

**HSE**

**HEALTH, SAFETY AND ENVIRONMENT**

PROTECTING PEOPLE, PROTECTING OUR PLANET



## PERFORMANCE MONITORING AND REPORTING

Leadership and Commitment

Policy and strategic objectives



Organisation, responsibilities,  
resources, standards, documents



Hazards and Effects Management



Planning and procedures



Implementation



Audit



Management review



Corrective action

Monitoring

Corrective action and improvement

Corrective action and improvement

The companies in which Royal Dutch Shell plc directly and indirectly owns investments are separate entities. In this manual, the expressions "Shell", "Group" and "Shell Group" are sometimes used for convenience where references are made to Group companies in general. Likewise, the words "we", "us" and "our" are also used to refer to Group companies in general or those who work for them. These expressions are also used where there is no purpose in identifying specific companies."

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HEALTH, SAFETY AND ENVIRONMENT ADVISERS PANEL

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Superseded issues of this document should be destroyed.

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## 1.0 REPORTING PRINCIPLES AND RULES

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The objective of this document is to provide reporting principles and rules to ensure a consistent basis for reporting Health, Safety, Security and Environment (HSE) data to Business Units (BUs), the Businesses and the Shell Group. Under Shell Control Framework, this document is mandatory for all Shell entities under operational control.

This is the seventh update of Shell's HSE Performance Monitoring and Reporting document. This document is approved by the HSE Panel and is available on the HSE site on the Shell Wide Web.

**Shell HSE Performance Monitoring and Reporting Manual.**

### 1.1 Reporting Principles

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Reporting principles are broad concepts that form the basis upon which HSE reporting can develop and improve over time. Sustainability and HSE accounting and reporting practices are evolving; however, the principles listed below are derived from generally accepted accounting and reporting policies. They are intended to underpin and guide data gathering and reporting to ensure that the reported information fairly presents the company's HSE performance.

<b>RELEVANCE</b>	Ensure that the HSE key performance indicators appropriately reflect the company's HSE performance and serve the decision-making needs of users – both internal and external. The data must be meaningful and valuable to the user.
<b>CONSISTENCY</b>	Use consistent methodologies to allow for meaningful comparisons of data over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.
<b>TRANSPARENCY</b>	Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.
<b>ACCURACY</b>	Ensure that the quantification of HSE data is systematically neither over nor under actual performance, as far as can be judged, and that uncertainties are reduced to a level as low as reasonably practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable confidence in the integrity of the reported information.
<b>COMPLETENESS</b>	All HSE information shall be included in a manner that is consistent with the definitions, scope and boundaries of this manual. Reported information shall be as complete as is reasonably practicable while recognising the inherent limitations of the reported data. Any specific exclusion must be disclosed and justified.

## 1.2 Business Goals

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The primary purpose of gathering HSE data is to manage HSE risks by monitoring performance. A sound understanding and analysis of HSE data are necessary to improve HSE performance. In addition, these data inform management on how Shell is performing against our competitors. Finally, these data can be publicly reported to inform stakeholders of our performance and to the extent to which we have met our public commitment.

Group requirements to report publicly are set out in the Statement on Risk Management and the Group HSE Standard. The Group HSE Standard states that:

- Shell companies have a systematic approach to HSE management designed to ensure compliance with the law and to achieve continuous performance improvement
- HSE performance targets shall be set to ensure progression towards long term goals of no harm to people and to protect the environment.
- We are all committed to publicly report on our performance.

To support data integrity for external reporting, the Chief Executive seeks assurance from the Disclosure Committee (DC) that internal controls are in place to deliver reliable (i.e. accurate and complete) data for public disclosure. The Terms of Reference of the Disclosure Committee lay out the Group's expectations with respect to the data we disclose:

- Comply in all material respects with applicable regulations, codes of practice, and stock exchange listing rules
- Data are accurate in all material respects, complete, relevant and balanced
- Data are not misleading under the circumstances under which they are disclosed
- Data and commentary fairly present in all material respects the results of our operations.
- The report contains no untrue statements of material facts or omission of material facts

The overall objective is to deliver reliable HSE data for internal performance improvement and to meet external disclosure requirements. Performance monitoring in the Business and the external disclosure requirements of the Shell Group shall be naturally congruent. Both call for a continual improvement in the quality of HSE data and controls.

## 1.3 Selection of Performance Indicators / Targets

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The HSE Executive determines the Group's HSE objectives and owns the Group HSE plan which lays down how these objectives will be achieved, risks mitigated and opportunities enhanced.

The HSE Executive also agrees the performance indicators that are necessary to monitor the performance at a Group level and determines which of these indicators should be included in the Annual Report and the Shell Sustainability Report. The HSE Executive also determines which parameters shall have performance improvement targets and the extent to which such targets are externally reported.

## 1.4 Reporting Boundaries

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HSE Data is reported for Shell companies that are under operational control (UOC). This is defined as companies in which a member company of Royal Dutch Shell plc has full authority to introduce and implement the Group HSE policy.

Companies not under Shell's operational control (NUOC) and certain companies to which we provide operational services may agree to report to the relevant Business Organisation. Shell's practice is to report data on a 100% basis (i.e. "as operated"), even where the Shell's interest is less than 100%. For further instructions on how operational control is defined please refer to Appendix 5. Specific reporting instructions for Gas and Power NUOC Joint Ventures can be found on the Gas and Power HSE website

In compliance with the "Incident Investigation, Classification and Reporting Guide", February 2002, all incidents with actual consequences rated 4 or 5 (RAM 4+) in the Risk Assessment Matrix Guide (March, 2006) must be reported.

To date, Shell does not gather data or include any emissions, discharges or waste resulting from the use by customers of Shell companies' products.

## 1.5 Managing Data Quality

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HSE data must be accurate and complete to be useful. The Statement of Risk Management (a foundation element in the Shell Control Framework) requires that "every Shell Business and Function incorporate and apply effective responses ... to ensure reliable reporting." To comply with this Group requirement, BUs are expected to manage HSE data quality systematically as part of their management system (HSE-MS). HSE data management procedures should ensure that:

- Appropriate monitoring, checks and review processes are in place to detect and correct errors and omissions;
- Tasks and responsibilities for data processing and review are assigned to both line and HSE management. It is the responsibility of line management in the BUs to ensure submission of accurate and complete data;
- Definitions used and the scope of the data management and reporting are in accordance with this manual, for the whole reporting period.

### Inherent limitations

There are inherent limitations to the accuracy, precision and completeness of HSE data that are beyond the scope of controls to rectify. These limitations stem from the nature of the data. Certain parameters rely on human dynamics and are affected by culture and personal perception. Other parameters rely on complex multivariate measurements that require constant tuning so that the data is inherently imprecise. Still others rely on estimation, which lacks accuracy and precision. Shell accepts that published HSE data will be affected by the inherent limitations that cannot be quantified.

Where data limitations are found that are not inherent and can be controlled, reporters shall endeavor to do so. In applying controls, it is necessary to balance the cost of control with the risk of reporting inaccurate or incomplete data.



### **Accuracy**

HSE performance data shall be determined by using the most accurate methodology that is reasonably practicable. For those cases where no direct parameter information is available, default emission factors are provided in Appendix 1. These are intended as fallbacks to ensure consistency of reporting. However, BUs that have more accurate means of determining emissions, or prescribed regulatory methods, shall use them.

BUs may be required to report HSE performance data to their regulator. Reporting instructions obtained from the regulator, together with this Manual form the reference documents for a BU's procedures on monitoring and reporting HSE data. However, where a different methodology is prescribed by a regulator this can be used if the methodology is not materially different from Shell requirements<sup>1</sup> (eg. injuries reported on the US Occupational Safety and Health Administration log or greenhouse gases reported under the European Union Emissions Trading Scheme). Where this is the case, the alternative methodology used shall be reported to the Group.

The use of site-specific correlations and emission factors shall be supported by periodic checks. This means that all reporting entities must have a programme to check that the correlations or default values are still valid.

### **Re-submission and Re-statement**

It is possible that some time after the closing of the HSE data submission, errors are detected. This could be a calculation error, a wrong application of default factors, omission of a reporting entity etc. In these cases, a re-submission of data shall be considered.

Changes larger than 10 % shall always be re-submitted to the Business Organisation. Changes between 5 and 10 % are subject to discussion with the Business Organisation. Changes smaller than 5 % can be communicated during the next round of data submission, with an explanation of the occurrence, but published data will not be amended. When assessing resubmission of ratio data (e.g. TRCF, energy/throughput), the above percentages would apply to errors in either the numerator or the denominator.

## **1.6 Internal Controls for HSE Data Management**

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Procedures and internal controls for Monitoring and Reporting shall be part of the HSE Management System of a Business Unit, the Class of Business or Business, and are therefore subject to audit and review. In this way, these procedures are part of the continuous improvement cycle.

### **Segregation of duties**

Where resources are available, consideration should be given to segregate the duties of those directly rewarded by improved HSE performance (monetarily, job promotion, achieving targets, meeting dashboard objectives) from those who collect, classify and report HSE data; a lack of such segregation can create a risk of impaired objectivity. Where formal segregation of duties is not possible, the objectives can also be achieved by internal implementing independent reviews. In addition, improved controls over data quality can be achieved by having different individuals involved in the collecting, checking and reporting of data.

<sup>1</sup> The demonstration that Group and regulatory methods are not materially different shall be done once and updated only if Group or regulatory requirements change significantly.

### Managing data risk

Risk management is the process used throughout Shell that enables resource allocation and the delivery of expected results. Businesses and Functions are required to apply the Group Statement on Risk Management to ensure that they have fit-for-purpose controls in place for data reporting. Data risk is different from a confidence interval or scientific/estimation uncertainty. Data risk is the potential for material error/omission at Group level, which could impact our understanding of performance or result in material misstatement of external disclosures. To minimise the risk of reporting unreliable data, the Businesses will prepare a data controls assurance plan at the beginning of the year. The plan will identify data risks, assess if the risks are material and apply controls to address the risks during the year.

Businesses (Downstream, E&P) that are material for external reporting of HSE data shall:

- **Identify** areas of potential material data risk (error/omission) at Group level,
- **Assess the likelihood** and severity of the error/omission. As a general rule, a high data risk occurs when there is the potential that there is >10% error/omission, medium risk 5-10% and low risk <5%.
- **Apply responses** after mapping existing controls to identify gaps that need to be better controlled and to show where unnecessary work on low risk areas could be eliminated.
- **Demonstrate** the risk analysis, together with progress against a mitigation plan at the year-end.

Additional controls over data collection and reporting shall be adopted where there are significant controls weaknesses that could lead to a material misstatement at Group level (+/- 5%). In such cases, the option of formal external assurance should be considered.

### Audit trail

In order to facilitate control and review of HSE data, each reported parameter shall have an audit trail. An audit trail is a clear (documented) record of definitions, assumptions, aggregation, calculations and references that result in the final reported data. In addition, responsibilities for internal control and signing off shall be specifically defined in the BU's monitoring and reporting procedures. In this way, the entire HSE data flow for each parameter becomes transparent and easily accessible for review and assurance (see Appendix 4 for instructions on documenting the audit trail).

### Data checks and review

Data checks shall be defined and documented in an audit trail that includes a description of the roles and responsibilities for those conducting the checks. The level of data checking will partly be dictated by the complexity of the parameter, the nature of the data collection, management and reporting process.

Data checks include (as appropriate):

- Checks on application of definitions;
- Checks on calculations;
- Variance analysis against a target, a prediction or the value from the previous period
- Trend analysis (comparison of data over time, taking production/events into account)

- Cross plotting trends against related parameter to check consistency
- Cross checks with other sources – internal (e.g. financial records) or external (e.g. independent measurements taken by the authorities);
- Assurance of industry or other standards being used;
- ‘Sign-off’ procedures that data has been checked for accuracy and completeness (e-mail trail provides sufficient audit trail for ‘sign-off’)

The timing of the checks will depend on the frequency of reporting, but should always be carried out by someone who is independent of the primary source (the person who undertakes the initial procedures).

## 1.7 Assurance

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The Statement of Risk Management requires that controls are in place ensure reliable reporting. In previous years, the Group Auditors externally assured HSE data by focussing on the effectiveness of the HSE data controls and data. As we now must assure data using internal processes, reporters will be responsible for assessing and attesting that their HSE data controls are in place and that their HSE data are accurate and complete.

### **Business demonstration of HSE data management and control**

During the fourth quarter and at year-end, the Businesses will provide a demonstration to the Group VP of HSE that controls are in place to reduce the risk of reporting inaccurate or incomplete data. This demonstration will include a review of data risks, of internal controls and evidence that the controls are operating. It will also require that the Businesses explain the data trends and provide data commentary to support external reporting. This exercise will be based on data materiality; therefore, it will only apply to Businesses that report data where there is a possibility of a material misstatement in external reporting (i.e. EP, Downstream and Trading).

### **Representation Letter process**

Annually, the Businesses and Functions will conduct a Representation Letter process where HSE Managers responsible for reporting material data to Group will ‘sign-off’<sup>2</sup> that data controls have been self-assessed and that the submitted year-end HSE data are accurate and complete. In turn, the Business Executives responsible for managing HSE will sign-off the aggregated Business letter to Group. Finally, the VP of HSE will sign-off on the final Group data to the Disclosure Committee and the Chief Executive.

The representation letter process will cascade to entities that are material to Group reporting. The HSE manager for the Functions, Global Solutions, Renewables and Trading will send letters to Group. In support of the Downstream letter to Group, the HSE managers for each Class of Business and HSE managers in the refineries/chemical plants will send letters to the Downstream HSE Manager. To support the EP Business representation letter to Group, the HSE managers for each Operating Company will send letters to the EP HSE Manager.

2 A physical signature is not necessary. Sign-off using e-mail and email attachments is allowed.

**Self-Assessment of internal controls**

A data management self-assessment protocol has been developed to assist Functions, Businesses, Class of Businesses, major installations and operating companies in completing their year-end HSE Representation Letters. This self-assessment protocol is a new assurance tool that has not been fully tested; therefore, signatories to the Business Representation Letter have the option to use the tool in 2007. The plan for 2008 is to make self-assessment an assurance requirement that can be reviewed as part of the cyclical HSE-MS audit. The self-assessment protocol can be found in Appendix 6.

