**NDCEE**

National Defense Center for Energy and Environment

# Developing a Greenhouse Gas Footprint for an Army Installation

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**DoD Executive Agent**

Office of the Assistant Secretary of the Army (Installations and Environment)

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# Project Origins Demonstration/Validation Project for EMIS/EMS

- FY05, FY06, FY08 appropriations to prove EMIS/EMS applicability
- Developed compliance and process solutions for selected installations
- Through the National Defense Center for Energy and Environment (NDCEE) worked with FORSCOM, TRADOC, AMC, MEDCOM, NGB, USAR
  - Forts Carson, Benning, Detrick; Anniston Army Depot, WV, CA, HI Army Guard, 9th RRC
- Developed solutions in most disciplines at installations
  - Air emissions, Title V permit management, water – DMR, HW management, and reporting, EMS ISO14001, inspections and audits, asbestos, regulatory reporting, GHG footprint
- Resulted in proven Value-Added benefits
  - Reduced risk of fines, NOV's
  - Single repository source and reporting tool
  - Institutionalized data
  - Cost avoidance and efficiency

# GHG Footprint Objectives - DASA-ESOH

- Standard approach to GHG inventories
- Scalable solution which can be applied at other installations
- Consistent reporting and rollup
- Demonstrate capability to comply with EO 13423
  - Strengthening Federal Environmental, Energy, and Transportation Management
    - Sec. 2. Goals for Agencies. In implementing the policy set forth in section 1 of this order, the head of each agency shall:

      (a) improve energy efficiency and reduce greenhouse gas emissions…

# GHG Footprint Objectives
# Ft. Carson DPW

- Build on existing emissions inventory
- Demonstrate initiative with regard to Colorado Department of Public Health and Environment (CDPHE)
- Contribute to Ft. Carson sustainability efforts

# GHG Footprint
# Major Project Components

- Detailed Project Plan
  - Identified approach, sources, and detailed emission estimating procedures (Dec 07)
- Configuration into existing Ft. Carson EMIS (Mar 08)
- Training (Mar 08)
- Adoption (ongoing)

Department of the Army


Greenhouse Gas Management System

GHG Emissions Inventory
Ft. Carson, CO

# Ft. Carson GHG Footprint

- ***Scope 1 Emissions*** – Direct GHG emissions from sources within the boundary of Ft. Carson: stationary, mobile, fugitive

- ***Scope 2 Emissions*** - Indirect GHG emissions from purchased electricity, heat, or steam consumed at the Installation, but not generated by sources within the boundary of Ft. Carson

- ***Scope 3 Emissions*** - Other indirect GHG emissions which are a consequence of Installation activities but are emitted from sources not owned or controlled by Ft. Carson

- ***GHG Reduction Projects*** – permanent removal or offset of GHG emissions resulting from planned human activity

# Scope 1- Direct Emissions

## *Direct Emissions: on-installation sources*

- Stationary External Combustion Sources (boilers, heaters, etc.)
- Internal Combustion Sources (generators, dynamometers, airfield engine testing)
- Military Training – Munitions Expended
- On-Installation Landfills
- Fire Training
- Prescribed Burning (Grassland Management)
- GSA/DPW Fleet Vehicles
- Tactical Vehicles (land & air)
- Tactical Vehicles Maintenance (fugitive emissions)

# Scope 2 & 3: Indirect and Other Emissions

- ***Scope 2: Indirect GHG emissions***

  *(from purchased* electricity, heat, or steam )

  - Purchased power—Colorado Springs Utility
  - Renewable energy
- ***Scope 3: Other indirect emissions***
  - Construction Vehicles (tenants and contractors)
  - Commercial Delivery Vehicles (includes all commercial traffic)
  - Waste Disposal – Landfill Emissions (tons of Solid Waste disposed off site)
  - Employee Travel – VMT for privately owned vehicles, based on registered vehicle counts.

# Calculating GHG Emissions

- ***Six GHG Gases***: Carbon Dioxide ($CO_2$), Methane ($CH_4$), Nitrous Oxide ($N_2O$), Hydrofluorocarbons (HFC's), Perfluorocarbons (PFC's), and Sulfur Hexafluoride ($SF_6$).

- ***Calculate Emissions*** for each GHG using established protocol methods and emission factors, examples include:
  - US EPA Emissions Estimates (AP 42)
  - U.S. EPA, *Inventory of Greenhouse Gas Emissions and Sinks: 1990-2005* (2007)
  - IPCC Guidelines for National Greenhouse Gas Inventories

- ***Convert Emissions*** for each GHG using established Global Warming Potentials (GWP)

- ***Report results*** in Carbon Dioxide Equivalents in metric tons ($CO_2e$) for each source and aggregate across Installation

