AMERICAN PETROLEUM INSTITUTE

# API SANGEA 4.0™ for GHG Emissions Accounting & Reporting

Sue Sung, PhD, PE

Director – EHS Technology

Trinity Consultants T3

# API Sponsored SANGEA 4.0™

**Ms. Bukky Adefemi**
**American Petroleum Institute**

- API sponsors the effort to promote standardized GHG emissions accounting and reporting approach
- Complete overhaul from the previous spreadsheet version to include both API Compendium 2009 and relevant EPA MRR subparts for petroleum industries
- SANGEA 4.0 is distributed free of charge to oil and gas companies

# SANGEA 4.0 Overview

- A desk-top application built in **Microsoft .net Framework** with **Access** database for storing source information and **Microsoft Reporting Services** for reports and export results

- Similar to SANGEA 3, the new software is designed to report emissions for an entity with emissions from multiple "Locations"

- Designed to assist petroleum companies with estimating, managing, and reporting greenhouse gas (GHG) emissions and can normalize GHG emissions based on energy consumption and/or productions

- Including EPA AP-42 emission factors for calculating criteria pollutant emissions

# Introduction to SANGEA 4.0

- System at a glance:

# STEP-BY-STEP SANGEA SET UP PROCESS

# Step 1: Select Overall Preferences

- *Standard conditions (60ºF vs. 68ºF) used for emissions calculations.* To avoid confusion of the standard condition for different source types, all gaseous material volumes are set under one condition. API Compendium is based on 60ºF while USEPA MRR has mixed standard conditions. SANGEA-4 has converted emissions factors to cover both conditions.

- *Whether to include criteria pollutants.* SANGEA-4 includes calculation methods for evaluating criteria pollutants based on emission factors from USEPA AP-42 (3) or user specified emission factors. If the user elects to calculate criteria pollutant emissions in SANGEA-4, additional questions for each source will appear for proper calculations.

# Step 2: Set Up A Reporting Entity

- For each reporting entity, users will provide basic entity information with the primary product that will be used for normalizing GHG emissions.

# Step 3: Set Up Reporting Locations

- SANGEA reports emissions for a given location, which can be managed under location groups to cover business segments and/or geographical regions

- For USEPA MRR reporting requirements, a reporting facility (e.g., an onshore production) can be set up as a "location"

- SANGEA 4.0 includes the EPA sub-basin categories database.