The focus of this protocol is on the data management system. It is an aid, not a replacement for a full review by competent internal or external staff. A full review should include sample checking of individual data trails from the sources to final aggregation.

**Business Assurance Letter**

The annual Business Assurance Letter (BAL) is also a bottom up process to provide assurance of compliance against Group standards and other elements of the Control Framework. As part of the BAL, line managers shall attest that their operation is in compliance with this Manual.

## 2.0 REPORTING INSTRUCTIONS

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### 2.1 Health and Safety

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The full definitions of the parameters named below can be found in the Group HSE Advisers Panel publication Incident Investigation, Classification and Reporting (February 2002). Section 2.1 of this guide defines work related activities for both employees and contractors. Incidents occurring during such activities must be reported and shall be included in the performance statistics.

This publication can be found on the Shell wide web with URL:  
[http://swm.shell.com/hse/group/hse/hse\\_publications/publications.htm](http://swm.shell.com/hse/group/hse/hse_publications/publications.htm)

**Parameter:** Exposure hours

**Definition:** The total number of hours of employment including paid overtime and training but excluding leave, sickness and unpaid overtime hours.

**Scope:** Exposure hours shall be calculated separately for company and contractor personnel. Time off duty, even if this time is spent on company premises, is not included in the calculation of exposure hours, but incidents during this time are included in statistics if they are the result of failure or absence of management controls. (Refer to guidance and examples in Appendix 14 of the **Incident Investigation, Classification and Reporting Guide (February 2002)**).

Contractor exposure hours should include all hours worked by contractor personnel on company premises and all work by contractor personnel on non-Company premises for which it is concluded on the basis of risk considerations that Company and Contractor management controls are required.

When an employee of a Shell company (x) performs work for another Shell company (y) on a contract basis, the exposure hours are counted by the company that employs the person (company x).

**Units:** hours

**Methods:** Report according to the Shell **Incident Investigation, Classification and Reporting Guide (February 2002)**.

The Shell BU shall check and confirm that all its contractors have a system to accumulate exposure hours and report them to Shell. In many company sites the number of exposure hours can be calculated from computer controlled access systems or time keeping records.

In the absence of more accurate methods exposure hours can also be calculated from a headcount and nominal working hours per person. The method for calculation must be documented and consistently applied throughout the year. In such cases, BUs shall report to the nearest 1000 hours.

On company owned or time charter vessels, Exposure Hours are calculated on the basis of 24 hours per day, rather than the usual hours on duty. This is in accordance with the Oil Companies International Marine Forum (OCIMF) "Marine Injury Reporting Guidelines."

**Parameter: Fatalities**

**Definition:** A death resulting from a work related injury or occupational illness, regardless of the time intervening between the incident causing the injury or exposure causing illness and the death.

**Scope:** Company employees, contractor employees and third parties to be reported separately. At Group level, third party fatalities will not be reported externally. In addition, Fatalities due to occupational illnesses that occur after employees or contractors are no longer in the service of Shell will not be reported externally because such fatalities are not systematically tracked and can not be assured.

**Units:** number

**Methods:** Report according to the Shell Incident Investigation, Classification and Reporting Guide (February 2002).

**Parameter: Lost Time Injuries (LTI)**

**Definition:** The sum of injuries resulting in fatalities, permanent total disabilities and lost workday cases, but excluding restricted work cases and medical treatment cases.

**Scope:** Company employees and contractors to be reported separately.

**Units:** number

**Methods:** Report according to the Shell Incident Investigation, Classification and Reporting Guide (February 2002).

**Parameter: Total Reportable Cases (TRC)**

**Definition:** The sum of injuries resulting in fatalities, permanent total disabilities, lost workday cases, restricted work cases and medical treatment cases.

**Scope:** Company employees and contractor employees to be reported separately.

**Units:** number

**Methods:** Report according to the Shell Incident Investigation, Classification and Reporting Guide (February 2002).

**Parameter: Total Reportable Occupational Illness (TROI)**

**Definition:** The sum of all identified occupational illnesses. Cases involving no lost or restricted workdays and no medical treatment are included. A single exposure can give rise to several occupational illness cases.

**Scope:** TROI, company employees only.

**Units:** number

**Methods:** Report according to the Shell Incident Investigation, Classification and Reporting Guide (February 2002).

## 2.2 Security

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**Parameter:** Security Incident

**Definition:** Security incidents are events (planned or unplanned) that threaten or actually impact the security of Shell's personnel (including contractors), property, confidential information, reputation, or business continuity arising from terrorism, militant activism, violent or organized crime, political or social instability or armed conflict.

**Scope:** Examples of security incidents include:

- Violent criminal acts on Company property or persons during the performance of Company business including theft, robbery, arson, assault, vandalism or criminal damage
- Bomb, incendiary or firearm incidents, including threats/hoaxes or any possible connected suspicious activity.
- Violent or threatening activity by NGOs or other politically motivated groups
- Illegal detentions, kidnaps or unauthorized occupation of Company property
- Terrorist, insurgent or riotous attacks against Company personnel or property
- War, civil disturbance threatening Company personnel or property
- Actual or attempted theft of Company sensitive information. This includes incidents of actual or suspected bribery, commercial espionage, illegal information brokering, corruption, counterfeiting of materials, products and certificates of quality or origin, criminal cartels, extortion, fraud and any illegal activity in the procurement process having the potential materially and/or adversely to affect the company.

**Units:** number, description and categorised by severity (0-5 using the severity definitions from the RAM).

**Methods:** The incident shall be described in the Business incident tracking system. **HSE Risk Assessment Matrix (RAM)** tool should be used to assess the severity of the security incident.

## 2.3 Activity Level

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**Parameter:** Upstream total oil and gas production (Exploration & Production and Gas & Power)

**Definition:** The mass of total oil, condensate and gas produced.

**Units:** tonne

**Methods:** The total oil, condensate and gas produced. refers to the total produced in fields for which Shell or a Shell joint venture company is the operator, i.e. the well-head production. Hence, this includes also the tonnage ultimately flared/vented and/or used for own consumption. Gas that is injected to enhance oil production (i.e. gas lifting), re-injected in the absence of a suitable market, or injected for (temporary) underground storage shall be subtracted to prevent double counting. Use well testing data and reporting of reconciled production data.

Report:

- Oil and condensate produced (unit: cubic metre m<sub>3</sub>)
- Associated gas produced (unit: cubic metre m<sub>3</sub>)
- Non-associated gas produced (unit: cubic metre m<sub>3</sub>)
- Total hydrocarbons equivalents produced (unit: tonnes hydrocarbon equivalent)

Include non-hydrocarbons, such as CO<sub>2</sub>, N<sub>2</sub> or H<sub>2</sub>S, unless these components form >5% of the total mass.

Separate instructions for compiling total production for Gas & Power facilities are provided on the internal GP HSE web site.

**Parameter:** Refinery crude and feedstock processed

**Definition:** Mass of crude and feedstock processed, excluding refinery intake for blending or fuel use.

**Units:** tonne

**Parameter:** Chemicals – Total production

**Definition:** Total production includes “end-products”, “co-products” and “intermediates” but excludes “by-products”. Total Production = sales production + intermediates where sales production = end products + co-products.

“End-products” are products for which there is a product code and which are produced with the intention of at least some portion of the total amount produced for sales to customers.

“Co-products” are produced on purpose simultaneously with the intended primary end-product (e.g., propylene is a co-product of ethylene production).

“Intermediates” are products that are produced by a Shell manufacturing plant / process unit and subsequently consumed as a feedstock or base material in another, different Shell manufacturing plant / process unit at the same manufacturing location.

“By-products” are materials which are produced incidentally to the intended primary end-product and co-products – “by-products” are typically used as a location auxiliary fuel (e.g., olefins unit process gas), re-circulated or recycled back to the process that produces it, or disposed of as waste.

**Units:** tonne

**Methods:** Mass balance calculation.



## 2.4 Energy

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**Parameter:** Energy

**Definition:** Own energy; energy imported; and energy exported. Imported and exported energy includes electricity, heat and steam.

**Scope:** Report separately:

- 1) Own energy
- 2) Imported steam/heat
- 3) Imported electricity
- 4) Exported steam/heat
- 5) Exported electricity

For own energy use, Exploration & Production includes: energy for mobile (supply boats, inland barges, Company cars, helicopters etc.) and stationary sources (platforms, offices, rigs, engines, turbines, etc.) involved in exploration, construction, production, transportation, waste treatment/discharge and abandonment activities, when these are considered to be under operational control.

All businesses exclude: flaring, venting and other hydrocarbon losses or disposal.

**Units:** Gigajoule (GJ)

**Methods:** When calculating own energy, the sites should use the actual combustion values of fuels consumed if available instead of the default combustion values listed below.

**Default conversion values:**

Energy source	Conversion
Gas (EP only)	35.6 MJ / Nm <sup>3</sup>
Diesel fuel (gas only)	42.9 GJ / tonne
Jet A-1	43.3 GJ / tonne
Gasoline	43.7 GJ / tonne
Electricity	3.6 GJ / MWh
Coal	31.8 GJ / tonne
Pyrolysis pitch (from olefin units)	38.9 GJ / tonne

**Ship's Fuel default heat of combustion values:**

Fuel Type	GJ /tonne
Heavy Fuel Oil	40.5
Marine Diesel Oil	42.7
Gas Oil	42.9
Liquefied Natural Gas (LNG-boil off)	49.8

**Defaults energy equivalents of steam:**

Steam [barg]	GJ /tonne
100	3.2
40	3.0
18	2.9
3.0	2.7

Enthalpy basis: water at 0 °C = 0

**Parameter: Energy Intensity Index (EII™) Solomon**

**Definition:** The Energy Intensity Index (EII™) as defined in Solomon Associates Refinery Comparative Performance Analysis Methodology (2005)<sup>3</sup> is a benchmark developed by Solomon Associates to compare energy efficiency of Fuels Refineries and Paraffinic Base Oil Plants. The Solomon EII™ is defined as the energy consumed by a refinery divided by the energy standard for the specific individual refinery configuration.

**Scope:** As defined in detail in the Solomon manual.

**Units:** Ratio

**Methods:** Refer to the Solomon Associates Refinery Comparative Performance Analysis Methodology (2005) manual.

**Parameter: Chemicals Energy Index (CEI)**

**Definition:** Energy Index (CEI) = (Actual energy consumed/production (current year)) / (Actual energy consumed/production (benchmark year)).

**Scope:** Actual energy consumed on the Chemical production units at the following sites: Berre, Pernis, Moerdijk, Stanlow, Deer Park, Norco, Mobile, Geismar, Scotford, Yabucoa, Seraya Chemicals

3 The Solomon Associates Energy Intensity Index is a trademarked entity and is only available for use by refineries or organisation that participate in the Solomon Fuels Study for their particular region. The Solomon Associates Refinery Comparative Performance Analysis Methodology manual is a copyright document that is Proprietary and Confidential to Study participants. The Energy Intensity Index and Manual may not be provided to non participants without the expressed permission of Solomon Associates and appropriate Non Disclosure Agreements between the non participant and Solomon.

and Ethylene Glycols (Singapore). Only those assets over which Shell Chemicals has technical input are included within the CEI, therefore excluding some assets that are formally under Shell Chemicals HSE Operational Control (e.g. Berre Refinery). Some assets meeting this definition are excluded for historical reasons (e.g. Aubette Cracker, Rheinland (Wesseling) Cracker).

Only the chemical processing units are included in the index. Utility generating facilities such as boiler houses and on site Cogeneration are not included in the index.

The index is expressed as a percentage relative to the benchmark year. The benchmark year data are not assured. The benchmark year is 2000 for units included within the Index from inception. New units are included within the Index after they have demonstrated a period of stable production and a full year of data to create a benchmark has been established.

Production is defined as the primary product from each production unit. Production volumes include intermediates that are further processed before sale to third parties. For the crackers the primary product is defined as ethylene.

Utility streams included in the metric include electricity, steam, fuel and water streams. The use of energy carriers in the processing units is accounted for by applying standard conversion factors for steam, electricity and fuel to convert consumption into tonnes of standard reference fuel (TSRF). For steam and electricity the standard conversion factors represent the primary energy requirement for producing the steam and electricity.

**Units:** Energy consumed is measured in tonnes of Standard Reference Fuel (TSRF). Production volume is measured in tonnes.

**Methods:** The method for conversion of utility streams to tonnes of Standard Reference Fuel values is defined in the "User manual Corrected Energy and Loss (CEL) monitoring system", which is issued by Shell GSI – latest update October 2002. Utility streams are measured using local measurement and accounting practices. Production volumes include intermediates that are further processed before sale to third parties.

**Procedures and Controls:** The Refinery Benchmarking group within SGSI (OGCC) controls the "Corrected Energy and Loss (CEL) monitoring system CEL spreadsheet and manual". Any/all changes are coordinated by this group.

**Parameter:** **EP Energy Intensity**

**Definition:** Energy consumption per mass of production.

**Scope:** For own energy use, Exploration & Production includes: energy for mobile (supply boats, inland barges, Company cars, helicopters etc.) and stationary sources (platforms, offices, rigs, engines, turbines, etc.) involved in exploration, construction, production, transportation, waste treatment/discharge and abandonment activities, when these are considered to be under operational control.

Exclude: flaring, venting and other hydrocarbon losses or disposal.

**Units:** Giga-joule (GJ)/tonne

**Methods:** Own energy + heat/steam/electricity imported – heat/steam/electricity exported)/Activity.

## 2.5 Emissions to Atmosphere

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Where BUs are required to report emissions data to their regulator, the prescribed methodology by the regulator can be used in lieu of the following methodologies as long as the reporting requirements are consistent with this manual.