# Ft. Carson – A GHG Prototype

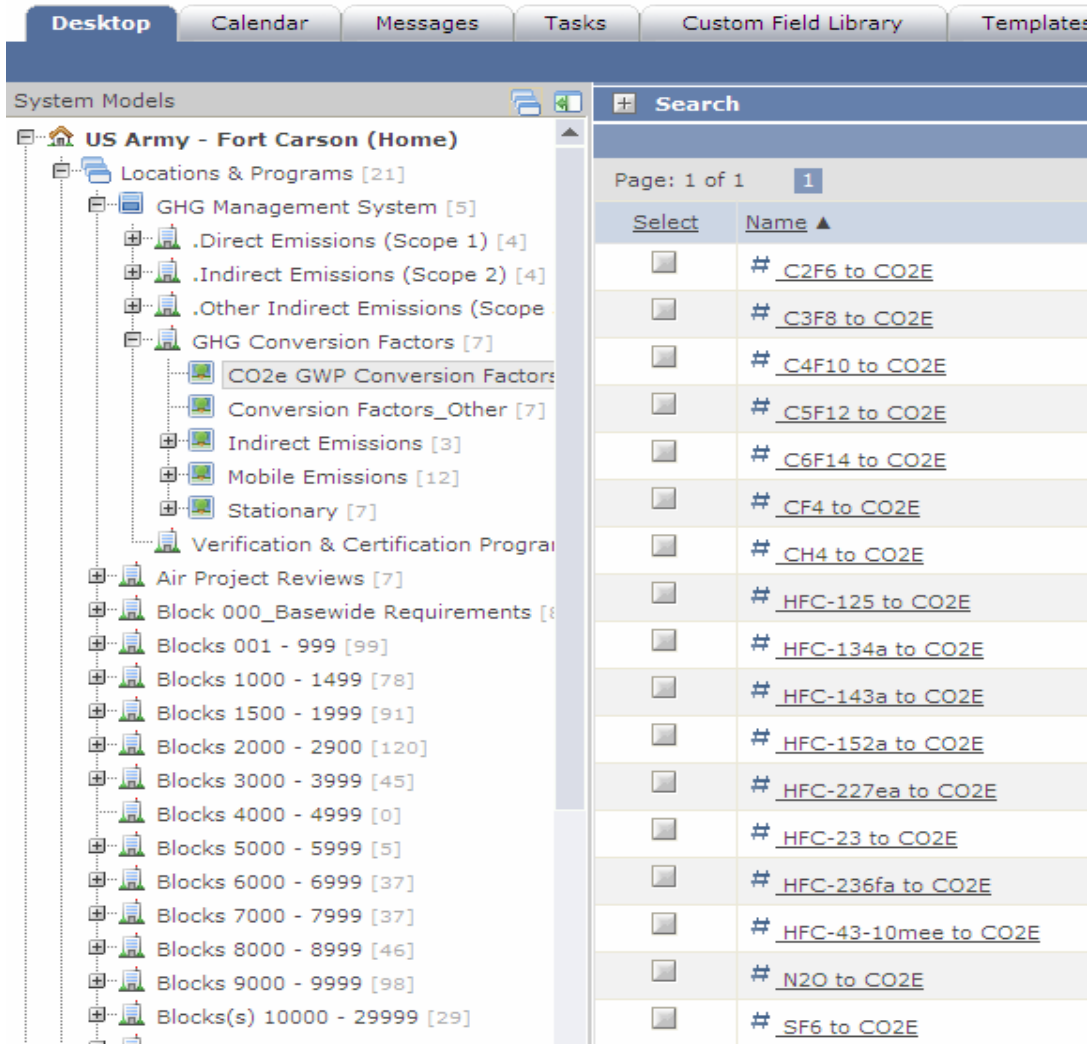
- Uniform Definitions
- Standard Libraries
- Standardized Calculations
- Standard Templates
- Standard Models
- Standard Data Rollups and Reporting

# Uniform Definitions

- Organizational and geographic boundaries at installations
- All six GHG gases and global warming potentials
- Standard equipment and GHG source categories for Army assets and programs
- GHG Intensity Metrics
- Verification protocols (modeled after CCAR and TCR)
- Critical terms, such as:
  - **$CO_2$ Sinks:** Locations in the environment that permanently absorb and store significant amount of $CO_2$
  - **GHG Emissions Credit:** A permanent, enforceable, quantifiable and surplus GHG emissions reduction certified by a qualified party and which may be used for the purpose of offsetting emissions