# SANGEA 4.0 Reporting Entity Hierarchy
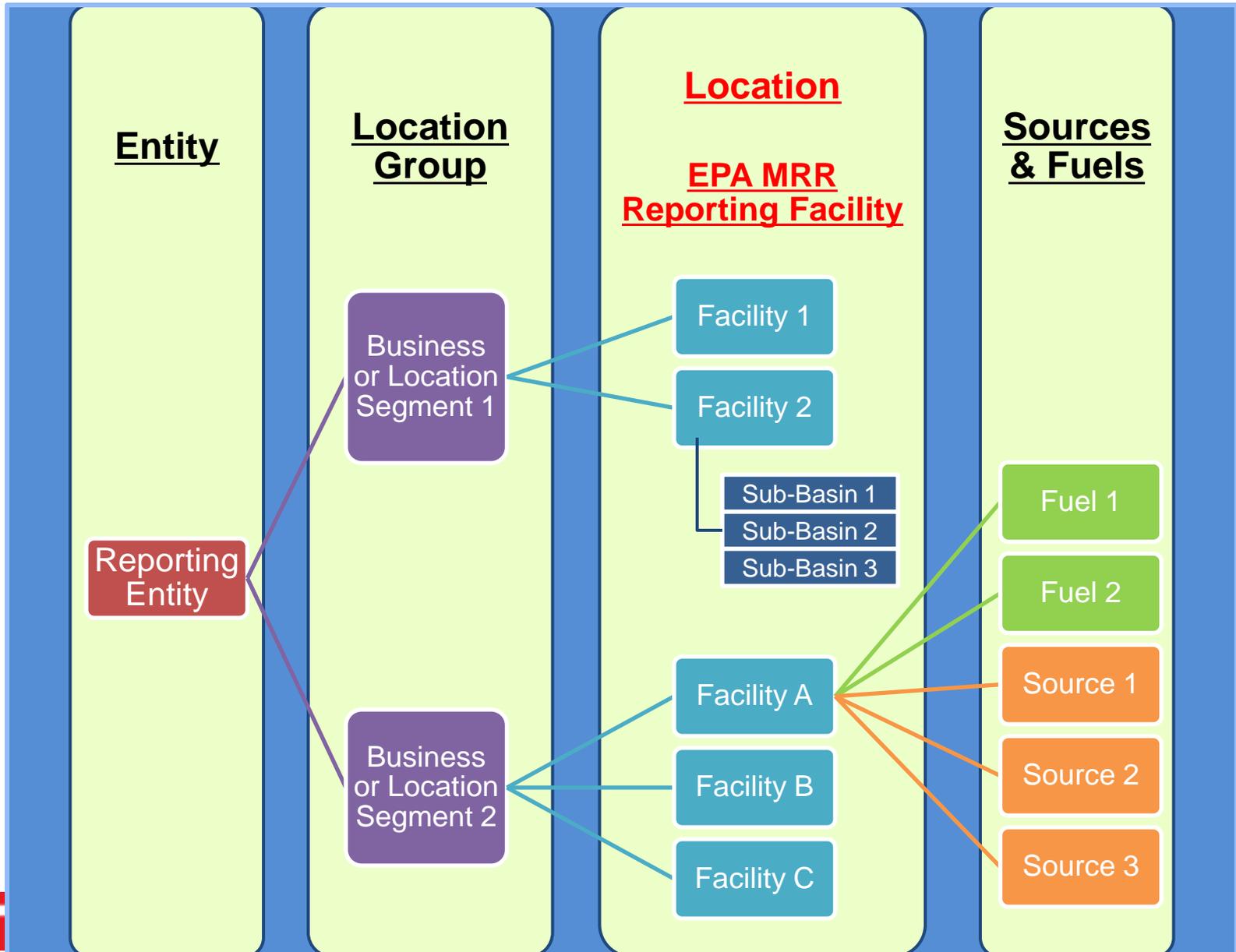
# Step 4:  Set Up Location Specific Fuel Types

- For each reporting location, users must select fuel types for combustion sources and flares. This will allow the user to maintain fuel property data and corresponding emission factors for all combustions sources at the reporting location.

AMERICAN PETROLEUM INSTITUTE

# Step 5: Select GHG Calculation Protocols

- Users can select a preferred protocol during the initial setup
- User can also select either API Compendium or USEPA MRR for each specific source

# Step 6: Configure Emission Sources under Specific Modules

- 16 source "modules" developed in SANGEA 4.0

- Each module includes multiple emission calculation methods and configured as a wizard to help users set up emission sources quickly

- Users specified source parameters are stored in the software source database for future emission inventory reports.

- SANGEA 4.0 also offers a "User Defined Sources" module under the API Compendium protocol that allows users to include sources that are not already established in the two protocols of the SANGEA reporting system.

# SANGEA 4.0 Source Modules

| SANGEA Source Modules | API Compendium 2009 | U.S. EPA MRR Subpart | | | |
|---|---|---|---|---|---|
| | | C | P | W | Y |
| Acid Gas Removal (AGR) | √ | | | √ | |
| Combustion Control | √ | | | | |
| Dehydrator | √ | | | √ | |
| Equipment Leaks | √ | | | √ | √ |
| Flare | √ | | | √ | √ |
| Hydrogen Plant | √ | | √ | | |
| Indirect Emissions | √ | | | | |
| Liquid Loading | √ | | | | √ |
| Miscellaneous | √ | | | | |
| Mobile and Transportation | √ | | | | |
| Oil and Gas Venting | √ | | | √ | |
| Refinery Process Units | √ | | | | √ |
| Stationary Combustion | √ | √ | | √ | |
| Storage Tank | √ | | | √ | √ |
| Sulfur Recovery Units (SRU) | √ | | | √ | |
| User Defined Sources | * | | | | |

# Step 7: Enter Source Activity Data

- For each source, users will enter activity data (e.g., fuel usage, annual operating hours, source specific carbon contents and many more for the reporting period):
    - Fuel properties for fuels data available for the specific location.
    - Single-source data entry
    - Multi-source data entry for user to enter source parameters for a group of sources such as tanks for onshore production.
    - Event based sources data entry for sources that are not operated routinely and emissions occurred on an event-basis.
    - Direct source emissions data entry for emissions calculated based on continuous emissions monitoring system (CEMS) or software programs such as GRI GLYClac$^{TM}$.
    - Location specific production data entry to support both USEPA MRR facility reporting requirements and API benchmarking with normalized emissions.