The Group's atmospheric emissions are determined using the following tiered approach; progress from Tier 1 to Tier 6 achieves improved accuracy in the reported data:

**Tier 6:** Continuous emissions or parameter monitoring

**Tier 5:** Periodic monitoring of emissions or parameters for calculating emissions

**Tier 4:** Monitoring over a range of conditions and deriving an emission factor

**Tier 3:** Engineering calculations

**Tier 2:** Equipment manufacturers emission factors

**Tier 1:** Use of default / standard emission factors

Tier 1 methods are the minimum acceptable methods and are included only in recognition that higher tier methods may not be practical or economic at all sites. BUs that have more accurate means of determining atmospheric emissions, or prescribed national methods, shall use them.

In order to ensure continuous improvement, BUs shall choose to move to higher tier methods wherever economically and technically practical. The decision to move to a higher tier will depend on:

- The significance of the source, which can be described as the relative contribution to a negative impact on the environment, and
- The effort required to increase the accuracy and reliability of the data, i.e. using a higher tier method.

The use of correlations and standard emission factors should be supported by periodic checks where practicable, or as required by regulators' direction. This means that sources of emission should be included in a monitoring programme to check that the correlations or default values are still valid. The **API Compendium** of Greenhouse Gas Emissions Methodologies for Oil and Gas Industry (February 2004) and **EPA AP42** are the industry standards. Default factors are provided in this document for those cases where no direct parameter information is available. In such cases, these factors are intended to ensure consistency of reporting.

It is recognized that predicting emissions for certain sources will be subject to inherent limitations stemming from the nature of the source and the business operation. These limitations shall be noted by the reporting entity.

Emissions to atmosphere does not include energy bought and sold for the purposes of Trading.

### 2.5.1 Greenhouse gas emissions (CO<sub>2</sub> equivalent)

To understand and manage the Group Greenhouse gas (GHG) position better, direct and indirect GHG emissions shall be gathered from all major installations on both an operational control and equity basis. Equity GHG data for both UOC and NUOC companies shall be gathered annually starting in 2007 and aggregated by the end of quarter one in the following year.

The collection of this data can be problematic. Therefore, reasonable efforts should be applied. When there are instances where the NUOC Company cannot comply with the reporting time line, the Business should estimate the Company's GHG emissions for the reporting period based on their historical data.

**Parameter: Direct GHG emissions (CO<sub>2</sub> equivalent)**

**Definition:** Mass of CO<sub>2</sub> equivalent Greenhouse gas emitted to the atmosphere. Greenhouse gas emissions are defined as the emission of all greenhouse gases expressed as carbon dioxide equivalents over a 100-year time horizon.

**Scope:** Mass of CO<sub>2</sub> equivalent emitted from combustion, flaring, venting, storage, fugitive emissions, loading, unloading, unplanned, planned releases. Downstream account for all refining and chemical manufacturing activities in their greenhouse gas emission calculations but exclude all other activities (such as blending operations, distribution activities, transportation etc.) Exploration and Production accounts for all exploration and production activities including operationally controlled transportation emissions.

**Units:** tonne of carbon dioxide equivalent.

**Methods:** A working method has been derived to compare the relative climate effects of greenhouse gases. The factor to derive CO<sub>2</sub> equivalent of an emission is known as a global warming potential (GWP). To compute the carbon dioxide equivalent of the emission of any gas, we multiply its emission by the GWP of that gas. The following greenhouse gasses are relevant to Shell's operations therefore:

The calculation for CO<sub>2</sub> equivalent greenhouse gas emissions is:

$$\text{Green house gas (tonnes)} = \text{CO}_2 \text{ tonnes} + (21 \times \text{CH}_4 \text{ tonnes}) + (310 \times \text{N}_2\text{O tonnes}) \\ + (1,300 \times \text{HFC tonnes}) + (23900 \times \text{SF}_6 \text{ tonnes}) + (6500 \times \text{PFC tonnes})$$

Greenhouse Gas	Global Warming Potential	Lifetime (year)
Carbon Dioxide (CO <sub>2</sub> )	1	50-200
Methane (CH <sub>4</sub> )	21	12.23
Nitrous oxide (N <sub>2</sub> O)	310	120
Hydrofluorocarbon (HFC)	1,300	17.1
Sulphur hexafluoride (SF <sub>6</sub> )	23,900	3,200
Perfluorocarbon (PFC)	6,500	50,000

**Note:** The figures listed in the table above are the 1995 GWP values. Whilst the Global Warming Potentials have since been updated, the Kyoto Protocol states that "global warming potentials used by Parties [to the Protocol] should be those provided by the Intergovernmental Panel on Climate Change in its Second Assessment Report ("1995 IPCC GWP values")".

**Source:** Annex H, List of Greenhouse gases Climate Change, **The UK Programme Department of the Environment, Transport and the Regions (now DEFR) November 2000.**

**Parameter: Indirect GHG emissions associated with imported energy**

**Definition:** GHG emissions associated with the import of electricity and steam to Shell's assets and major installations<sup>4</sup>.

**Scope:** Indirect GHG emissions can encompass a broad range of emissions associated with the product and supply chains. For the purposes of Shell's accounting in accordance with IPIECA and API guidance, indirect emissions include emissions from only two types of sources: imported steam/heat and electricity to major installations.

**Report separately** GHG emissions caused by

- 1) Imported steam/heat and
- 2) Imported electricity

**Report separately** emission factors (if relevant) used to convert energy (GJ) to tonnes of CO<sub>2</sub>. Excludes energy bought and sold for the purposes of Trading.

**Units:** tonne of carbon dioxide equivalent

**Methods:** Electric utility emissions refer to **API Compendium** Section 4.7.1 (pdf file page 117)  
Steam utility emissions refer to **API Compendium** Section 4.7.2 (pdf file page 124)

**Parameter: GHG emissions associated with exported energy**

**Definition:** GHG emissions associated with the export of energy.

**Scope:** GHGs emissions associated with the export of steam/heat and electricity and from major installations.

**Report separately** GHG emissions associated with:

- 1) Exported steam/heat and
- 2) Exported electricity

**Units:** tonne of carbon dioxide equivalent

**Methods:** Electric utility emissions refer to **API Compendium** Section 4.7.1 (pdf file page 117)  
Steam utility emissions refer to **API Compendium** Section 4.7.2 (pdf file page 124)

**Parameter: Equity position**

**Definition:** The percentage of Shell's ownership or economic interest in an operation.

**Scope:** The equity position is a financial basis for setting organizational boundaries. This approach allows reporting GHG data in proportion to the economic interest in the reporting company.

**Units:** percent (%)

**Methods:** As recorded in Central Finance systems.

<sup>4</sup> Major installations include crude oil and natural gas terminals, gas plants, offshore platforms, and major flow stations, floating production and storage vessels, refineries and chemical manufacturing facilities.

**Parameter: CO<sub>2</sub> (carbon dioxide) emissions**

**Definition:** Mass of carbon dioxide gas emitted to the atmosphere.

**Scope:** Report all directly emitted CO<sub>2</sub>, no debits or credits for emissions related to receipts or deliveries of energy or steam to or from third parties.

Include flaring (routine, operational and emergency flaring as well as flaring associated with well testing), combustion, venting, process emissions such as HMU- and SGP- Units, FCC regeneration, gas treatment (LNG plants), Shipping Fleets.

Exploration and Production also includes transport emissions in CO<sub>2</sub> calculations, when these are considered to be under operational control.

**Units:** tonne

**Methods:** The uses of standard emission factors is the minimum acceptable method for calculating CO<sub>2</sub> mass and are included in Appendix 1 only in recognition that higher tier methods may not be practical or economic for all emission sources. Where there are sources that have more accurate means of determining atmospheric emissions, or there is a prescribed national method, sites shall use them.

**Parameter: CH<sub>4</sub> (methane) emissions**

**Definition:** Mass of methane gas emitted to the atmosphere.

**Scope:** Tonnes of CH<sub>4</sub> emitted from flaring, venting, storage, fugitive emissions, loading / unloading, unplanned / planned releases.

**Units:** tonne

**Methods:** The uses of standard emission factors is the minimum acceptable method for calculating CH<sub>4</sub> mass and are included in Appendix 1 only in recognition that higher tier methods may not be practical or economic for all emission sources. Where there are sources that have more accurate means of determining atmospheric emissions, or there is a prescribed national method, sites shall use them.

**Parameter: N<sub>2</sub>O (nitrous oxide) emissions**

**Definition:** Mass of nitrous oxide emitted to the atmosphere.

**Scope:** N<sub>2</sub>O emitted from flaring and combustion.

**Units:** tonne

**Methods:** The uses of standard emission factors is the minimum acceptable method for calculating N<sub>2</sub>O mass and are included in Appendix 1 only in recognition that higher tier methods may not be practical or economic for all emission sources. Where there are sources that have more accurate means of determining atmospheric emissions, or there is a prescribed national method, sites shall use them.

**Parameter: HFCs (hydro fluorocarbons) emissions**

**Definition:** Mass of HFCs emitted to the atmosphere. HFCs as a group are listed in the Kyoto Protocol.

**Scope:** Emissions from all sources to be reported, excluding:

- domestic sized appliances;
- emissions from equipment which is on a Shell site but which is owned by a third party – e.g. a cold beverage supplier; and
- emissions from equipment in facilities/buildings which are not considered to be under Shell operational control.

A “domestic sized appliance” is defined as any piece of equipment which is an integral/self contained unit and simply plugs into an electricity supply. Emissions from refrigeration or air-conditioning units that are remote from the point of use should be reported.

**Units:** kilogram (kg)

**Methods:** Estimate the consumption using the sum of purchase records and stock change.

**Parameter: PFCs (perfluorocarbons) emissions**

**Definition:** Mass of PFCs emitted to the atmosphere. PFCs as a group are listed in the Kyoto Protocol. PFCs are used as degreasing agents / solvents and for impregnation of textiles.

**Scope:** Emissions from all sources to be reported.

**Units:** kilogram (kg)

**Methods:** Estimate the consumption using the sum of purchase records and stock changes.

**Parameter: SF<sub>6</sub> (sulphur hexafluoride)**

**Definition:** Mass of SF<sub>6</sub> emitted to the atmosphere. SF<sub>6</sub> as a group are listed in the Kyoto Protocol. SF<sub>6</sub> is used as “insulator” material in high voltage switchgear.

**Scope:** Emissions from all sources to be reported.

**Units:** kilogram (kg)

**Methods:** Estimate the consumption using the sum of purchase records and stock change.



### 2.5.2 Flaring, acid gases and other emissions

**Parameter:** Hydrocarbons flared (Exploration & Production only)**Definition:** Total mass of hydrocarbons sent to flare for disposal.**Scope:** Includes purge gas and gas for flare pilot burners and gas and oil flared from well testing. This includes all hydrocarbons to flare whether for emergency disposal or installation blow-down, continuous disposal of hydrocarbon gas for which there is no commercial or own use, or to keep the flare system alive (pilot or purge).**Units:** tonne**Methods:** Mass of hydrocarbons flared is calculated using flow measurements and actual field gas composition data where available.**Parameter:** SO<sub>x</sub> (oxides of sulphur) emissions**Definition:** Mass of SO<sub>x</sub> emitted to the atmosphere. SO<sub>x</sub> is the generic name for sulphur dioxide (SO<sub>2</sub>) and trioxide (SO<sub>3</sub>)Shell's emissions to air of SO<sub>x</sub> are expressed as tonnes SO<sub>2</sub>.**Scope:** Emissions from flaring, sulphur recovery, FCC regeneration and combustion including the Shipping Fleets.**Units:** tonne**Methods:** The uses of standard emission factors is the minimum acceptable method for calculating SO<sub>x</sub> mass and are included in Appendix 1 only in recognition that higher tier methods may not be practical or economic for all emission sources. Where there are sources that have more accurate means of determining atmospheric emissions, or there is a prescribed national method, sites shall use them.**Parameter:** NO<sub>x</sub> (nitric oxide and nitrogen dioxide) emissions**Definition:** Mass of NO<sub>x</sub> emitted to the atmosphere. NO<sub>x</sub> is the generic name for nitric oxide (NO) and nitrogen dioxide (NO<sub>2</sub>).Shell's emissions to atmosphere are expressed as tonnes of NO<sub>2</sub>.**Scope:** Emissions from Flaring, sulphur recovery, FCC regeneration and combustion including the Shipping Fleets.**Units:** tonne**Methods:** The uses of standard emission factors is the minimum acceptable method for calculating NO<sub>x</sub> mass and are included in Appendix 1 only in recognition that higher tier methods may not be practical or economic for all emission sources. Where there are sources that have more accurate means of determining atmospheric emissions, or there is a prescribed national method, sites shall use them.

**Parameter: Volatile Organic Compounds (VOCs) emissions**

**Definition:** Mass of VOCs emitted to the atmosphere. VOCs are the group of compounds known as hydrocarbons, substituted hydrocarbons, (e.g. mercaptans) and oxygenated hydrocarbons (e.g. MTBE) which will evaporate at ambient temperatures. Liquefied petroleum gases (LPG) are included in the definition of VOCs. Methane and halogenated hydrocarbons are excluded. These latter compounds are regulated under the Montreal protocols and reported separately.

**Scope:** VOC emissions from flaring, venting, combustion, storage, loading/unloading, fugitive emissions, wastewater treatment systems, drainage and shipping fleet transportation. Excludes vehicle refuelling emissions and emissions of kerosene from cutback bitumen (product use) but includes emissions from storage tanks at retail sites under Shell operational control. VOC emissions from refineries should not include a percentage of unidentified losses from mass balance calculations.

**Units:** tonne

**Methods:** The uses of standard emission factors is the minimum acceptable method for calculating VOC mass and are included in Appendix 1 only in recognition that higher tier methods may not be practical or economic for all emission sources. Where there are sources that have more accurate means of determining atmospheric emissions, or there is a prescribed national method, sites shall use them.

**Parameter: CFCs (chlorofluorocarbons), Halons and TCE (trichloroethane) emissions**

**Definition:** Mass of CFCs emitted to the atmosphere. CFCs are those substances as listed in the Montreal Protocol, Annex A, group I and Annex B group I ("Hard CFCs").

Halons are listed in Annex A group II.