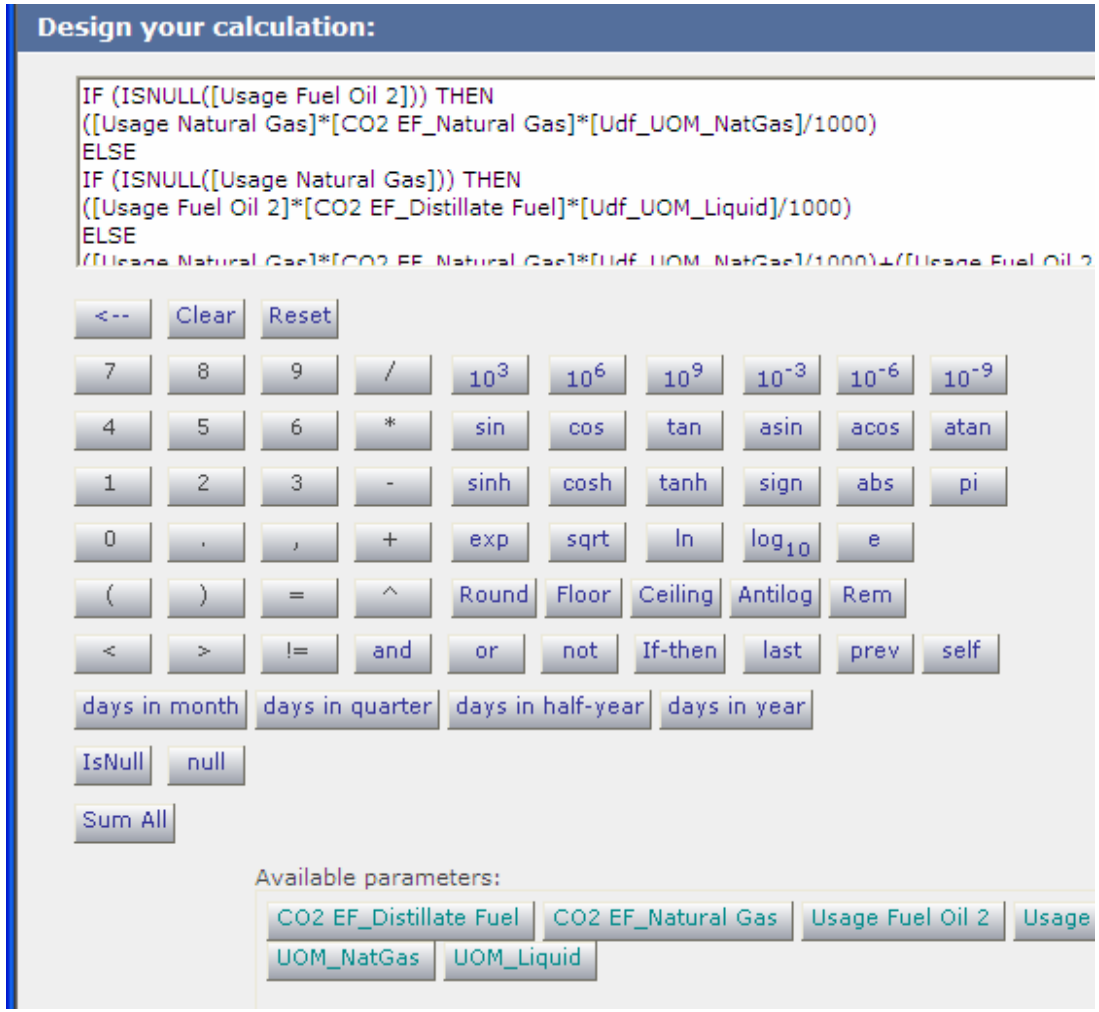
# Standard Libraries

- Standardized and Universally Applied
  - Emission Factors
  - Conversion Factors
  - Global Warming Potentials
  - Historized Values



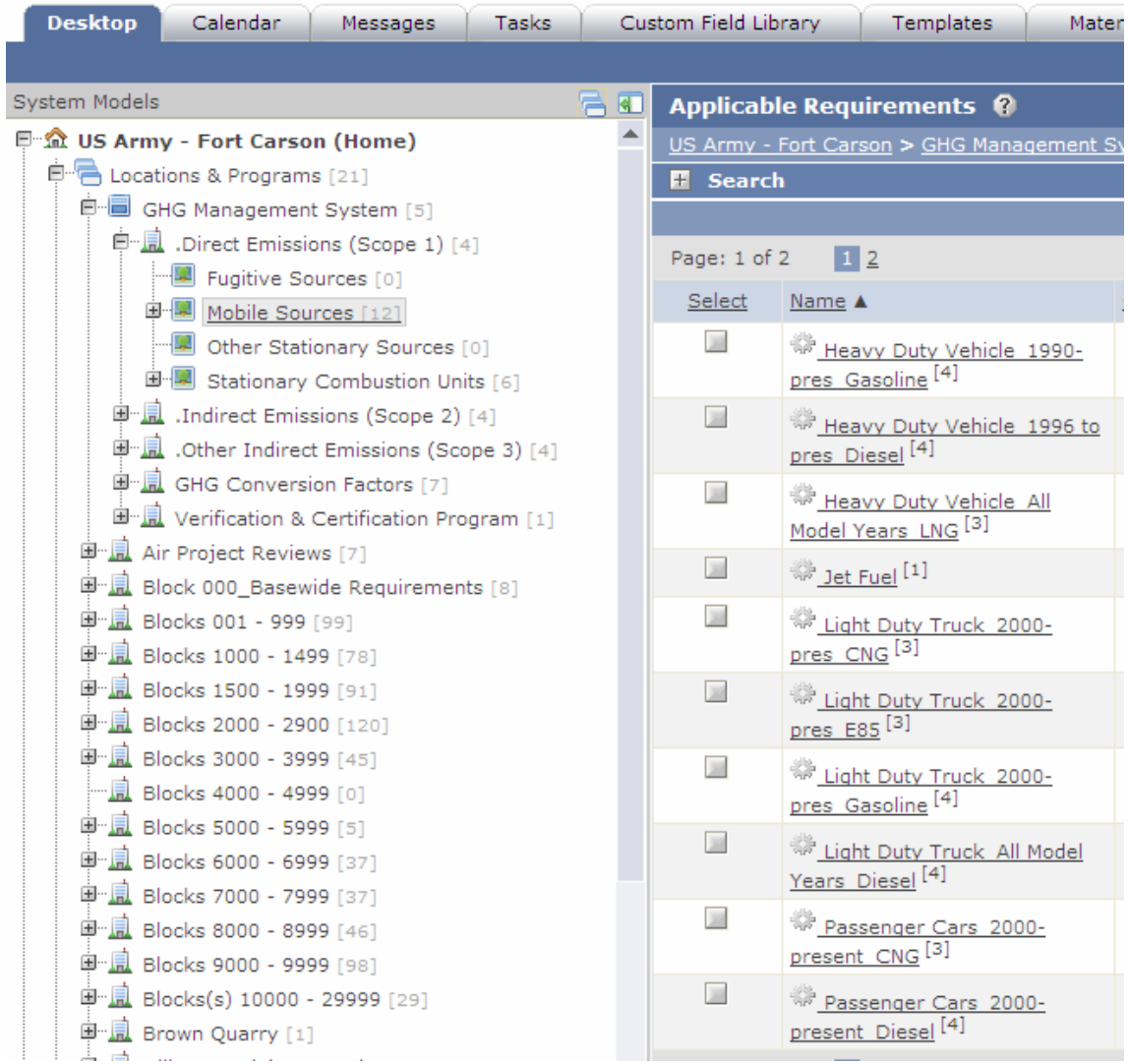
# Standard Calculations

- Consistent Formulae
- Unit of Measure Conversions for Easy Data Entry
- Consistent Output



