

Saudi Aramco Greenhouse Gas Emissions



Basis of Preparation (2019)

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1. Introduction to Saudi Aramco's GHG Emissions Basis of Preparation

Saudi Aramco's Greenhouse gas (GHG) basis of Preparation document provides an overview of the reporting boundaries, basic definitions, the basis of calculations, period of reporting, base year, De minimis, and the processes flow, intended to be used for 2019 GHG emissions reporting purposes.

1.1.1 Purpose

The purpose of this document is to provide a guide on Saudi Aramco GHG emissions reporting process to ensure consistency across the organization and alignment with industry best practice.

The overarching objective of the Saudi Aramco GHG emissions reporting is to:

- Communicate environmental performance trends in a transparent manner, aligned with industry best practice for GHG reporting;
- Provide relevant information at a level of accuracy commensurate with its intended use, upon which internal and external stakeholders can rely;
- Provide data to develop corporate key performance indicators, used to help determine appropriate emission reduction targets; and
- Develop strategies to help shape policy development and comply with all relevant local regulations.

2. GHG Reporting Basis

2.1.1 Reporting Boundaries

Organizational Boundaries

For 2019 GHG emissions accounting purposes Saudi Aramco reports its GHG emissions on an operational control basis.

Operational Control definition

An entity is designated to be under Saudi Aramco's Operational Control, if Saudi Aramco is able to exercise direct operational control over the day-to-day activities of that entity.

For the 2019 GHG emission inventory reporting boundaries are defined as follows:

- In-Kingdom wholly owned operated assets
- Entities under the Aramco operational control (first year of reporting):
 - o Saudi Aramco Shell Refinery Company (SASREF)
 - o Motiva Enterprises LLC
 - o Arlanxeo Holding B.V.
 - o Aramco Trading Company (excluded from the 2019 GHG emissions inventory)

2.1.2 Greenhouse Gases

The Company reports emissions for three out of the seven GHGs required by the UNFCCC/Kyoto Protocol - carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O).

The remaining Kyoto gases are not accounted to the 2019 GHG emissions inventory.

GHG emissions are converted to total CO₂ equivalent (CO₂e) emissions by multiplying the emissions of a given GHG constituent by its respective Global Warming Potential (GWP)¹. The GWPs used in the Aramco inventory are provided below:

- CO₂ GWP = 1
- CH₄ GWP = 25
- N₂O GWP = 298

JVs/Affiliates may elect to use different GWPs as long as these are properly documented and justified.

2.1.3 Definitions

Operational Boundaries

Operational boundaries involve the specification of the emission sources within, and associated with, each Saudi Aramco facility/asset for GHG accounting and reporting. The goal of prescriptively setting the operational boundaries is to ensure that GHG emissions are reported completely and consistently. Saudi Aramco's primary GHG emissions are from oil and gas industrial operations in the following sectors:

- Onshore and Offshore Oil and Gas Production
- Natural Gas Processing
- Oil and Natural Gas Transmission and Distribution
- Refining
- Chemicals

For 2019, which is the second year Saudi Aramco has chosen to conduct a GHG inventory, the Company will report direct (Scope 1) and indirect (Scope 2) emission sources from its operations. Other indirect emissions (Scope 3) associated with raw materials and product lifecycle are not being estimated in the current inventory.

Direct (Scope 1) Emissions

Direct emissions, also referred to as Scope 1, are emissions from sources within assets under Saudi Aramco's Operational Control. Direct emissions include the following types of emission sources: □ Fuels combusted in stationary sources on-site □ Flaring

- Process vents such as storage tanks, dehydration units, etc
- Fugitive emissions from leaking components

Saudi Aramco has initially focused on the sources with the highest potential to impact the overall inventory, with ambition to expand the scope of emission sources that are included over time.

Indirect (Scope 2) Emissions

Scope 2 accounts for GHG emissions from the generation of purchased electricity and steam consumed by the company. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organizational boundary of the company.

The Company accounts for and reports its GHG emissions associated with the generation of imported/purchased electricity and steam (Scope 2) separately from Scope 1 emissions, which is consistent with the practice that has evolved in voluntary corporate GHG emissions reporting.