TCE is listed in Annex B group III

**Scope:** Emissions from all sources to be reported, excluding:

- domestic sized appliances;
- emissions from equipment which is on a Shell site but which is owned by a third party – e.g. a cold beverage supplier; and
- emissions from equipment in facilities/buildings which are not considered to be under Shell operational control

CFCs, TCE and Halons to be reported together.

A "domestic sized appliance" is defined as any piece of equipment which is an integral/self contained unit and simply plugs into an electricity supply. Emissions from refrigeration or air-conditioning units that are remote from the point of use should be reported.

**Units:** kilogram (kg)

**Methods:** Estimate emissions using the sum of purchase records and stock change if they result in emissions to the atmosphere.

**Parameter: CFCs (chlorofluorocarbons), Halons and TCE (trichloroethane) in stock**

**Definition:** Mass of CFCs in stock. CFCs are those substances as listed in the Montreal Protocol, Annex A, group I and Annex B group I ("Hard CFCs").

Halons are listed in Annex A group II.

TCE is listed in Annex B group III

**Scope:** All stocks include CFCs, TCE and Halons in equipment and in storage to be reported together.

**Units:** kilogram (kg)

**Methods:** Use stock records and an estimate of CFCs, TCE and Halons in use.

**Parameter: HCFCs (hydro chlorofulorocarbons) emissions**

**Definition:** Mass of HCFCs emitted to the atmosphere. HCFCs are listed in Annex C, group I of the Montreal Protocol ("Soft CFCs").

**Scope:** Emissions from all sources to be reported, excluding:

- domestic sized appliances;
- emissions from equipment which is on a Shell site but which is owned by a third party – e.g. a cold beverage supplier; and
- emissions from equipment in facilities/buildings which are not considered to be under Shell operational control

A "domestic sized appliance" is defined as any piece of equipment which is an integral/self contained unit and simply plugs into an electricity supply. Emissions from refrigeration or air-conditioning units that are remote from the point of use should be reported.

**Units:** kilogram (kg)

**Methods:** Estimate emissions using the sum of purchase records and stock change if they result in emissions to the atmosphere.

**Parameter: HCFCs (hydro chlorofulorocarbons) inventory**

**Definition:** Mass of HCFCs in stock. HCFCs are listed in Annex C, group I of the Montreal Protocol ("Soft CFCs").

**Scope:** All stocks include HCFC in equipment and in storage.

**Units:** kilogram (kg)

**Methods:** Use stock records and estimate of HCFCs in use.

## 2.6 Unintended emissions and discharges to air, water and/or to land

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**Parameter:** Loss of Primary Containment (LOPC)

**Definition:** The uncontrolled or unplanned release of a product from a process or storage that serves as primary containment.

**Scope:** Report separately according to the following three categories

1. LOPC Incidents that release from 10 up to 100 kg
2. LOPC Incidents that release from 100 up to 1000 kg
3. LOPC Incidents that release greater than 1000 kg

LOPC include all releases from operations that are considered to be under Shell's operational control such as from:

- Primary containment into the 'environment' including the atmosphere, land, ice or water.
- Sabotage, earthquakes, storm events or any other accidental release. Sabotage is the wilful and malicious damage to or destruction of property or interference with normal operations.
- All transport that is considered to be under Shell's operational control (under a Shell HSE-MS)
- On-going aboveground or underground leakage over time, counted once at the time it is identified

A 'Product' is a gas, solid or liquid that is a raw material (e.g. crude, chemical, base oils, additives, inks odorants, residual, bitumen, heavy fuel oils, etc.) process streams in manufacturing plants, by products, finished product (e.g. gasoline, fuels, chemicals, oils, greases, automatic transmission fluid, heating/cooling fluids, antifreeze, windshield washing fluid concentrates, etc.) mixed product, used product or waste. Maintenance materials such as paints, thinners, cleaners, degreasers, soaps, etc. are also considered products. Includes Releases of product from cargo Ships, barges and bunker tanks and pipelines.

Excluded are supplied water, steam, normal flaring or venting related to planned activities such as planned shutdowns or product delivery.

Incidents that occur at the company-customer interface will be recordable if investigation reveals the primary causes of the incident are attributable to failures in the company's (or its contractor's) HSE-MS, in which case the incident will be recorded by the CoB whose HSE-MS failed.

**Units:** number of incidents by category:

1. LOPC Incidents that release from 10 up to 100 kg
2. LOPC Incidents that release from 100 up to 1000 kg
3. LOPC Incidents that release greater than 1000 kg

**Methods:** Quantity to be reported according to best estimate.

For examples of LOPC reporting and how the metric can be used refer to RLF, RAM3+ LOPC Guidance for the process safety KPI for Downstream Manufacturing.

**Parameter: Hydrocarbon Spills to water and/or to land**

**Definition:** Mass of hydrocarbon liquid spills greater than 100 kg that reach the environment.

**Scope:** Hydrocarbon liquids include crude oil, condensate, and petroleum-related products containing hydrocarbons that are used or manufactured, such as gasoline, residuals, distillates, jet fuel, lubricants, naphtha, light ends, bilge oil, kerosene, aromatics, cutback bitumen and refinery petroleum-derivatives. Where spills of hydrocarbon and water/sludge mixtures occur, an estimate of the oil content shall be reported and the basis for the estimate should be stated. The mass reported should represent the total estimated amount of the spill that reached the environment and should not be reduced by the amount of such hydrocarbon subsequently recovered, evaporated or otherwise lost. Spills or portions of spills that do not reach the environment shall not be reported.

Spills include all releases from operations that are considered to be under Shell's operational control such as from:

- Primary or secondary containment into the 'environment', including land, ice or water.
- Sabotage, earthquakes, storm events or any other accidental release. Sabotage is the wilful and malicious damage to or destruction of property or interference with normal operations.
- All transport that is considered to be under Shell's operational control (under a Shell HSE-MS)
- On-going aboveground or underground leakage over time, counted once at the time it is identified

Excluded are:

- Spills or parts of spills to secondary containment or other impermeable surfaces that do not reach the environment (e.g. spills into non-cracked concrete and good condition bitumen bunds) should be excluded. Earthen bunds do not count as secondary containment unless they are engineered to be sufficiently impervious to prevent spilled oil from contaminating underlying soil and/or groundwater.
- Work over fluids and synthetic oil or mineral based drilling fluids (report as oil discharged to surface water)
- Bitumen releases that do not impact the environment (soil and groundwater). A release of cutback bitumen, for example, would be reportable as a spill.
- The water portion of any spill where the water is in a separate phase.
- Any non hydrocarbon spill such as acid, caustic

Oil spills from vessels shall be included in Group reporting as follows:

- i) Spills from any vessel of oil to which a Shell company has title
- ii) Spills of oil, whether owned by a Shell company or a third party, from a vessel owned or demise chartered by a Shell company or operated by Shell Trading on behalf of others.

Exploration & Production shall report spills separately by the following categories:

- 1) sabotage;
- 2) corrosion;
- 3) equipment failure;
- 4) human error;
- 5) other.

Spills that occur at the company-customer interface will be recordable if investigation reveals the primary causes of the incident are attributable to breached barriers in the company's (or its contractors') HSE-MS, in which case the incident will be recorded by the BU or CoB whose HSE-MS barriers did not prevent the spill.

**Units:** tonne

**Methods:** Quantity to be reported according to best estimate. Because spills are a subset of LOPC, each recorded spill must also be recorded as an LOPC.

**Parameter:** **Number of Hydrocarbon spills to water and/or to land**

**Definition:** The number of hydrocarbon liquid spills greater than 100 kg that reach the environment.

**Scope:** Same scope as for mass of hydrocarbon spills to water and/or land (see above).

**Units:** number

## 2.7 Oil discharged to surface water

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**Parameter:** **Oil discharged to surface water**

**Definition:** Total mass of oil discharged to surface water directly and via aqueous effluents – expressed on the basis of net oil increase.

**Scope:** **Includes** oil discharged via produced water, process water, cooling water, oil based mud and cutting losses, boiler blow-down water and surface run-off water (see 3.6 below).

**Excludes** oil spills and oil in water re-injected into reservoirs.

Where effluent from a distribution terminal is discharged into a Company owned refinery drainage system, only oil in the refinery total effluent requires reporting.

**Units:** tonne

**Methods:** In the absence of a locally required analysis method, the following can be used:

Concentration of oil in water to be measured by Institute of Petroleum method number 426/98 "Oil Content of Effluent Water – Extraction and Infra-red Spectrometric Method" (ST-G-2).

## 2.8 Waste disposal

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For the purpose of Group reporting, waste is any unavoidable material from an activity for which there is no economic demand and which must be disposed of. This includes solids, liquids and sludges, but excludes aqueous and gaseous discharges, e.g. blow down water, produced water or vented gasses.

Disposal of contaminated soil from decommissioning and remediation activities should be included in the total waste volumes unless the soils are remediated on site or in situ.

All waste covered by the definitions must be reported, i.e. all waste that is disposed of for all activities under direct operational control of the Company, thus including waste from contractors. The definition of waste and the categorisation of waste i.e. hazardous/non-hazardous for Group reporting should be in accordance with local legislation where applicable. It is not the intention that sites should keep a separate set of records for reporting to the Group.

**Parameter:** Hazardous waste

**Definition:** Mass of hazardous waste. The definition of hazardous waste is according to local legislation/regulations. In case this provides insufficient guidance, other definitions such as those developed for the Waste Management Guide (1996) and the Basle Convention should be adopted.

For the Shipping Fleets, hazardous waste is defined by the Marpol convention.

**Scope:** Only material, residue and waste that is classified as hazardous waste, and is disposed of, should be measured and reported. This comprises:

- a) All hazardous waste removed from the premises for disposal and/or treatment.
- b) All hazardous waste disposed of on site, e.g. by landfill and deep well disposal.
- c) All hazardous residues resulting from treatment on own site/another Shell site, and are classified as waste, should be reported, e.g. bottom ash from incineration and bio-sludge from waste water treatment.

**Not** reported are the following materials

- a) Material that undergoes treatment on site, or at another Shell site, e.g. wastes incinerated as a fuel supplement, soils/sludge treated in a Shell operated land-farm, soils remediated on site or *insitu*.
- b) Stored wastes for subsequent disposal or treatment should not be reported until it is finally disposed of (this is to avoid double counting).
- c) Materials that are re-used, recycled or sold as raw material are not classified as waste.
- d) Produced water from oil and gas production that is injected back into the subsurface.

**Units:** tonne (wet).

**Methods:** Mass should be determined by direct measurement wherever possible using calibrated weighbridges. In the absence of weighing facilities, mass shall be estimated. There is no minimum recordable mass of hazardous waste.

**Parameter: Non-hazardous waste**

**Definition:** Mass of non-hazardous waste. Non-hazardous waste is all waste not classified as hazardous (see definition of hazardous waste).

**Scope:** Only material, residue and waste that is classified as non-hazardous waste, and which is disposed of, shall be measured and reported. This comprises:

- a) All non-hazardous waste removed from the premises for disposal and/or treatment.
- b) All non-hazardous waste disposed of on site, e.g. by landfill and deep well disposal.
- c) All residues resulting from treatment on own site/another Shell site, and are classified as waste, should be reported.
- d) Stored wastes for subsequent disposal or treatment should be reported only when the waste is finally disposed of (this is to avoid double counting).

**Not reported** are the following materials

- a) Material that undergoes treatment on site, or at another Shell site.
- b) Materials that are re-used, recycled or sold as raw material are not classified as waste.

**Units:** tonne (wet).

**Methods:** Mass should be determined by direct measurement wherever possible using calibrated weighbridges. In the absence of weighing facilities, mass should be estimated. There is no minimum recordable mass of non-hazardous waste.

**Parameter: Re-used or recycled residual materials**

**Definition:** Mass of residual materials sent off-site for recycling, re-used or sold as raw material that would otherwise have been disposed of as hazardous or non-hazardous waste.

**Scope:** Only residual materials that are sent off-site for reuse, recycling or sold as raw material should be measured and reported. These materials are not sold as the original product, or disposed of as wastes, but are re-used (e.g. used as a raw material for another process), reclaimed or otherwise recovered for beneficial use. Example may include spent catalysts sent for reclamation or regeneration, tank bottoms blended into fuels, reused construction materials, recycled scrap metal, reclaimed used oil and solvents, drums and pallets returned or reused, plastic, glass and paper that is reused or reprocessed, used batteries for reclamation, etc.

**Not reported** are the following materials

- Stored residual materials for subsequent re-use or recycling should not be reported until it is finally shipped off-site (this is to avoid double counting).
- Materials that are sent for disposal.

**Units:** tonne (wet).

**Methods:** Mass should be determined by direct measurement wherever possible using calibrated weighbridges. In the absence of weighing facilities, mass should be estimated. There is no minimum recordable mass of reused or recycled residual materials.



## 2.9 Water Consumption

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**Parameter:** **Fresh water consumption (withdrawn from the environment)**

**Definition:** The total volume of fresh water withdrawn from the environment categorised by source (excluding once-through cooling water).

**Scope:** State the volumes of consumed water, using the following categories:

- (a) Utilities
- (b) Surface water
- (c) Ground water

**Units:** cubic metre (m<sup>3</sup>)

**Methods:** Use the following methods to estimate water volume

- (a) metering;
- (b) Water bills from utilities
- (c) Estimates of average drinking water use per person
- (d) Pumping capacity multiplied by the time of pumping
- (e) Process requirement estimates

**Parameter:** **Once-through cooling water**

**Definition:** The total volume of water withdrawn from the environment for once-through cooling purposes.

**Scope:** State the volumes of consumed water, using the following categories:

- (a) Fresh and estuarine surface water
- (b) Ground water

**Units:** cubic metre (m<sup>3</sup>)

**Methods:** Use the following methods to estimate water volume

- (a) Metering
- (b) Pumping capacity multiplied by the time of pumping
- (c) Process requirement estimates

**Parameter:** **Produced water (Exploration & Production)**

**Definition:** The total volume of water co-produced with hydrocarbon production from the hydrocarbon reservoir.

**Scope:**

- (a) State the total volume of produced water;
- (b) state the volume of produced water re-injected for reservoir management purposes
- (c) state the volume of water re-used for other purposes
- (d) state the volume of water re-injected for disposal
- (e) state the volume of water discharged to surface water

**Units:** cubic metre (m<sup>3</sup>)

**Methods:**

- (a) total volume of reservoir fluids produced (metered) multiplied by the fraction of produced water in the reservoir fluids (well tests)
- (b) pumping capacity multiplied by the time of pumping
- (c) process requirement estimates

## 2.10 HSE Financial Data

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The Finance Function is responsible for collection of HSE financial data for external reporting (Annual Report, OFR, 20-F and Shell Report). This HSE financial data uses the same basis of reporting that is required by international financial standards for the Shell Group accounts. Primary responsibility for reporting and associated controls around these parameters remains with the finance function. Notwithstanding this primary responsibility, the HSE Manager has a role to check that the HSE financial data that is reported through the Finance systems are accurate and complete and have been correctly classified in accordance with definitions.