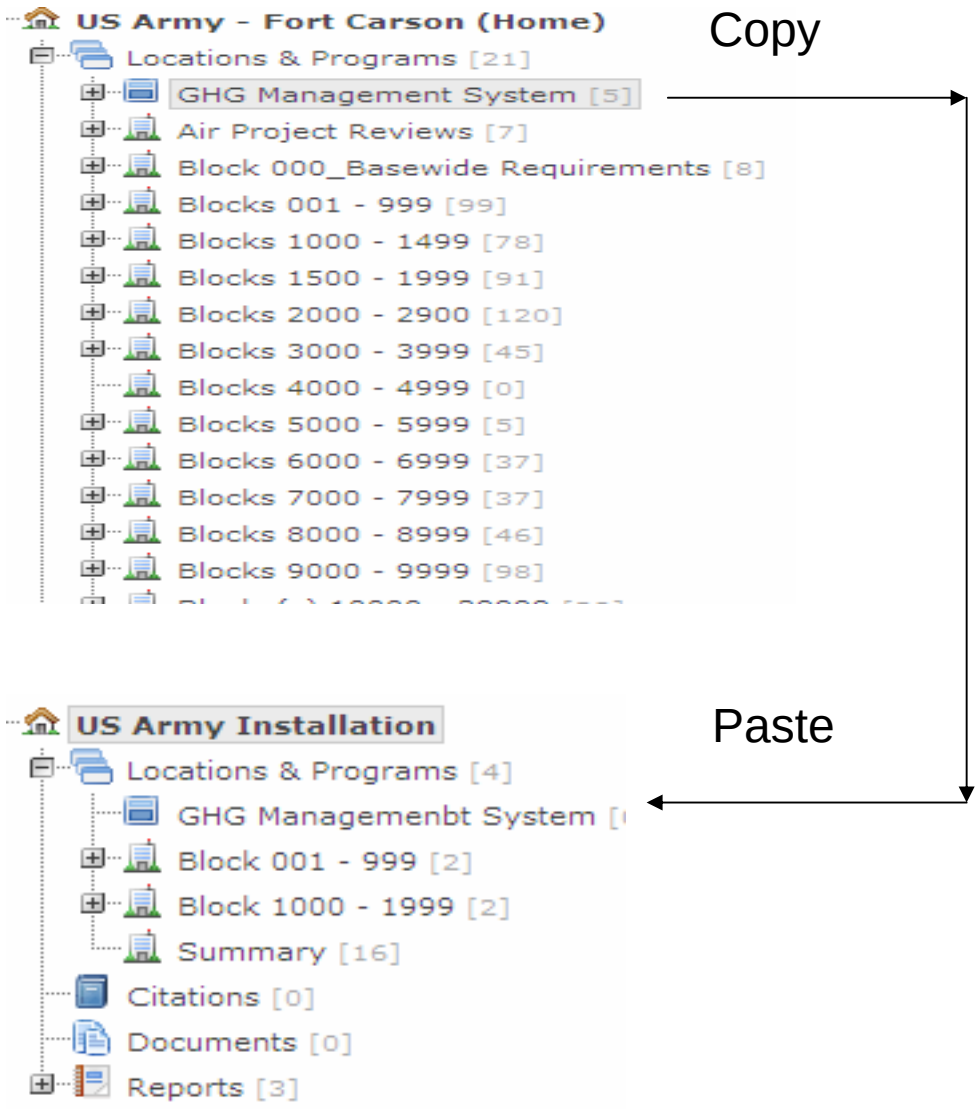
# Standard Templates

- Uniform Source Categories
- Utilize Standard Calculations
- Uniform Template Library for all Installations
- Copy and Paste by Installation Personnel



# Standard Installation Model

- Entire Ft. Carson GHG Model is Easily Reproduced at any Installation
- Automatically Incorporates Standard Definitions, Calculations, Templates
- Simple Customization
  - Copy and Paste Templates
  - Rename to Match Local Equipment