2.1.4 Basis of Calculations

Saudi Aramco follows the guidelines listed below for reporting and managing greenhouse gas (GHG) emissions:

- International Petroleum Institute Environmental Conservation Association (IPIECA) *Petroleum Industry Guidelines for Reporting Greenhouse Gas Emissions, 2011*,² which sets out the accounting guidance for reporting. The IPIECA Guidelines are aligned with international best practices for corporate GHG accounting (see GHG Protocol below).
- World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) *Greenhouse Gas (GHG) Protocol: A Corporate Accounting and Reporting Standard, 2015*³ (GHG Protocol).
- American Petroleum Institute (API) *Compendium of Greenhouse Gas Methodologies for the Oil and Natural Gas Industry, 2009*⁴ (referred to as the "API Compendium") calculation methodologies for quantifying GHG emissions.
- Other GHG emissions accounting and reporting guidelines as required by national GHG emissions reporting schemes.
- The International Standard on Assurance Engagements (ISAE 3000, revised in 2015).

² IPIECA, *Petroleum Industry Guidelines for Reporting Greenhouse Gas Emissions, 2011*

³ WRI/WBCSD, *Greenhouse Gas (GHG) Protocol: A Corporate Accounting and Reporting Standard, 2015*

⁴ API, *Compendium of Greenhouse Gas Methodologies for the Oil and Natural Gas Industry, 2009*

2.1.5 GHG Inventory Principles

Saudi Aramco follows the generally accepted GHG accounting and reporting principles to ensure:

(1) Reported data represents a faithful, true, and fair account of the organization's GHG emissions; and (2) Reported information is credible and unbiased in its treatment and presentation of the issues.

The Company (GI under sign-off) requires that GHG accounting and reporting be carried out in accordance with the principles outlined below. These principles support the quality controls over the GHG data at Saudi Aramco and shall be applied throughout all stages of the reporting process, aligned with the WBCSD GHG Protocol and IPIECA Guidelines.

2.1.6 Reporting Period

The GHG emissions reporting period is from January 1st till December 31st for each calendar year.

2.1.7 Base Year

Saudi Aramco for in-kingdom wholly owned and operated assets, has selected calendar year 2018 as the base year for reporting to compare against current year metrics to track performance, as well as set and manage reduction targets. The 2018 calendar year was the first year Saudi Aramco reported GHG emissions with confidence in accuracy across the assets in the Kingdom of Saudi Arabia. As such, 2018 was Aramco's base year to compare against future years.

For entities under Saudi Aramco operational control, the 2019 is defined as the base year for reporting to compare against current year metrics to track performance, as well as set and manage reduction targets. The 2019 calendar year is the first year Saudi Aramco will report GHG emissions with confidence in accuracy across entities under Company's operational control.

2.1.8 De minimis

As a company's GHG emissions inventory matures over time, the basis for exclusion of smaller contributors to the overall emissions inventory will evolve from assumptions to calculations to justify exclusion. For example, a source such as a fire water pump is expected to be insignificant, and the data required to justify that assumption is typically not readily available. Therefore, in the initial years of Saudi Aramco's GHG inventory, key assumptions have been made on the level of materiality of certain source types within the inventory so that the focus can be on collecting accurate data for the largest, most material sources. As the GHG inventory improves over time, the ambition will be to collect some data to justify the exclusion

of these smaller, or de minimis, sources. Saudi Aramco plans to adopt a threshold for exclusion of de minimis sources, aligned with best practice reporting.

Sources excluded will be reviewed annually by Saudi Aramco to determine if excluded sources remain beneath the 1% de minimis threshold for that given source. Collectively, all de minimis sources must be below 5% of the global GHG emissions inventory.

2.1.9 Process workflow

2.1.9.1 In-Kingdom wholly owned operated assets

Saudi Aramco/Environmental Protection Department (EPD) provides a reporting template to Saudi Aramco operations, included in the reporting boundaries via email by the 1st of January of the year following the calendar year of the reporting period. This template is routed through Business Line and Admin Area representatives.

The reporting templates seek Saudi Aramco operations to report activity data for the entire previous calendar year (reporting period).

Saudi Aramco representatives at Saudi Aramco operations (Environmental Coordinators) fill in the provided reporting template with activity data of the operations for the entire previous calendar year based on data obtained from the Plant Information System, meter readings, records, and estimates. This information is routed to Saudi Aramco/Environmental Protection Department through Business Line and Admin Area representatives.

Activity data are quality controlled and reviewed at Department, Admin Area and Business Line level prior of being submitted to EPD for further analysis and processing.

EPD collects filled-in reporting templates from Saudi Aramco departments and validates provided activity data by conducting trend analyses and cross-checking data with other Saudi Aramco Processes.

EPD submits the validated activity data spreadsheet following the calendar year of the reporting period.

EPD performs further quality controls on the received activity data, and informs Saudi Aramco departments on any inconsistencies and clarification using a QA/QC tracking log file to ensure that all pending issues have been properly addressed.

EPD, using the received activity data, calculates direct and indirect GHG emissions following the calendar year of the reporting period.