# Step 8: Execute Calculations & Select Reports

- SANGEA-4 uses Microsoft Reporting Services to generate various types of reports.

- Currently, the system includes more than 20 different reports.

- Users can select one report that can be displayed within the system.

- Results can be exported to files in Excel.

# SANGEA 4.0 Architecture Overview

**SANGEA – Entity/Users/Locations**

**Fuels**
- Fuel Properties
- Emission Factors

**Sources**
- Module 1
- Module 2
- Module 3
- …
- Module n

Source Parameters

**Activities**
- Fuel Data
- Single Source Data
- Multi Sources Data
- Source Non-Routine Events
- Source Emission Data

**Import/Export**

**Calculation Layer**

**Report**
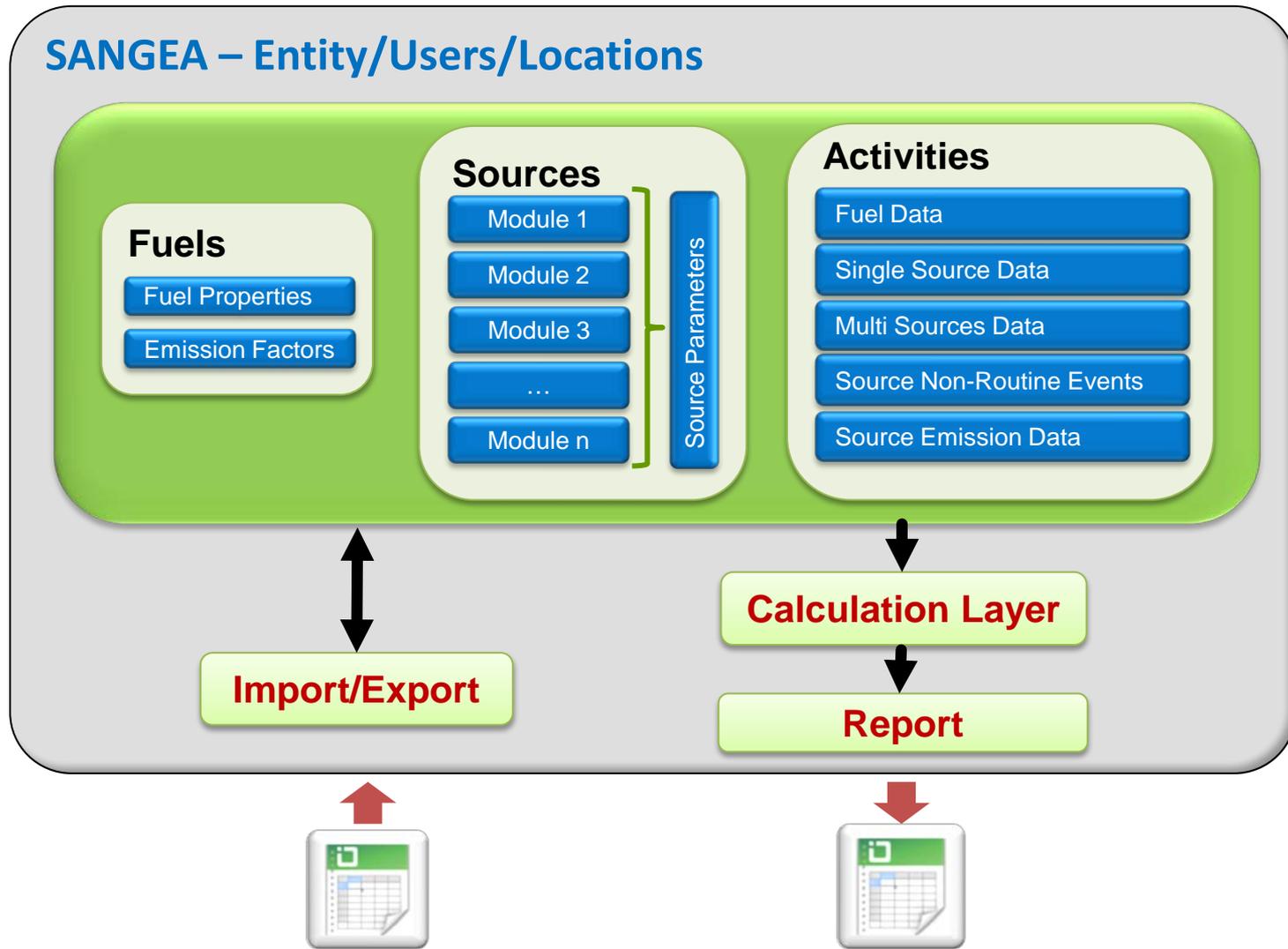
# Example Gas Processing Plant

| Source type | Source Input Information |
|---|---|
| Compressor 1 Combustion | A 4SLB unit with annual fuel usage of 50 mmscf/yr. Fuel type is natural gas. |
| Compressor 2 Combustion | A 4SRB unit with annual fuel usage of 68 mmscf/yr. Fuel type is natural gas. |
| Flare | Emissions from flaring events with total flare gas of 1.5 mmscf/yr with local specified fuel composition |
| Dehydrator Reboiler | A small boiler with annual fuel usage of 6 mmscf/yr. Fuel type is natural gas. |
| Dehydrator | An uncontrolled glycol dehydrator with a design capacity of 6 mmscfd unit. |
| Equipment Leaks | API protocol – A gas processing plant with 250 mmscf/yr gas processed |
| | EPA protocol – Two monitoring events with leak counts for various type of components; 800 hours average leak time for 1st monitoring event; 4200 hours average leak time for 2nd monitoring event |
| Compressor 1 Venting | API protocol – Included in facility level fugitive leaks |
| | EPA protocol – A centrifugal Compressor with measured release rate at 1 scf/hr for all operating mode; 8000 hours in operation and 200 hours in other modes. The release rate is used for testing only and not meant for a typical rate. |