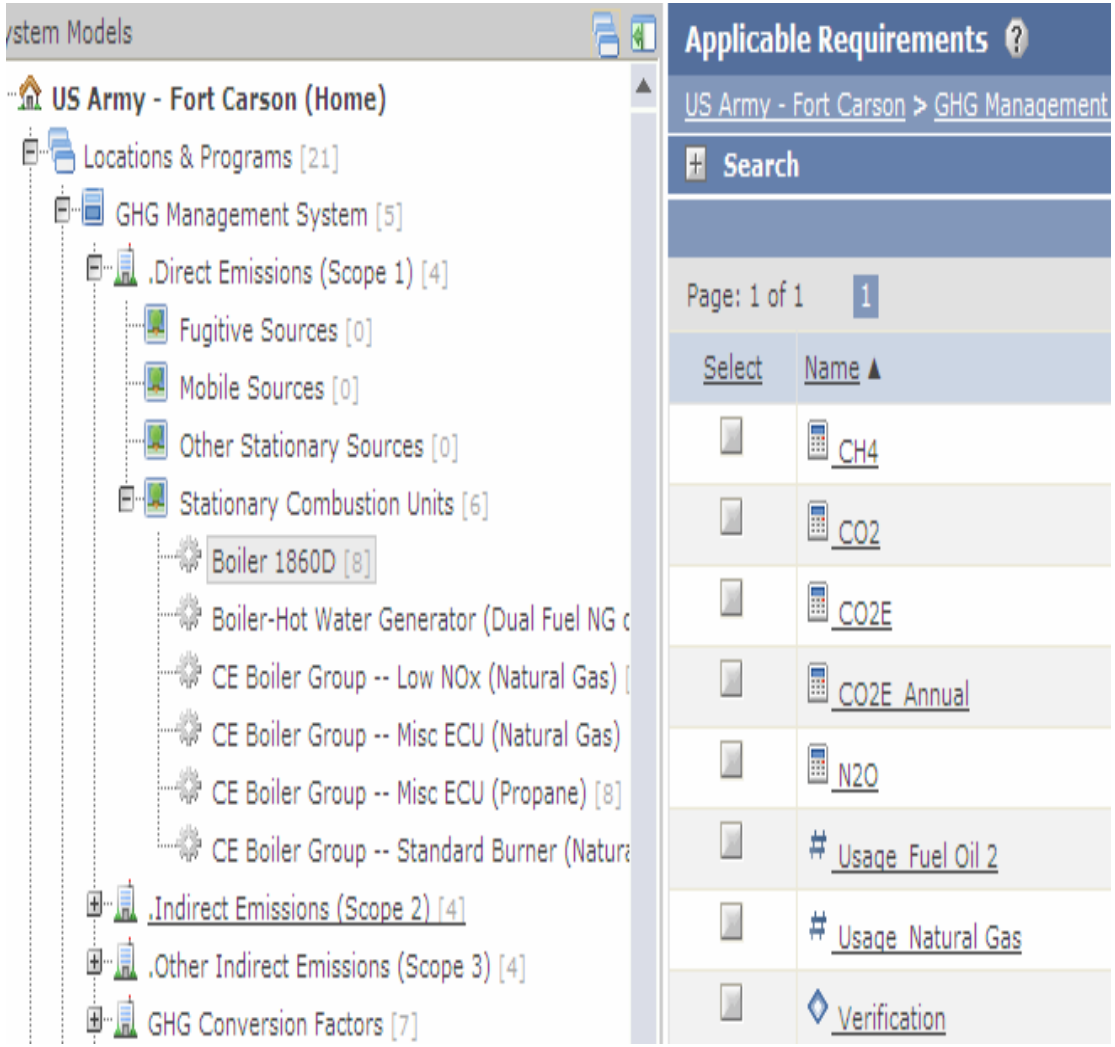


# Direct Emissions - Stationary Sources

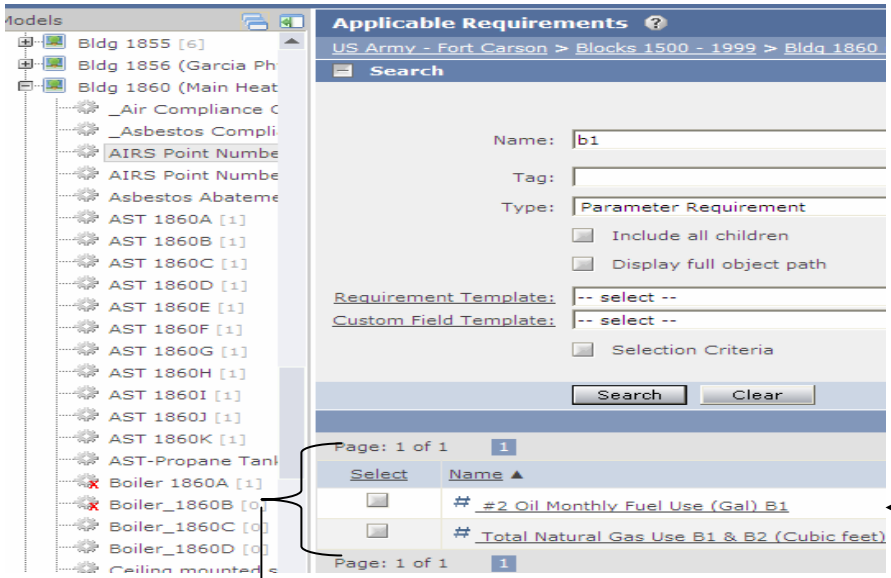
- Stationary External Combustion Sources (boilers, heaters)
  - Fuel type – Natural Gas, #2 Fuel Oil, Diesel, Propane
  - GHG's emitted – $CO_2$, $CH_4$, $N_2O$
  - Emissions estimating method
    - $CO_2$ from U.S. EPA, *Inventory of Greenhouse Gas Emissions and Sinks: 1990-2005* (2007), Annex 2.1
    - $CH_4$ & $N_20$ from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 2: Stationary Combustion
  - Input data – standard cubic feet (gas/propane), gallons (oil/diesel)
  - Additional info – Usage data already in Enviance for Title V air emissions inventory (metered gas fuel use corrected for altitude)
  - Confidence level – High, certified Title V sources

# Standard Template Combustion Source as Implemented at Ft. Carson

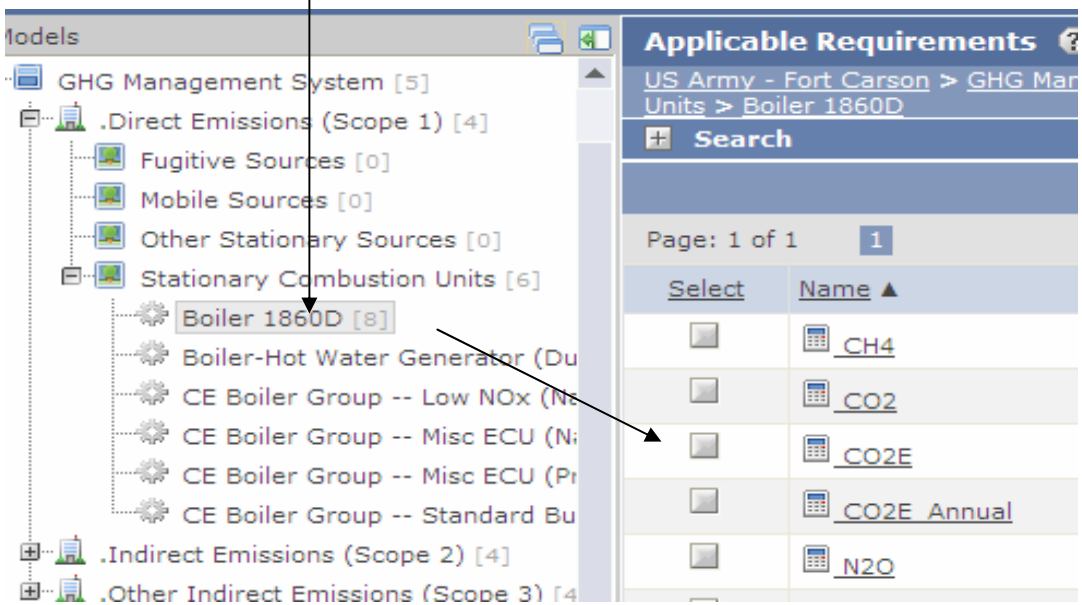
- Standard Template for External Combustion used to create actual sources at Ft. Carson
- Each of these actual sources utilize the standard calculations
- Next slide shows leveraging existing Title V data to produce the GHG emissions for these sources



# Example: Boiler, Bldg 1860




Fuel Use Entered for Existing Title V Emission Inventory ….