It is the responsibility of the HSE Manager to liaise with the relevant Finance focal point to check and confirm that the data are correctly allocated according to the C-76 Finance policy and that the totals are accurate and complete. A complete listing of FIRST focal points by Area of Operation can be found on the Group Controllers Web site: [http://swwhome.shell.com/corporate/finance/group\\_controller/](http://swwhome.shell.com/corporate/finance/group_controller/)

Appendix 8 includes abstracted definitions of the HSE Financial parameters.

## APPENDIX 1: EMISSIONS INVENTORY AND CALCULATION METHODS

A detailed overview of potential emission sources related to the Oil and Gas industry can be found in the **API Compendium** Section 2.0 where they are listed per industry sector.

For emissions not covered by the **API Compendium** reference should be made to EPA AP-42 **Volume 1** and **Volume 2** (mobile source emissions factors are available using the EPA- Office of Transportation and Air Quality (OTAQ) mobile source models.

### CO<sub>2</sub> (carbon dioxide)

#### CO<sub>2</sub> Gas Combustion:

As a baseline, we assume a gas composition of 100% methane so that 2.75 kg of CO<sub>2</sub> is produced from every kg of gas burnt. However, the ratio of carbon to hydrogen in gas varies depending on the mixture hydrocarbons in the gas therefore differing amounts of CO<sub>2</sub> are produced depending on the molar mass of the combusted gas. Added accuracy can be obtained by calculating the CO<sub>2</sub> produced from the mass of

The best calculation for CO<sub>2</sub> emissions from 100% combustion is:

$$\text{CO}_2 \text{ (tonnes)} = \left( \text{fuel gas (tonnes)} \right) \left( \frac{\text{molar mass Carbon in the gas}}{\text{molar mass of fuel}} \right) \left( \frac{44 \text{ (molar mass CO}_2\text{)}}{12 \text{ (molar mass Carbon)}} \right)$$

If the carbon content is not known, the following default calculation for CO<sub>2</sub> emission from fuel gas combustion in tonnes can be used:

$$\text{CO}_2 \text{ (tonnes)} = \left( \text{fuel gas (tonnes)} \right) \left( \frac{(12 \times \text{molar mass of gas}) - 44}{7 \times \text{molar mass of gas}} \right)$$

#### CO<sub>2</sub> Fuel Combustion:

For the purposes of CO<sub>2</sub> emission calculation, process furnaces and gas turbines are deemed to have a combustion efficiency of 100% i.e. all carbon is converted to CO<sub>2</sub>.

The calculation for CO<sub>2</sub> emissions is:

$$\text{CO}_2 \text{ (tonnes)} = \left( \text{fuel used (tonnes)} \right) \left( \frac{\text{molar mass Carbon in fuel}}{\text{molar mass of fuel}} \right) \left( \frac{44 \text{ (molar mass CO}_2\text{)}}{12 \text{ (molar mass Carbon)}} \right)$$

Using CO<sub>2</sub> conversion factors

$$\text{CO}_2 \text{ (tonnes)} = \text{fuel used (tonnes)} \times \text{conversion factor}$$

CO<sub>2</sub> conversion factors for alkanes

Hydrocarbon	Conversion factors Tonnes CO <sub>2</sub> / Tonne Hydrocarbon
Methane CH <sub>4</sub>	2.75
Ethane C <sub>2</sub> H <sub>6</sub>	2.93
Propane C <sub>3</sub> H <sub>8</sub>	3.00
Butane C <sub>4</sub> H <sub>10</sub>	3.03
Pentane C <sub>5</sub> H <sub>14</sub>	3.06
Octane C <sub>8</sub> H <sub>18</sub>	3.09
Decane C <sub>10</sub> H <sub>22</sub>	3.10
C <sub>12</sub> H <sub>26</sub>	3.11
C <sub>15</sub> H <sub>32</sub>	3.11
C <sub>22</sub> H <sub>46</sub>	3.12
Coal Cn (44/12)	3.67

CO<sub>2</sub> conversion factors

Fuel type	Conversion factors Tonnes CO <sub>2</sub> / Tonne Hydrocarbon
Fuel gas/ Gas Turbine/ Gas Engine/ Gas heater (assumes pure methane)	2.75
Purchased gas (C <sub>1</sub> to C <sub>3</sub> )	2.80
Gasoline/petrol (C <sub>5</sub> to C <sub>12</sub> )	3.08
Kerosene (Jet Fuel) (C <sub>10</sub> to C <sub>14</sub> )	3.11
Diesel (C <sub>15</sub> to C <sub>22</sub> )	3.12
Standard Refinery Fuel	3.14
Marine heavy fuel oil	3.17
Crude oil	3.21
Coal / FCC coke	3.67

**Note:** EP turbines, gas engines and heaters will normally run on field gas. Actual gas composition should be used to derive conversion factors. Where gas composition is not available a default factor of 2.80 should be

**CO<sub>2</sub> Estimated on equipment basis**

Refer to **API Compendium** Section 4.3 (pdf file page 88).

**CO<sub>2</sub> Flaring:**

Emissions calculations should be based on all hydrocarbons flared which includes purge gas and gas for pilot burner(s). Efficiencies and carbon content are expressed as a decimal fraction i.e. a value between 0 and 1. Determine carbon content of flare gas( molar mass of carbon / molar mass of gas)

The calculation for CO<sub>2</sub> emissions in tonnes:

$$\text{CO}_2 \text{ (tonnes)} = \left( \text{mass of flared gas (tonnes)} \right) \left( \frac{\text{molar mass Carbon in gas}}{\text{molar mass of the gas}} \right) \left( \frac{44 \text{ (molar mass CO}_2\text{)}}{12 \text{ (molar mass Carbon)}} \right) \left( \text{flare efficiency} \right)$$

Default flare efficiencies:

Type of flare	Flare efficiency
Ground flares	0.98
Elevated flares (EP)	0.98
Elevated flares (Others)	0.99

**CO<sub>2</sub> Transport:**

Fuel consumption basis see **API Compendium** Section 4.5.1 (pdf file page 107).

**CO<sub>2</sub> Other miscellaneous sources**

Refer to **API Compendium** Section 4.6 (pdf page 114).

**CO<sub>2</sub> Emissions associated with purchased energy**

Electric utility emissions refer to **API Compendium** Section 4.7.1 (pdf file page 117)

Steam Utility emissions refer to **API Compendium** Section 4.7.2 (pdf file page 124)

**CO<sub>2</sub> Venting/removal:**

Calculation for CO<sub>2</sub> emissions:

$$\text{CO}_2 \text{ (tonnes)} = \text{total mass of vented gas (tonnes)} \times \text{CO}_2 \text{ content as \% of mass}$$

Alternatively, for example for LNG plants, CO<sub>2</sub> removed from feed gas can be calculated as follows:

$$\text{CO}_2 \text{ (tonnes)} = \left( \text{feed gas (tonnes)} \right) \left( \text{CO}_2 \text{ content (\% mass)} \right) \left( \text{Removal efficiency of CO}_2 \text{ (fraction)} \right)$$

See also **API Compendium** Section 5.1 (pdf file page 148)

**CO<sub>2</sub> FCC regeneration:**

CO<sub>2</sub> emission calculation in tonnes:

$$\begin{aligned} \text{Full-burn unit: CO}_2 \text{ (tonnes/yr)} &= [\text{Coke burnt (tonne/yr)} + \text{Torch Oil (tonne/yr)}] \times 3.392 \\ \text{Partial-burn unit: CO}_2 \text{ (tonnes)} &= 1.1 \times [\text{Coke burnt (tonne/yr)} + \text{Torch Oil (tonne/yr)}] \times 3.392 \end{aligned}$$

The 3.392 factor assumes 92.5% Carbon in Coke.

See also **API Compendium** Section 5.2.1 (pdf file page 158).

**CO<sub>2</sub> Hydrogen Plants (e.g. HMU and SGP units):**

Apply following correlation:

$$\text{CO}_2 \text{ (tonnes)} = \left( 1.63 - \left( 0.00001754 \times \text{LHV of feed} \right) \right) \left( \text{feed rate} \right) \left( \frac{44}{12} \right)$$

Default HMU carbon content feed: 2.80 tonnes CO<sub>2</sub> per tonne feed. LHV: Lower Heating Value

See also **API Compendium** Section 5.2.2 (pdf file page 162).

**CO<sub>2</sub> Cokers**

See **API Compendium** Section 5.2.3 (pdf file page 170).

**CO<sub>2</sub> Other catalyst regeneration**

See **API Compendium** Section 5.2.4 (pdf file page 171).

**CO<sub>2</sub> Asphalt blowing**

See **API Compendium** Section 5.2.5 (pdf file page 172).

**CO<sub>2</sub> Other refinery vents**

CO<sub>2</sub> emissions from these activities are considered to be negligible (See **API Compendium** Section 5.2.6 (pdf file page 175)).

**CO<sub>2</sub> Cold process vents**

See **API Compendium** Section 5.3 (pdf file page 176).

**CO<sub>2</sub> Storage tank emissions**

In general for CO<sub>2</sub> these emission are insignificant, see **API Compendium** Section 5.4 (pdf file page 179).

**CO<sub>2</sub> Loading, ballasting and transit loss emissions**

In general, for CO<sub>2</sub>, these emissions are insignificant, see **API Compendium** Section 5.5 (pdf file page 197).

**CO<sub>2</sub> Other venting sources**

See **API Compendium** Section 5.6 (pdf file page 204).

**CO<sub>2</sub> Non routine emissions (incl. turnaround and gas transmission)**

See **API Compendium** Section 5.7 (pdf file page 221).

**CO<sub>2</sub> Fugitive emissions (e.g. equipment leaks, water treatment)**

See **API Compendium** Section 6.0 (pdf file page 247).

## CH<sub>4</sub> (methane)

### CH<sub>4</sub> Combustion:

CH<sub>4</sub> emissions calculations should be based on the annualised fuel consumption and the equipment dependant emission (Refer also to **API Compendium** Section 4.3 (pdf file page 88)).

CH<sub>4</sub> emission calculation

$$\text{CH}_4 \text{ (tonnes)} = \text{fuel (tonnes)} \times \text{emission factor}$$

Equipment emission factors:

Type of equipment	Tonnes of CH <sub>4</sub> Emissions/Tonne Fuel
Gas turbine (generic)	4.2 x 10 <sup>-4</sup>
Gas turbine power generation	4.6 x 10 <sup>-4</sup>
Gas turbine compressor drive	1.0 x 10 <sup>-3</sup>
Diesel turbine	8.0 x 10 <sup>-5</sup>
Gas engine	2.8 x 10 <sup>-2</sup>
Diesel engine	1.4 x 10 <sup>-4</sup>
Gas heater (generic)	7.0 x 10 <sup>-5</sup>
Gas heater > 30MW	6.0 x 10 <sup>-6</sup>
Gas heater < 30MW	6.0 x 10 <sup>-5</sup>
Diesel heater	7.8 x 10 <sup>-6</sup>
Pyrolysis pitch (from olefin units)	2.9 x 10 <sup>-5</sup>
Residual fuel oil utility boilers	4.0 x 10 <sup>-5</sup>
Marine boilers	4.0 x 10 <sup>-5</sup>
Marine diesel engines (Shell Trading)	2.4 x 10 <sup>-4</sup>



**CH<sub>4</sub> Flaring:**

Methane emissions calculations should be based on flare gas composition analysis. In absence of this data, use the default values provided below. Purge gas should be added to the content of flared gas. Efficiencies and contents are expressed as a decimal fraction i.e. a value between 0 and 1.

CH<sub>4</sub> emissions calculation:

$$\text{CH}_4 \text{ (tonnes)} = \text{flare gas (tonnes)} \times (1 - \text{flare efficiency}) \times \text{CH}_4 \text{ content of flare gas.}$$

Where the CH<sub>4</sub> content of flare gas is not known, the following default factors for methane content of flare gas can be used:

Type of flare gas	Tonnes CH <sub>4</sub> / Tonne Flare Gas
Exploration & Production associated gas	0.7
EP non associated gas/Gas Plants	0.9
Downstream refineries	0.36
Chemicals plants	0.20

Default flare efficiencies:

Type of flare	Flare efficiency
Ground flares	0.98
Elevated flares (EP)	0.98
Elevated flares (Others)	0.99

See also **API Compendium** Section 4.4 (pdf file page 100).

**CH<sub>4</sub> Transport**

Refer to **API Compendium** Section 4.5 2 (pdf file page 108).

Exploration & Production Type of transport	Tonnes CH <sub>4</sub> / Tonne Fuel
Air transport	$8.7 \times 10^{-5}$
Marine transport	$2.7 \times 10^{-4}$
Land transport	$2.3 \times 10^{-4}$

**CH<sub>4</sub> Venting:**

CH<sub>4</sub> emissions calculations should be determined using vent gas flow rate and gas composition data.