EPD validates direct and indirect GHG emissions data by conducting trend analyses and investigating noticeable data points with data reporters.

Saudi Aramco in-kingdom wholly owned operated assets GHG emissions reporting process workflow for 2019 is presented in Annex A.

2.1.9.2 Entities under operational control

For entities under operational control, the following process have been developed by those entities:

Conduct a pre-assurance review to assess maturity and verification readiness of affiliate GHG accounting and reporting during 4Q 2019.

Implement improvement actions for gaps identified in pre-assurance review process and prepare 2019 GHG emissions report.

Develop a Basis of Reporting (BoR) document describing the context of 2019 GHG emissions reporting data based on a template developed by EPD.

Submit quality assured and quality controlled 2019 GHG emission data and the BoR document to EPD through Business Line and Admin Area representatives.

JVs/Affiliates GHG emissions reporting process workflow for 2019 is presented in Annex B.

2.1.10 Alignment with Saudi Aramco Processes

The Saudi Aramco GHG emissions are aligned with the following internal processes:

- **Corporate Flare Monitoring System (CFMS) Program;**
The CFMS allows the facility the ability to monitor their flaring losses in real-time from each individual source in the flare header. CFMS constitutes the basic foundation required to provide opportunity to develop site specific Flare Minimization Plan (FMP) thereby minimizing flaring. CFMS leverages available automation technologies, namely distributed control systems and real-time data historians to translate available real-time measurements of control valves (PCV) openings, pressures, temperatures and other process variables, to flared quantities in standard cubic feet. CFMS flaring figures are validated by the plant engineer and central engineering.
- **Leak Detection and Repair (LDAR) Program;**
As part of Saudi Aramco's continuous efforts in managing fugitive emissions from its operations, Company's facilities both onshore and offshore, are required to conduct a Leak Detection and Repair (LDAR) program, and estimate the associated fugitive emissions annually. The objective of this program is to conduct a comprehensive surveys to monitor, repair, estimate, and control fugitive leaks of Volatile Organic Compounds (VOCs), Hazardous Air Pollutant (HAPs), and Methane (CH₄).
- **Other individual Programs by entities under Saudi Aramco Operational control as described in their BoR document.**

2.1.11 Completeness

Saudi Aramco's GHG inventory accounts for the GHG emissions from all sources and activities that fall within the organizational and operational boundaries of the company. The completeness principle means in practice that:

- Facilities include all emission sources and activities consistent with the guidance in this document. Sources deemed to be less than the de minimis threshold [5% of emissions (in aggregate, if multiple sources)], and not feasible or cost-effective to collect data on a quarterly or annual basis, can be excluded.
- Acquisitions and divestitures are monitored by Facility Environmental Coordinators and EPD and reflected in the inventory (and base year, if appropriate).

2.1.12 Consistency

Company's GHG inventory allows for comparisons of GHG emissions across departments and facilities. The consistency principle means in practice that:

- Calculation methods used are consistent across the facilities within the inventory;
- Changes to the boundaries or calculation methodologies used over time need to be consistently applied and transparently documented.
- The Saudi Aramco/EPD GHG Team is responsible for compiling the GHG information from all of the facilities across the corporation in a manner that ensures that the aggregate information is internally consistent and comparable over time.

2.1.13 Transparency

Saudi Aramco's GHG inventory should be factual, clear, and well documented, such that a third party can review and replicate the calculations. The transparency principle means in practice that:

- A clear data trail must be provided by the Facility-Level Data Coordinators that documents the data flow from source to report;
- Any assumptions used in the estimates are well documented;
- All references to calculation methods or data sources are documented; □ Any data substitutions or exclusions are justified and well documented.

2.1.14 Accuracy

Saudi Aramco's GHG inventory should be sufficiently accurate to enable intended internal and external users of the data to make informed decisions. The accuracy of the inventory should be improved over time, prioritizing the most material emission sources (i.e., the sources contributing the most to the overall emissions). The accuracy principle means in practice that:

- Emissions data, including measurements and estimates, are systematically neither over nor under the true value, as far as can be judged;
- The most accurate calculation methodology (i.e. activity data from flowmeters, etc) is used to estimate GHG emissions from sources that are material to the facility level inventory, unless demonstrated to not be feasible or cost effective; and
- Uncertainties in the data are reduced as far as practicable.

3. GHG Emissions Quantification

Per the IPIECA Guidelines, when planning the consolidation of GHG data, it is important to distinguish between *GHG accounting* and *GHG reporting*.