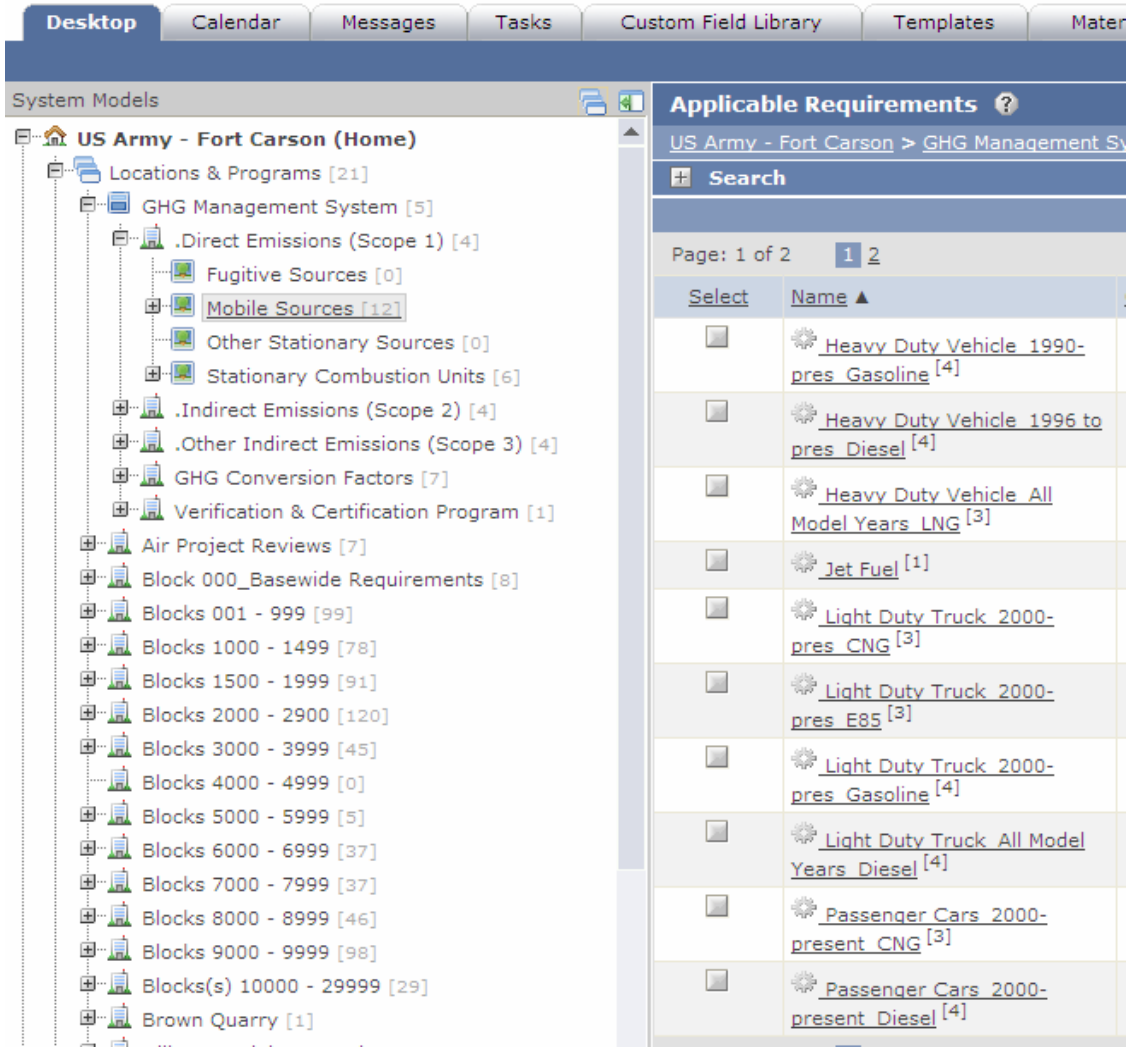

Automatically Triggers GHG Emissions Calculations in the GHG Model. (No separate data entry required.)

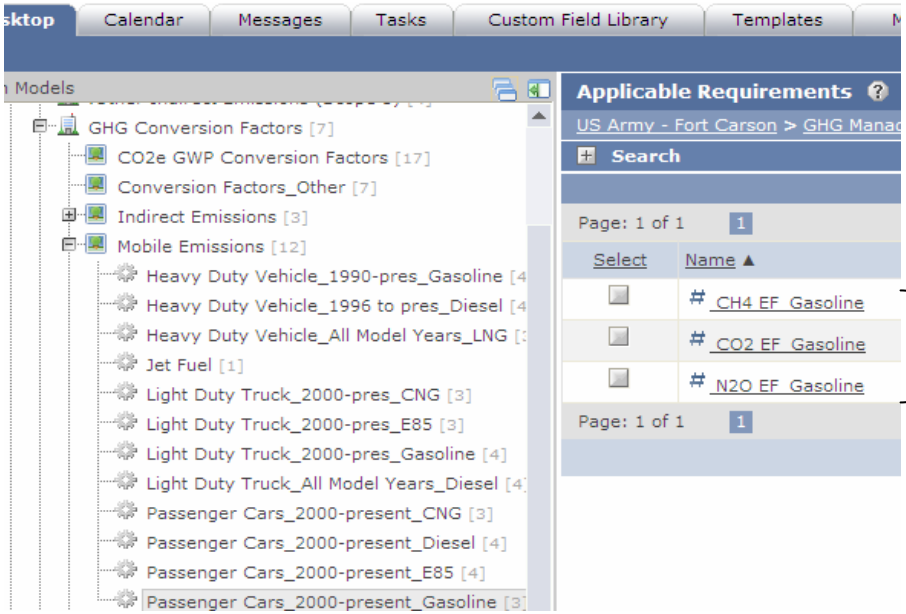
# Direct Emissions - Installation Vehicles

- Installation Vehicles (not tenants and contractors)
  - Fuel type – Diesel, Gasoline
  - GHG's emitted – $CO_2$, $CH_4$, $N_2O$
  - Emissions estimating method – U.S. EPA, *Inventory of Greenhouse Gas Emissions and Sinks: 1990-2005* (2007) – highway vehicle tables
  - Input data – Vehicle Miles Traveled, Fuel usage, # Vehicles
  - Confidence level – High, input data for standard methods is available