CH<sub>4</sub> emission calculation:

$$\text{CH}_4 \text{ (tonnes)} = \text{gas vented (tonnes)} \times \text{CH}_4 \text{ content of vented gas.}$$

Where the actual methane content is not known, the following default factors for methane content of gas vented can be used:

Type of gas vented	Tonnes CH <sub>4</sub> / Tonne Gas
Associated gas	0.7
Non associated gas/Gas Plants	0.9

**Note:** If vented gas contains significant non-hydrocarbon content such as CO<sub>2</sub> and Nitrogen, then corrections should be applied.

See also **API Compendium** Section 5.1 (pdf file page 148).

**CH<sub>4</sub> Refinery Processes in General**

See **API Compendium** Section 5.2.1 (pdf file page 158).

**CH<sub>4</sub> Hydrogen Plants (e.g. HMU and SGP units):**

CH<sub>4</sub> emissions from the process are in general negligible, however for the process heaters should be treated as combustion sources.

See **API Compendium** Section 5.2.2 (pdf file page 162).

**CH<sub>4</sub> Cokers**

No quantitative estimation method available (**API Compendium** Section 5.2.3 (pdf file page 170)), in general these CH<sub>4</sub> emissions are negligible.

**CH<sub>4</sub> Other catalyst regeneration**

No significant CH<sub>4</sub> emissions from this activity (see **API Compendium** Section 5.2.4 (pdf file page 171)).

**CH<sub>4</sub> Asphalt blowing**

See **API Compendium** Section 5.2.5 (pdf file page 172).

**CH<sub>4</sub> Other refinery vents**

CH<sub>4</sub> emissions from these activities are considered to be negligible (See **API Compendium** Section 5.2.6 (pdf file page 175)).

**CH<sub>4</sub> Cold process vents**

See **API Compendium** Section 5.3 (pdf file page 176).

**CH<sub>4</sub> Other venting sources**

See **API Compendium** Section 5.6 (pdf file page 204).

**CH<sub>4</sub> Non routine emissions (incl turnaround and gas transmission)**

See **API Compendium** Section 5.7 (pdf file page 221).

**CH<sub>4</sub> Fugitive emissions:**

Methane emissions from equipment leaks.

Fugitive emissions are leaks from components such as pipe connections, valves, rotating shafts etc. The calculation of fugitive emissions is relatively insensitive to the number of components and the benefit to be derived from identifying the precise number of components is negligible. A coarse estimate of component numbers, focusing on large potential sources such as compressors, is recommended.

Below are the average overall total hydrocarbon fugitive emission factors per component (API 1993). Composition is assumed to be 70% CH<sub>4</sub> and 30% VOC by mass if no other information is available.

CH<sub>4</sub> fugitive emission calculation in tonnes:

$$\text{CH}_4 (\text{tonnes/year}) = \left( \frac{(0.7) (\text{number of components}) (\text{factor kg/year})}{1000 (\text{kg/tonne})} \right)$$

Type of facility	Average emission factor kg/year-component
Onshore light crude	1.41
Onshore heavy crude	0.033
Onshore gas production	3.86
Offshore oil and gas	0.911

See also **API Compendium** Section 6.0 (pdf file page 247).

**CH<sub>4</sub> Storage tank emission:**

Methane emissions resulting from storage of crude oil at dispatching and receiving terminals.

CH<sub>4</sub> emission calculation [tonnes]:

$$\text{CH}_4 \text{ (tonnes)} = \left( \begin{array}{c} \text{crude oil throughput} \\ \text{(tonnes)} \end{array} \right) \left( \begin{array}{c} \text{emission factor} \end{array} \right) \left( \begin{array}{c} \text{Tank diameter (meters)} \\ 41.5 \text{ meters} \end{array} \right)$$

**Note:** Tank diameter in metres.

Exploration & Production – Default emission factors:

Exploration & Production Type of storage	Tonnes CH <sub>4</sub> / Tonne Throughput
Fixed roof	2.0 x 10 <sup>-7</sup>
Internal floating roof tanks	4.0 x 10 <sup>-8</sup>
External floating roof tanks	1.5 x 10 <sup>-7</sup>

**Note:** The above factors assume a 15 % CH<sub>4</sub>, 85% VOCs by mass composition of vapours exiting the tank. The external floating roof tank is based on a tank diameter of 135 feet (41.5m); correct the factor by multiplying by D/135 feet (or D/41.5 m).

See also **API Compendium** Section 5.4 (pdf file page 179).

**CH<sub>4</sub> Loading and ballasting:**

Methane emissions occur only during loading operations of Crude Oil; no emissions occur from ships whilst loading LNG or when vapour return systems are employed.

During discharge from a ship, road tanker or rail tanker only negligible emissions will occur at the ship, road tanker or rail tanker (air is sucked into the tank during discharge, so there is little emission of hydrocarbons). Emissions will occur from the tank that is being filled, but these will be included as part of storage emissions (see above).

CH<sub>4</sub> emission calculation [tonnes]:

$$\text{CH}_4 \text{ (tonnes)} = \text{crude oil loaded (tonnes)} \times \text{factor}$$

Shipping fleets – Default loading emission factors :

Shipping fleets loading		Tonnes CH <sub>4</sub> / tonne Throughput	
Crude Oil	Barges	3.8 x 10 <sup>-5</sup>	Uncontrolled
	Ships	2.35 x 10 <sup>-5</sup>	Uncontrolled

**Exploration & Production** – Default loading emission factors:

Exploration and Production loading	Tonnes CH <sub>4</sub> / Tonne crude
Rail cars/tanker trucks	5.8 x 10 <sup>-5</sup>
Average for barges and ships	1.8 x 10 <sup>-5</sup>

For default Emission factors for crude oil loading operations, the composition is assumed to be 15% CH<sub>4</sub> and 85% VOC by mass. Emission factors for splash loading of rail cars and trucks may be obtained by multiplying the values by 2.9 For gasoline emissions: CH<sub>4</sub> mass fraction in emission is negligible.

See also **API Compendium** Section 5.5 (pdf file page 197).

#### **CH<sub>4</sub> Transit losses during a ship's voyage:**

Methane emitted during a ship's voyage transporting Crude Oil.

CH<sub>4</sub> emission calculation [Tonnes]:

$$\text{CH}_4 \text{ (tonnes)} = 2.0 \times 10^{-6} \times \text{mass of cargo transported (tonnes)}.$$

**Note:** emergency emissions: 100 % methane.

See also **API Compendium** Section 5.5 (pdf file page 197).

#### **CH<sub>4</sub> Preparation for refit of LNG Ships:**

CH<sub>4</sub> emissions that occur, as a consequence of cargo tank venting, during refit preparations when the tanks are warmed up and subsequently inerted prior to aeration.

CH<sub>4</sub> emission calculation [tonnes]:

$$\text{CH}_4 \text{ (tonnes)} = \left( \left( \text{total volume of cargo tanks (m}_3\text{)} \times 0.00162 \right) + \left( \text{heel (m}_3\text{)} \times 0.46 \right) - \left( \text{gas burnt in boilers during warm-up and inerting (tonnes)} \right) \right) \times 0.94$$

## N<sub>2</sub>O (nitrous oxide)

### N<sub>2</sub>O Combustion:

N<sub>2</sub>O emissions calculations should be based on the annualised fuel consumption and the equipment dependant emission (Refer also to **API Compendium** section 4.3)

N<sub>2</sub>O emission calculation in tonnes:

$$\text{N}_2\text{O (tonnes)} = \text{fuel consumed (tonnes)} \times \text{factor}$$

Equipment default factors:

Type of equipment	N <sub>2</sub> O emission Tonnes / Tonne fuel
Gas turbine	$2.2 \times 10^{-4}$
Diesel turbine	$2.2 \times 10^{-4}$
Gas engine	$2.2 \times 10^{-4}$
Motor ships and diesel engines (stationary & mobile)	$2.2 \times 10^{-4}$
Process heaters, gas fired	$2.2 \times 10^{-4}$
Process heaters, diesel fired	$2.2 \times 10^{-4}$
Refinery furnaces, gas fuel	$5.0 \times 10^{-6}$
Steam ships, Refinery furnaces, liquid fuel	$2.5 \times 10^{-5}$
FCC	$1.71 \times 10^{-4}$

**N<sub>2</sub>O Flaring:**

N<sub>2</sub>O emissions should be calculated using flare combustion efficiency, the flare gas volume and composition. Flared quantities should include purge gas and gas for pilot burner(s). Efficiencies and contents are expressed as a decimal fraction i.e. a value between 0 and 1.

N<sub>2</sub>O emission calculation in tonnes:

$$\text{N}_2\text{O (tonnes)} = 0.000081 \times \text{hydrocarbons flared (tonnes)} \times \text{flare efficiency.}$$

Default flare efficiencies:

Type of flare	Flare efficiency
Ground flares	0.98
Elevated flares (EP)	0.98
Elevated flares (Others)	0.99

See also **API Compendium** section 4.4

**N<sub>2</sub>O Transport**

Exploration & Production Type of transport	Tonnes N <sub>2</sub> O / Tonne Fuel
Air transport	2.2 x 10 <sup>-4</sup>
Marine transport	2.2 x 10 <sup>-4</sup>
Land transport	2.2 x 10 <sup>-4</sup>

For higher accuracy refer to **API Compendium** Section 4.5.2 (pdf file page 109).

**N<sub>2</sub>O Vented emission estimation methods:**

N<sub>2</sub>O emissions from venting are negligible.

**N<sub>2</sub>O Refinery processes:**

N<sub>2</sub>O emissions from refinery processes are negligible, however the process heaters (incl CO-boiler) should be treated as combustion sources. See **API Compendium** appendix C.

**N<sub>2</sub>O Petrochemical processes:**

It should be noted that different operating conditions associated with specific petrochemical units, such as high operating temperatures of olefin units, may result in higher N<sub>2</sub>O combustion emissions than observed at refinery processes. See **API Compendium** section 2.2.6 and **API Compendium** Appendix C.

## SO<sub>x</sub> (oxides of sulphur) emissions

### SO<sub>2</sub> Flaring:

SO<sub>2</sub> emissions should be determined using flare gas sulphur mass fraction. Several parameters are required to quantify the atmospheric emissions from flaring, such as the mass of gas flared, the flare gas composition and flare efficiency. Flared quantities including purge gas and gas for pilot burner(s). Efficiencies and contents are expressed as a decimal fraction i.e. a value between 0 and 1.

Default calculation for SO<sub>2</sub> emissions in tonnes:

$$\text{SO}_2 \text{ (tonnes)} = 2 \times \text{weight fraction of sulphur} \times \text{flare efficiency} \times \text{mass of gas (tonnes)}$$

Default flare efficiencies:

Type of flare	Flare efficiency
Ground flares	0.98
Elevated flares (EP)	0.98
Elevated flares (Others)	0.99

### SO<sub>2</sub> Combustion:

SO<sub>2</sub> emissions calculation in tonnes:

$$\text{SO}_2 \text{ (tonnes)} = 2 \times \text{weight fraction of sulphur in the fuel} \times \text{mass of fuel consumed (tonnes)}$$

### SO<sub>2</sub> FCC regeneration:

SO<sub>2</sub> emissions calculation in tonne:

$$\text{SO}_2 \text{ (tonnes/yr)} = 2 \times \text{Coke burnt (tonnes/yr)} \times \text{Sulphur in Coke (weight fraction)}$$

With

$$\text{Sulphur in coke} = R \times \text{Sulphur in feed (weight fraction)}$$

Where

R = 1.1 for Vacuum Gas Oil, sometimes also named Flash Distillate

R = 2.0 for hydrotreated Vacuum Gas Oil,

R = 1.8 for residues,

R = 3.1 for hydrotreated residues



**SO<sub>2</sub> Sulphur recovery:**

Claus or Claus + SCOT unit SO<sub>2</sub> emission calculation in tonnes:

$$\text{SO}_2 \text{ (tonnes)} = \text{H}_2\text{S feed rate (tonnes)} \times (1 - \text{recovery efficiency}) \times 64/34$$

**SO<sub>2</sub> Transport:**

For air transport use fixed and rotating wing operations; exclude business travel on commercial flights.

For land transport calculate for diesel and petrol use.

**SO<sub>2</sub> Shipping fleets:**

Motor and Steam ships SO<sub>2</sub> emissions calculation in tonnes:

$$\text{SO}_2 \text{ (tonnes)} = 2 \times \text{sulphur weight fraction of fuel} \times \text{mass of fuel consumed (tonnes)}$$

Note: LNG boil off gases contain no sulphur hence no SO<sub>2</sub> emissions are resulting from this fuel.

## NO<sub>x</sub> (nitric oxide and nitrogen dioxide)

### NO<sub>2</sub> Flaring:

Flared quantities should include purge gas and gas for pilot burner(s). Efficiencies are expressed as a decimal fraction i.e. a value between 0 and 1. NO<sub>x</sub> emissions should be calculated using flare combustion efficiency, the flare gas volume and composition.

Default calculation for NO<sub>x</sub> emissions in tonnes:

For flares without steam injection:

$$\text{NO}_2 \text{ (tonnes)} = \text{mass of gas flared (tonnes)} \times 0.0015 \times \text{flare efficiency}$$

For flares with steam injection:

$$\text{NO}_2 \text{ (tonnes)} = \text{mass of gas flared (tonnes)} \times 0.0005 \times \text{flare efficiency}$$

Default flare efficiencies:

Type of flare	Flare efficiency
Ground flares	0.98
Elevated flares (EP)	0.98
Elevated flares (Others)	0.99

### NO<sub>2</sub> Combustion:

For furnaces and boilers in refinery operations, gas and chemical plants use the following default calculation for NO<sub>2</sub> emission in tonnes:

$$\text{NO}_2 \text{ (tonnes)} = \left( \left( 0.0041 \times \frac{\text{liquid fuel mass}}{\text{fraction of total fuel package}} \right) + 0.0009 \right) \left( \text{Mass of fuel (tonnes)} \right)$$

Example: Fuel package: 30% gas, 70% liquid fuel

Emission factor:  $0.0041 \times 0.7 + 0.0009 = 0.00377$

NO<sub>x</sub> emission in tonnes:  $0.00377 \times$  tonnes of fuel consumed

For other equipment use the following default factors:

Type of equipment	NO <sub>x</sub> emission tonnes / Tonne fuel
Gas turbines	$6.7 \times 10^{-3}$
Diesel turbines	$9.4 \times 10^{-3}$
Gas engines	$7.6 \times 10^{-2}$
Diesel turbines	$7.0 \times 10^{-2}$
Process gas heaters (EP only)	$3.1 \times 10^{-3}$
Diesel heater	$2.8 \times 10^{-3}$

### NO<sub>2</sub> FCC regeneration:

Only two parameters are required to calculate NO<sub>x</sub>: regenerator bed temperature (°C) and the total nitrogen in feed (ppmw).