- ***GHG accounting*** concerns the recognition and consolidation of GHG emissions from operations in which a parent company holds an interest, and linking the data to specific operations, sites, geographic locations, activities and owners.
- ***GHG reporting*** concerns the presentation of GHG data in formats tailored to the needs of various reporting uses.

3.1.1 GHG Accounting

Emissions Quantification Methods

The Company will quantify GHG emissions in accordance with calculation methodologies listed in the 2009 API Compendium.

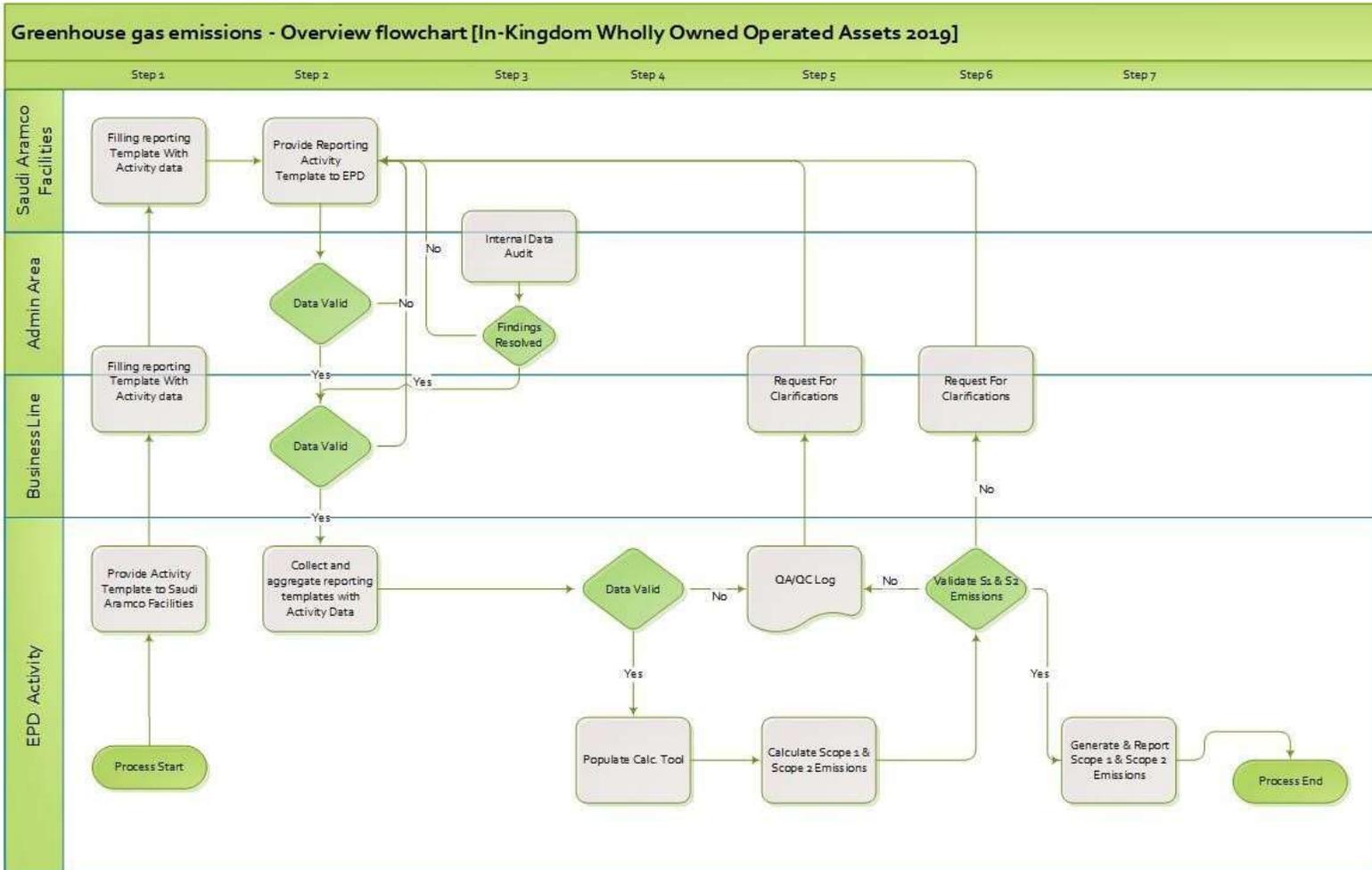
Emissions Reporting Hierarchy

Inventorying of GHG emissions is typically conducted as a ‘bottom-up’ activity by summing emissions from individual sources (or emissions from the total consumption of individual fuel types) at a reporting unit to create an inventory for the reporting unit, and aggregating emissions from the reporting units to create a corporate inventory. Reporting units represent logical groupings of activities and assets for the purpose of reporting GHG data to the parent company, and typically represent the smallest building block of the corporate inventory.