# Standard Template
# Mobile Sources at Ft. Carson

- Standard Template for Mobile Source used to match actual vehicle classes at Ft. Carson
- Each of these actual sources utilize the standard calculations
- Next slide shows use of standard emission factors and Ft. Carson VMT data to produce the GHG emissions for these sources

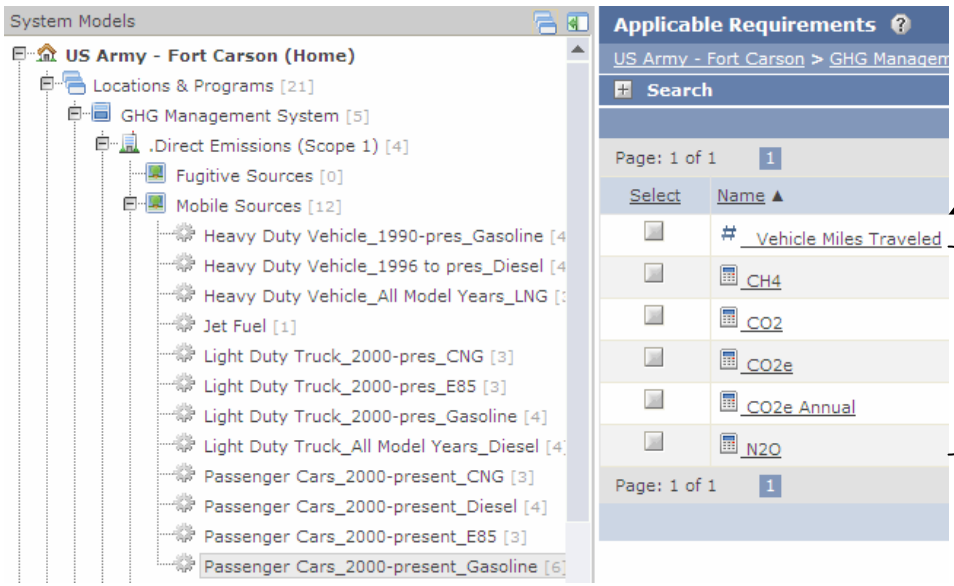





Example: Passenger Cars (Gasoline)

Emission Factors (emission per mile traveled) from Standard Library…

Multiplied by…




Ft. Carson Vehicle Miles Traveled Data (uploaded via Excel)

GHG Emissions (Standard Components and Units of Measure)

# Indirect Emissions - Purchased Electricity

- Colorado Springs Utilities
- GHG's emitted – $CO_2$, $CH_4$, $N_2O$
- Input data – MWh metered, emission factors for $CO_2$, $N_2O$, and $CH_4$
- Emission Factor Sources
  - $CO_2$ – Colorado Springs Utilities
  - $N_2O$ and $CH_4$ - US Department of Energy, Revised/Updated State-Level GHG EF's for Electricity (February 2000)
- Emissions estimating method – MWh metered multiplied by individual emission factors for $CO_2$, $N_2O$, and $CH_4$. GWP's applied to yield $CO_2e$.
- Confidence level – High, metered values for MWh and standard emission factors

# GHG Emission - Reduction Projects

- Several energy efficiency and renewable energy projects are being considered that may result in GHG emission reductions:

| Source | Comments |
|---|---|
| Solar water heaters | GHG savings from reduced electric/gas utility purchases. |
| Transpired solar collectors | GHG savings from reduced electric utility purchases. |
| Johnson Controls EE RFP | GHG savings from reduced electric/gas utility purchases. |
| HVAC control system | GHG savings from reduced electric/gas utility purchases. |
| Biomass Sequestration | GHG offsets through managed projects. |
| REC trading | GHG credits associated with renewable energy credit purchases. |

# GHG Footprint and Management Reports

The System will generate the following Installation-level reports:

## Directorate of Public Works (DPW)

- *Federal Report* – DOE/EIA 1605b Voluntary GHG Reporting Program
- *Intensity-based Metrics* – US Army metrics to be established