For full-burn units:

$$\text{For } O_2 < 2.5 \text{ \% volume}$$

$$NO_2 \text{ (ppmv)} = 56 + (0.229N_{\text{feed}}) + 1.65(T_{\text{regen}} - 680) + 117.1 (O_2 - 2)$$

Where:

NO<sub>x</sub> = the concentration of NO<sub>x</sub> in the flue gas (dry basis) in parts per million volume (ppmv)

$N_{\text{feed}}$  = total nitrogen in feed, in parts per million weight (ppmw)

$T_{\text{regen}}$  = regenerator bed temperature (°C),

$O_2$  = % volume oxygen in flue gas.

If  $O_2 > 2.5$  % volume in Flue Gas, take  $O_2 = 2.5$  % vol in the calculation.

$$NO_2 \text{ emission (tonnes/yr)} = NO_2 \text{ (in ppmv, as calculated above)} \times C_1 \times (23 \times 10^6)$$

Where:  $C_1$  = coke burnt in FCC (tonnes/yr) + fuel oil and/or torch oil (tonnes/yr) order of magnitude: NO<sub>x</sub> emissions should be no more than a few tonnes per day

For partial-burn units:

No correlations are known for partial-burn units. As a rough average, the NO<sub>2</sub>-make is about 55% that of a full-burn unit. Hence to calculate NO<sub>2</sub> emissions from partial-burn FCC's, use the above formulas then multiply the result with 0.55.

**NO<sub>2</sub> Shipping fleets:**

Default NO<sub>2</sub> emission calculations in tonnes, compliant with Regulation 13 of Marpol Annex VI.

**Steam ships:** NO<sub>2</sub> (tonnes) = 0.01 x fuel combusted (tonnes)

**Motor ships:** NO<sub>2</sub> (tonnes) = 0.095 x fuel combusted (tonnes)

**NO<sub>2</sub> Transport (Exploration and Production only):**

NO<sub>x</sub> emissions from transport is reported by Exploration & Production BUs only

- For air transport use fixed and rotating wing operations; exclude business travel on commercial flights.
- For marine transport, use fuel oil + diesel + gasoil. Diesel oil and gasoil have a similar composition, therefore are not differentiated in the calculation.
- For land transport calculate for diesel and petrol use.

Exploration & Production Type of transport	Tonnes NO <sub>x</sub> / Tonne Fuel
Air transport	1.25 x 10 <sup>-2</sup>
Marine transport	5.9 x 10 <sup>-2</sup>
Land transport	3.8 x 10 <sup>-2</sup>

## Volatile Organic Compounds (VOCs)

### VOCs Flaring:

Flared quantities should include purge gas and gas for pilot burner(s). Efficiencies and contents are expressed as a decimal fraction i.e. a value between 0 and 1.

VOC emission calculation [tonnes] :

$$\text{VOC (tonnes)} = \left( \text{Mass of flare gas (tonnes)} \right) \left( 1 - \text{flare efficiency} \right) \left( \text{VOC content of flare gas} \right)$$

Where the VOC content of the gas is not known the following default factors can be used:

Type of hydrocarbon source	VOC Content of flare gas
Oil and associated gas	0.3
Non associated gas / gas plants	0.1
Downstream refineries	0.64
Chemical Plants	0.8

Default flare efficiencies:

Type of flare	Flare efficiency
Ground flares	0.98
Elevated flares (EP)	0.98
Elevated flares (Others)	0.99

### VOCs Venting:

VOC emissions should be determined using vent gas flow rate and gas composition data.

VOC emission calculation [tonnes]:

$$\text{VOC (tonnes)} = \text{mass of vent gas (tonnes)} \times \text{VOC content of vent gas.}$$

Default factors for VOC content of vent gas:

Type of vent gas	VOC
Associated gas	0.3
Non associated gas/ gas plants	0.1

**Note:** If the gas contains a significant non HC content, then a correction should be applied before estimating VOC emissions.

### VOCs Combustion:

VOC emissions should be calculated based on the annualised fuel consumption and the equipment dependent emission factor.

Default factors are provided here. It is, however, recommended to use equipment specific factors derived from the manufacturer or based on measurements.

VOC emission calculation:

$$\text{VOC (tonnes)} = \text{Tonnes of fuel} \times \text{emission factor}$$

Default emission factors:

Type of equipment	Tonnes of VOC emissions / tonne fuel
Gas turbine	$5.1 \times 10^{-5}$
Diesel turbine	$7.0 \times 10^{-4}$
Gas engine	$3.0 \times 10^{-3}$
Diesel engine	$1.9 \times 10^{-3}$
Motor ships	$2.4 \times 10^{-3}$
Gas heater	$6.2 \times 10^{-4}$
Diesel heater	$2.8 \times 10^{-5}$
Gas boiler	$2.0 \times 10^{-4}$
Gas furnace boiler or heater > 39 MW	$2.8 \times 10^{-5}$
Gas furnace boiler or heater < 39 MW	$5.5 \times 10^{-5}$
Residual fuel oil utility boilers	$1.5 \times 10^{-4}$

**VOCs Storage:**

Preferred methodology for calculating VOC emissions is the Manual of Petroleum Measurement Standards, Chapter 19 – Evaporative Loss Measurements

Section 1 – Evaporative Loss From Fixed-Roof Tanks. API Publication 2518. Second Edition, October 1991

Section 2 – Evaporative Loss From Floating-Roof Tanks. First Edition April 1997 (formerly API Publications 2517 and 2519).

Where emissions quantification methods are prescribed by local authorities and are based on API or equivalent standards (e.g. VROM/TNO method in The Netherlands) these can be used, provided accuracy exceeds Tier 1.

Default storage terminal VOC emission calculation [tonnes]

$$\text{VOC (tonnes)} = \text{throughput (tonnes)} \times \text{emission factor}$$

**Exploration & Production:** default crude oil terminal emission factors:

Type of crude oil storage	Tonnes VOC / tonne Throughput
Fixed roof tanks	$1.12 \times 10^{-4}$
Internal floating roof tanks	$2 \times 10^{-7}$
External floating roof tanks	$8.5 \times 10^{-7}$

**Notes:** The above factors assume a 15% CH<sub>4</sub>, 85% VOCs by mass composition of vapours exiting the tank. The external floating roof tank factor is based on a tank diameter of 135 feet (41.5m); correct the factor by multiplying by D/135 ( or D/41.5m).

**Downstream:** default emission factors for tanks containing gasoline (or other Class 1 hydrocarbons with a flash-point below 40°C, e.g. gasoline components, naphthas) at refineries depots/terminals and retail sites:

Type of gasoline and naphtha storage	Tonnes VOC / tonne Throughput
Fixed roof tanks	$1.9 \times 10^{-3}$
Fixed roof tanks connected to VRU	$1.0 \times 10^{-4}$
Floating roof tanks	$9.0 \times 10^{-5}$
Fixed roof tank with internal floating roof cover	$2.0 \times 10^{-4}$
Retail storage tanks	$1.6 \times 10^{-3}$
Retail storage tanks with vapour return	$2.7 \times 10^{-4}$

**Notes:** The above factors for VOC assume a 15% CH<sub>4</sub>, 85% VOCs by mass composition of vapours exiting the tank.

**VOCs Loading a ship, road tanker or rail tanker:**

During discharge from a ship, road tanker or rail tanker only negligible emissions will occur at the ship, road tanker or rail tanker (air is sucked into the tank during discharge, so there is little emission of hydrocarbons). Emissions will occur from the tank that is being filled, but these will be included as part of storage emissions (see above).

VOC emission calculation [tonnes] :

$\text{VOC (tonnes)} = \text{Product loaded (tonnes)} \times \text{emission factor}$
--

**Exploration & Production:** loading default factors for crude oil (only)

Type of loading operation	Tonnes VOC / tonne Throughput
Average for barges and ships	$1.0 \times 10^{-4}$
Rail cars/tank trucks	$3.3 \times 10^{-4}$

Default Emission factors for crude oil loading operations. Composition assumed to be 15% CH<sub>4</sub> and 85% VOC by mass. Emission factors for splash loading of rail cars and trucks may be obtained by multiplying the values by 2.9.

**Other businesses:** loading default factors:

Type of loading operation		Tonnes VOC / tonne Throughput	
Crude Oil <sup>1,3</sup>	Barges	$7.3 \times 10^{-4}$	Uncontrolled
	Ships	$4.5 \times 10^{-4}$	Uncontrolled
Gasoline <sup>5,6</sup>	Barges	$4.2 \times 10^{-4}$	Uncontrolled
	Ships	$3.2 \times 10^{-4}$	Uncontrolled
	Road & rail tankers	$5.5 \times 10^{-4}$	Uncontrolled
	Bottom loading road tankers	$3.0 \times 10^{-5}$	Controlled <sup>2</sup>

**Notes:**

- Factors from US EPA AP 42, 1995, Ch 5.2. Crude Oil RVP: 0.344 barA, CH<sub>4</sub> = 15 % and VOC = 85 % of Total Emissions, ref. **EPA AP-42**.
- Controlled Emissions : stage 1 vapour recovery operational, efficiency 95%; Actual efficiency shall be used if supported by measurements. Uncontrolled Emissions: No emission reduction measures applied.
- Crude Oil 0.855 T/ m<sup>3</sup>, Factors to be adjusted if actual density differs: factor x (0.855/ Actual density).
- For gasoline emissions: CH<sub>4</sub> and C<sub>2</sub>H<sub>6</sub> weight fraction in emission is negligible.
- Gasoline 0.75 T/ m<sup>3</sup>; Factors to be adjusted if actual density differs: factor x (0.750 / Actual density).
- European factors based on CONCAWE report 85/54 "Hydrocarbon Emissions from gasoline storage and distribution systems", July 1986.



**VOCs Transit losses during a ships voyage:**

Tonnes of VOC emitted from cargo during a ships voyage.

Default emission calculation [tonnes]:

<b>Crude oil:</b> $3.3 \times 10^{-5}$ x tonnes transported
<b>Gasoline:</b> $6.6 \times 10^{-5}$ x tonnes transported

**Notes:**

1. 85 % of vapours emitted from crude oil cargo are assumed VOC, in line with EPA AP-42 Ch. 5 , Jan '95.
2. Based on crude oil RVP: 0.344 barA and Gasoline RVP : 0.69 barA.
3. LNG emergency emissions: 0 % VOC.
4. LPG emergency emissions: 100 % VOC.

**VOCs from preparation for refit of LNG ships:**

Emissions will occur, as a consequence of cargo tank venting, during refit preparations when the tanks are warmed up and subsequently inerted prior to aeration.

$$\text{VOC (tonnes)} = \left( \left( \text{total volume of cargo tanks (m}_3\text{)} \times 0.00162 \right) + \left( \text{heel (m}_3\text{)} \times 0.46 \right) - \left( \text{gas burnt in boilers during warm-up and inerting (tonnes)} \right) \right) \times 0.06$$

**VOCs Fugitive emissions:**

VOC emissions from equipment leaks. Fugitive emissions are leaks from components such as pipe connections, valves, rotating shafts etc. The calculation of fugitive emissions is relatively insensitive to the number of components and the benefit to be derived from identifying the precise number of components is negligible. A coarse estimate of component numbers, focusing on large potential sources such as compressors, is recommended.

Below are the average overall total hydrocarbon fugitive emission factors per component (API 1993). Composition is assumed to be 70% CH<sub>4</sub> and 30% VOC by mass if no other information is available.

VOC fugitive emission calculation in tonnes:

$$\text{VOC (tonnes/year)} = \left( \frac{(0.3) (\text{number of components}) (\text{factor kg/year})}{1000 (\text{kg/tonne})} \right)$$

Type of facility	Average emission factor kg/year-component
Onshore light crude	1.41
Onshore heavy crude	0.033
Onshore gas production	3.86
Offshore oil and gas	0.911

**VOCs Wastewater treatment processes and drainage:**

Water treatment plants VOC emission calculation:

$$\text{VOC (tonnes/year)} = \text{Treated water flow [tonnes/year]} \times \text{factor}$$

Default factors for separators:

Type of separator	Tonnes emission/tonne treated water
Covered separator and /or vapour recovery	$2.4 \times 10^{-5}$
Uncovered separator / no vapour recovery	$6.0 \times 10^{-4}$

For continuous oil containing drain systems VOC emission calculation:

$$\text{VOC (tonnes/yr)} = 0.074 \text{ tonnes/yr} \times (\text{total number of manholes} + \text{junction boxes})$$

**VOCs Transport (Exploration & Production only):**

VOC emissions from transport are report by Exploration & Production BUs only.

- For air transport use fixed and rotating wing operations for Shell operational business; exclude business travel on commercial flights.
- For marine transport, use fuel oil + diesel + gasoil. Diesel oil and gasoil have a similar composition, therefore are not differentiated in the formulas. It should be noted that the carbon content of the fuel is assumed to be 87% and where it is known to be different, a corrected factor should be used.
- For land transport calculate for diesel and petrol use.

Exploration & Production Type of transport	Tonnes VOC / tonne Fuel
Air transport	$8.0 \times 10^{-4}$
Marine transport	$2.4 \times 10^{-3}$
Land transport	$5.4 \times 10^{-3}$

## APPENDIX 2: GLOSSARY OF TERMS

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For definition of terms not found below, reference is made to glossaries in other publications issued under the auspices of the HSE Advisers Panel.

### **Associated gas**

Associated gas is the gas that is co-produced with crude oil from a subsurface reservoir.