| Compressor 2 Venting | API protocol – Included in facility level fugitive leaks |
| | EPA Protocol – A reciprocating Compressor with measured release rate at 1 scf/hr for all operating mode; 8000 hours in operation and 200 hours in other modes |
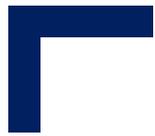
# Summary of Example Location

| Source type | SANGEA Result | | EPA Subpart W Calculation Tool |
| --- | --- | --- | --- |
| | API (tonnes CO2e) | EPA (tonnes CO2e) | |
| Compressor 1 Combustion | 2887.68 | 2792.05 | |
| Compressor 2 Combustion | 4607.29 | 3789.22 | |
| Dehydrator | 264.00 | 620.44 | 620.09 |
| Dehydrator Reboiler | 343.06 | 343.47 | |
| Equipment Leaks | 161.94 | 322.05 | 323.70 |
| Compressor 1 Venting | | 4.93 | 4.90 |
| Compressor 2 Venting | | 5.86 | 5.83 |
| Flare | 95.41 | 96.12 | 95.42 |

# User Friendly Features

- User selected single standard temperature (60°F or 68°F) for gas property calculations and emission factors.

- Calculation tool for gas composition property and API gravity.

- Source import and export tools in Excel spreadsheets for several common source types (e.g., combustion sources, O&G well venting sources, tanks, etc.), which allow users to edit a large number of the same type of sources in spreadsheets then import into SANGEA 4.0.

# User Friendly Features (cont.)

- GHG results and source parameters exported to spreadsheets – this allows users to process results into formats that are required for regulatory and/or corporate emissions inventory reports.

- For each new reporting year, users can copy from an existing file – this function copies all source parameters from the existing file and removes all activity data that should be updated for the new reporting year.

# Closing

- Beta release:
  - Waiting for final Subpart W final technical revision and reporting requirements
  - More tests on API compendium source modules
  - Accepting comments and bug reports

- Support:
  - Training courses (1-Day hands-on training)
  - support@api-sangea.org

AMERICAN PETROLEUM INSTITUTE