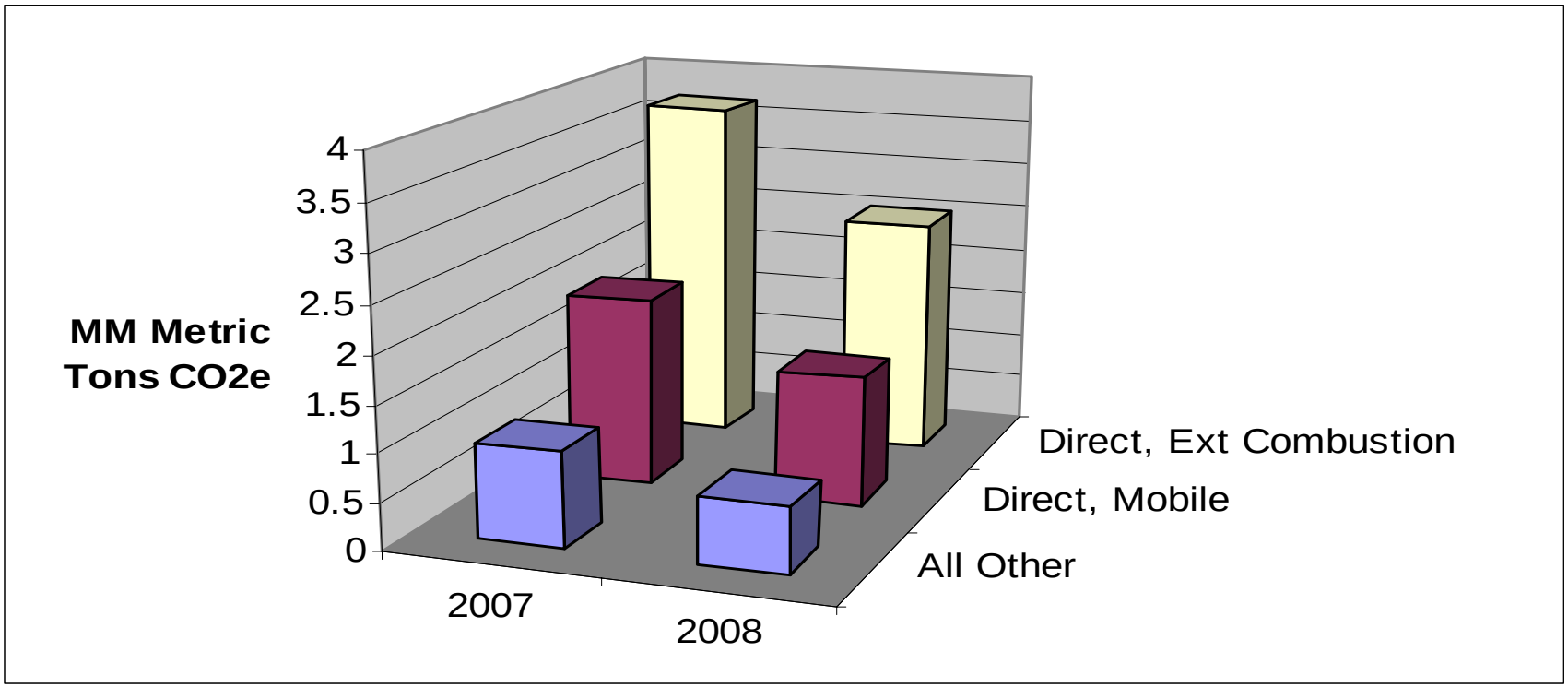
## Fort Carson Command

- *Greenhouse Gas Emission Annual Inventory Report* – addendum to current AEI report for Criteria Pollutants (PM10, NOx, CO, VOC, $SO_2$, Pb) and Hazardous Air Pollutants
- *Sustainability Report* – GHG performance measures to be included in annual sustainability report

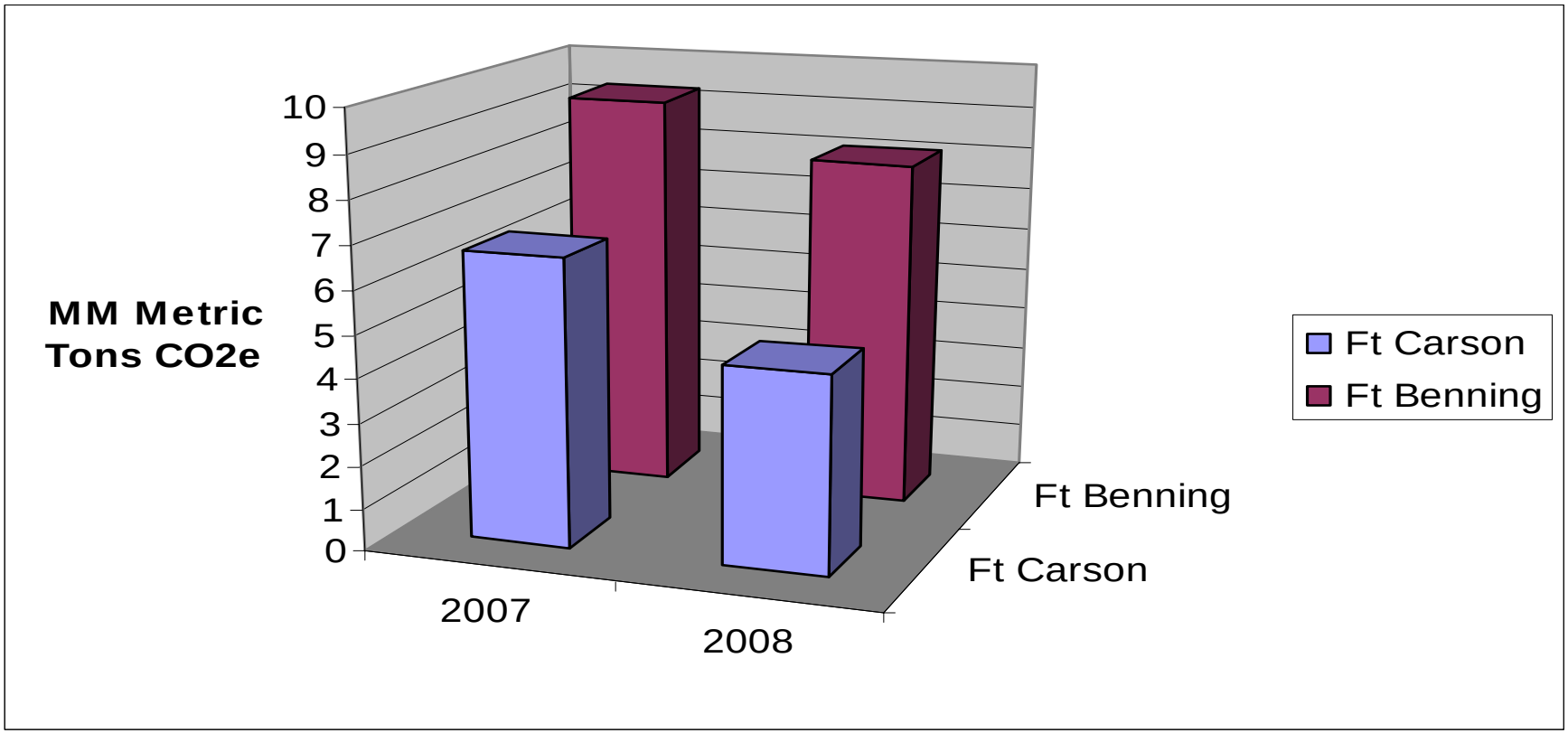
## State Voluntary Reporting

- *The Climate Registry* -- Voluntary multi-state registry adopted by 39 states (including Colorado) as best management practice for state-level reporting (format not yet determined)

# Rollup Reports
# Compare Sources at Ft. Carson



# Rollup Reports
# Compare Entire Installations



# Contact Information

## Task N. 490 – Development of a Greenhouse Gas (GHG) Footprint Creating and Assessment Methodology for the U.S. Army

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# Questions and Answers