The Company has chosen to group and aggregate emissions for the following reporting groups: □ By emission source types across all reporting units

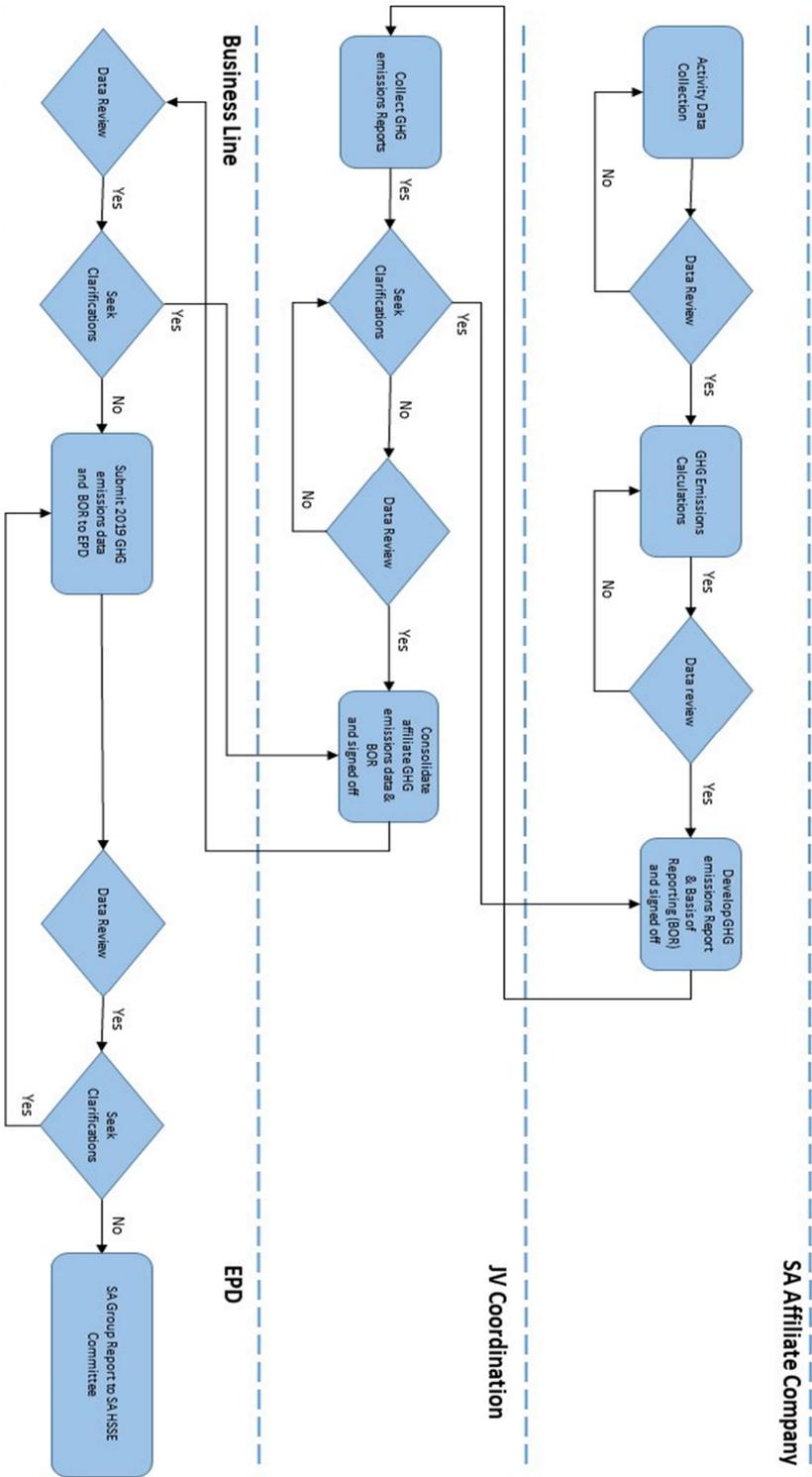
- By facility
- By Department
- By Administrative Area
- By Upstream and Downstream Business Lines
- By Corporate level Scope 1 and Scope 2

Annex A - Saudi Aramco In-Kingdom wholly owned operated assets GHG Emissions Process workflow



Annex B - JVs/Affiliates GHG Emissions Process workflow

SA Group Greenhouse Gas Reporting Process Flowchart



Saudi Aramco Group GHG emissions 2019 Basis of Preparation



For more information on our sustainability journey and our sustainability reporting, please visit www.aramco.com/sustainability.