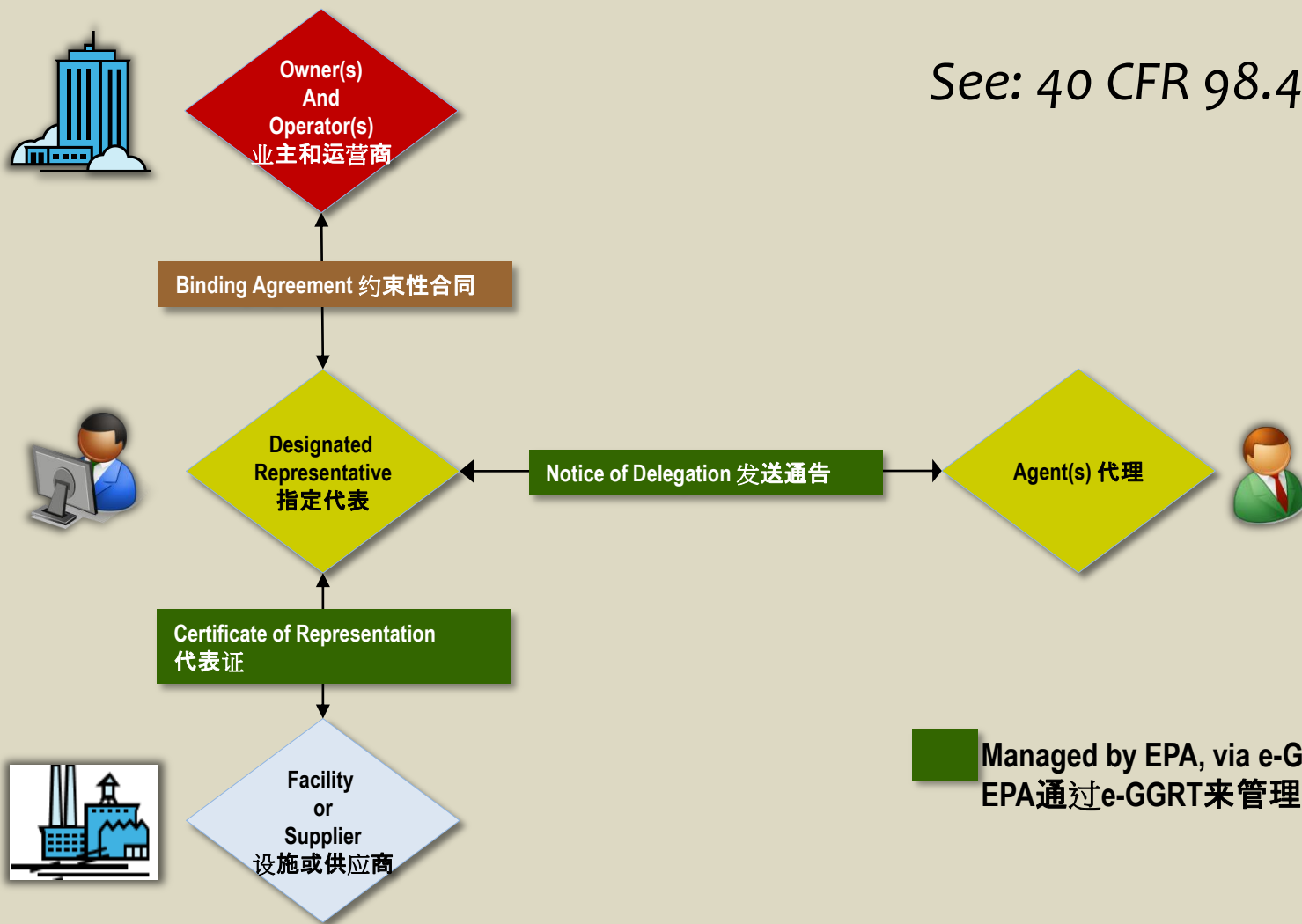


- **Examples:** Suppliers of Petroleum Products, Suppliers of Industrial GHGs, Natural Gas Supply

Designated Representative for Facility or Supplier



See: 40 CFR 98.4



Thank You! For More Information:



- Part 98 (U.S. GHG Reporting Rule) Info:
 - www.epa.gov/ghgreporting
- Published Data:
 - ghgdata.epa.gov

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