### **Business**

One of the global Shell businesses, i.e. Exploration and Production, Downstream, Gas and Power, Renewables.

### **Business Unit**

Activities in one of the Group businesses that are operated as a single economic entity. A business unit can coincide with a Group company or straddle part or all of several companies.

### **Contractor**

All parties working for the company either as direct contractors or as subcontractors  
See also the guide Incident Investigation, Classification and Reporting, February 2002.

### **Environmental Impact**

The negative impact on the environment resulting from an incident. (Refer to examples in Appendix 7 of the **Incident Classification, Investigation and Reporting**, Issue 2.0, February 2002).

### **Equity Reporting**

The equity position is a financial basis for setting organizational boundaries. This approach requires reporting in proportion to the economic interest in the reporting company.

### **First Aid Case (FAC)**

Any single treatment and subsequent observation of minor scratches, cuts, burns, splinters, etc. that do not normally require medical care by a physician. Such treatment and observation is considered first aid case even if provided by a physician or registered professional personnel. (Refer to examples in Appendix 3 of the **Incident Classification, Investigation and Reporting**, Issue 2.0, February 2002).

### **Fugitive emissions**

Point source emissions due to leakage from process equipment such as pump and compressors seals and piping items such as valves and flanges.

### **High Risk Incident (HRI)**

An incident for which the combination of potential consequences and probability are assessed to be in the high-risk (red shaded) area of the RAM. HRIs can be incidents that result in injuries, illnesses or damage to assets, the environment or company reputation, or they can be near misses.

### **Incident**

An unplanned event or chain of events that has, or could have, resulted in injury or illness or damage to assets, the environment or company reputation. Incidents do not include operations, maintenance, quality or reliability incidents which had no HSE consequence or potential. Incidents do not include degradation or failure of plant or equipment resulting solely from normal wear and tear.

### **Injury**

Any injury such as a cut, fracture, sprain, amputation etc. that results from a single instantaneous exposure.

**Lost Time Injuries (LTI)**

The sum of injuries resulting in fatalities, permanent total disabilities and lost workday cases, but excluding restricted work cases and medical treatment cases.

**Lost Time Injury Frequency (LTIF)**

The number of lost time injuries per million exposure hours.

**Lost Workday Case (LWC)**

Any work related injury that renders the injured person temporarily unable to perform their normal work or restricted work on any day after the day on which the injury occurred. Any day includes rest day, weekend day, scheduled holiday, public holiday or subsequent day after ceasing employment. A single incident can give rise to several lost workday cases, depending on the number of people injured as a result of that incident.

**Lost Workdays (LWD)**

The total number of calendar days on which the injured person was temporarily unable to work as a result of a lost workday case. In the case of a fatality or permanent total disability no lost workdays are recorded.

**Major Installation:**

Major installations include crude oil and natural gas terminals, gas plants, offshore platforms, major flow stations, floating production and storage vessels, refineries and chemical manufacturing facilities.

**Medical Treatment Case (MTC)**

Any work related injury that involves neither lost workdays or restricted workdays, but which requires treatment by a physician or other medical specialist. Medical treatment does not include first aid even if a physician or registered professional personnel provide this. (Refer to **Incident Investigation, Classification and Reporting**, February 2002, Appendix 3).

**Occupational illness**

Any work related abnormal condition or disorder, other than one resulting from an injury that is caused by or mainly caused by exposures at work. (50% or more probability that the illness was caused by exposures at work). Occupational illnesses include acute and chronic illness or diseases that may be caused by inhalation, absorption, ingestion or direct contact. (Refer to **Incident Investigation, Classification and Reporting**, February 2002, Appendix 4).

**Operational Control Companies**

A member company of the Royal Dutch Shell plc that has full authority to introduce and implement the Group HSE policy.

**Permanent Total Disability (PTD)**

Any work related injury that permanently incapacitates an employee and results in termination of employment.

**Potential Incident**

An unsafe practice or a hazardous situation that could result in an incident (incident has not occurred).

**Reputation Impact**

The negative impact on company reputation resulting from an incident. The negative impact can be in the form of adverse attention from media, politicians or action groups, or in public concern about company activities. (Refer to guidance and examples in Appendix 8 of the **Incident Classification, Investigation and Reporting**, Issue 2.0, February 2002).

**Restricted Work Case (RWC)**

Any work related injury which renders the injured person temporarily unable to perform all, but still some, of their normal work on any day after the day on which the injury occurred.

**Restricted Workdays (RWD)**

The total number of calendar days counting from the day of starting restricted work until the person returns to his normal work. When restricted workdays follow a period of lost workdays, the restricted workdays are recorded in addition to the lost workdays, but the injury is recorded as a lost workday case only.

**Risk Assessment Matrix (RAM)**

A tool that standardises qualitative risk assessment and facilitates the categorisation of risk from threats to people, assets, environment and company reputation. The tool is described in detail in the HSE Adviser's Panel guide **Risk Assessment Matrix** (1999).

**Sabotage**

The wilful and malicious damage to or destruction of property or interference with normal operations.

**Significant Incidents**

Incidents with actual consequences to the company that rate 4 or 5 on the RAM.

**Settlement**

A settlement is any payment made either to the government or other parties as compensation.

**Third parties**

Third Parties are persons or organisations that are not employed by or contracted to a company or contractor.

**Tonnes (wet)**

Tonnes (wet) is the mass of waste measured by weighbridge, i.e. no corrections are applied, i.e. for water content.

**Total Reportable Case Frequency (TRCF)**

The sum of injuries resulting in fatalities, permanent total disabilities, lost workday cases, restricted work cases and medical treatment cases per million exposure hours.

**Total Reportable Occupational Illness Frequency (TROIF)**

The sum of all identified occupational illnesses. Cases involving no lost or restricted workdays and no medical treatment are included. A single exposure can give rise to several occupational illness cases per million exposure hours.

**Work Related Activities**

Those activities for which management controls are, or should have been, in place. Refer to Section 2.1 of the Incident Classification, Investigation and Reporting, Issue 2.0, February 2002 for detailed guidance. Injuries occurring in the course of work related activities are work related injuries.

### APPENDIX 3: COMMON CONVERSION FACTORS

To convert	From	To	Multiply by
Volume	US gal	litre (l)	3.78541
	US barrels (bbl)	litre (l)	158.987
	US barrels (bbl)	m <sup>3</sup>	0.159
	ft <sup>3</sup>	m <sup>3</sup>	0.0283168
Mass	US (short) ton	tonne (t)	0.907186
	lb	tonne (t)	0.000453592
Energy	Btu	kJ	1.05506
Power	hp	kW	0.7457
Pressure	psi	bar	0.0689476
	atm (standard)	bar	1.01325
	Inches of water (4 OC)	mbar	2.49089
	mm water (4 OC)	mbar	0.0980665
	inches of Hg (0 OC)	mbar	33.8639
	mm Hg (0 OC)	mbar	1.33322
Mass to Volume	tonnes natural gas	1000 m <sup>3</sup> natural gas	1.1823
	tonnes associated gas	1000 m <sup>3</sup> associated gas	0.9458
	tonnes methane	1000 m <sup>3</sup> methane	1.3951
	tonnes crude oil	m <sup>3</sup> crude oil	1.1696
	tonnes gasoil (diesel)	m <sup>3</sup> gasoil (diesel)	1.1900
	tonnes marine diesel	m <sup>3</sup> marine diesel	1.1429
	tonnes gasoline	m <sup>3</sup> gasoline	1.2987
	tonnes Jet A1	m <sup>3</sup> Jet A1	1.2500
	tonnes CO <sub>2</sub>	1000m <sup>3</sup> CO <sub>2</sub>	0.509

## APPENDIX 4: THE HSE DATA AUDIT TRAIL

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In order to facilitate internal control and review of HSE data, each reported parameter shall have an audit trail. An audit trail is a clear (documented) record of definitions, assumptions, aggregation, calculations and references that result in the final reported data and additional commentary text. For each of these data process steps, it shall be indicated whether relevant documentation exists. This documentation shall be kept in the "HSE Audit Trail" file, or an indication shall be given as to where the document is filed (e.g. IT system, a web site, other department, laboratory etc). In addition, responsibilities for internal control and signing off shall be defined in the BU's monitoring and reporting procedures.

In this way, the entire HSE data flow for each parameter becomes transparent and easily accessible for review, audit and assurance. Auditors will then be able to obtain sufficient evidence to place reliance on the data management systems, reducing the need for detailed testing of the data.

### A General information

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An overview of BU operations, including:

- A description of the raw materials, processes and products.
- A plan / map of the operations / site indicating major emission points / sources).

A description of changes and notable events in the reporting year, including:

- Major changes in the organisation (e.g. structure, staffing) or activities (e.g. acquisitions / disposals, new / discontinued processes) and equipment (e.g. for emission reduction) that might effect the HSE data.
- Major events such as shutdowns / maintenance operations and incidents / accidents.

An overview of Operational Control, including:

- A brief description of the operational control structure (indicating the activities where Shell is the operator or manager)
- Materials/services shared with external parties (e.g. energy).

### B HSE-MS information

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#### HSE management system

A brief description of the HSE management system, including the HSE risk assessment (a list of significant HSE impacts of the operations)

#### HSE organisation structure

An overview of the HSE organisational structure indicating the relevant staff / responsibilities

#### Certification

If the HSE Management Systems are certified under ISO (9001 or 14001) or EMAS, a description shall be available of the scope of the certificate(s), date of certification, and name of the certification body. The most recent certification report shall be made available.

## C Parameter specific information

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The following information needs to be available for each selected parameter, with the relevant documentation in separate sections of the "HSE Data Audit Trail" (or grouped, for example, where the audit trail and internal controls are identical).

### Definition

The definition of the parameter used by the BU (including the reporting units) for reporting data to Group. If different definitions are in use for reporting to non-Shell bodies an assessment of the differences between the definitions shall be provided.

### Scope (where relevant e.g. for emissions)

A list of emission sources shall be provided. If any sources are excluded from the scope (not reported) the reason shall be explained (e.g. a mathematical justification provided for the exclusion of minor emission sources).

### Determination method

The monitoring and determination method shall be fully documented.

- In the case of calculations or estimations, this shall include: assumptions; definitions; formulas / conversion factors; standards; exemptions.
- In the case of measurements, this shall include: the type and frequency of sampling / testing; checks on the reliability of tests; corrective measures in place; instructions regarding missing data (e.g. due to breakdown of sampling or measuring equipment)

The qualifications of the relevant personnel or external parties (e.g. laboratories) shall also be mentioned, as well as BU rules on cut-off points for year start/end.

### Aggregation

Where data are collected from different sources (e.g. plants / emission points) or are derived from other data sources (e.g. CO<sub>2</sub> from gas / electricity / diesel) the aggregation process needs to be documented. This shall describe the activities carried out (e.g. factors used for conversion of data from one reporting unit to another), the system used (paper / IT and manual / automated), the person(s) responsible, the security systems in place (e.g. for data input and later adjustments to the data).

### Internal controls (throughout the audit trail)

The checks and internal controls on the data shall be defined and documented for each stage of the audit trail. The level of control measures will partly be dictated by the complexity of the parameter, the nature of the data collection, management and reporting process. Control measures include:

- checks on application of definitions (especially at multi-site entities)
- cross checks with other sources – internal (e.g. financial records) or external (e.g. independent measurements taken by the authorities)
- checks on calculations
- assurance of industry or other standards being used
- trend analysis (comparison of data over time, taking production/events into account) The timing of the checks will depend on the frequency of reporting, but shall always be carried out by someone who is independent of the primary source (the person who undertakes the initial procedures)



**Audit trail (overview)**

The steps that occur between measurement and reporting shall be described (preferably with a diagrammatical presentation of the data flow). The description shall indicate the responsible persons for each stage of the process (determination, aggregation, internal controls), the frequency of reporting, and indicate when/where independent checks and reviews take place.

**Reporting**

The internal controls that have been undertaken during the year (see "internal controls") shall be visible e.g. with the date and signature(s) of relevant person(s), and shall include:

- any errors identified (at any stage in the data trail) or missing data
- action initiated
- the outcome (e.g. adjustments to the data, calculation of missing data)

For end of year data assurance, the following additional items are required:

- Documentation of the final reported data for the current and previous year.
- Evidence of management review and authorisation of the final data set.

## APPENDIX 5: INSTRUCTIONS ON DETERMINING OPERATIONAL CONTROL

### JV Instructions

The aim of this table is to explain the reporting requirements for JVs and 3rd Parties.

Asset Owner	Asset Operator	Who reports HSE data
Shell	Shell	Shell has operational control and reports HSE data to the Group.
Shell	3rd party	Shell does not have operational control and does not report the HSE data.
3rd party	Shell	Shell has operational control and reports HSE data to the Group.
JV where Shell owns < 50% of the shares	JV	Shell does not have operational control and does not report the HSE data.
JV where Shell owns > 50% of the shares	JV	Shell does not have operational control and does not report the HSE data.
JV where Shell owns < 50% of the shares	Shell	Shell has operational control and reports the HSE data to Group.
JV where Shell owns > 50% of the shares	Shell	Shell has operational control and reports the HSE data to Group.

This table reflects the current view. There are cases where, for historic reasons, reporting has developed differently. For all new situations, the reporting of HSE data shall follow the above-mentioned guidance.

### Instructions on shipping and barge transport

Under the provisions of international maritime conventions and in particular the International Safety Management (ISM) Code, Shell cannot assume operational control over the activities on third party operated vessels of any kind. However, Shell does encourage sharing of information within the industry on HSE matters. Therefore, although the seafarers on chartered ships and barges, managed by third parties are not considered to be "contractors", Shell does invite the managers of vessels that are chartered or employed on a period basis (typically for more than six months) to provide safety and environmental data in order to provide a basis for discussion in the regular review process. The review process is carried out by the Global Business or BU that manages the contractual arrangements. The Shipping Standards division of Shell Trading provides advice on this, and may by agreement undertake the review on behalf of the Global Business or BU. However, Group reporting shall be limited to vessels and barges under operational control i.e. within the scope of a Shell HSE-MS.

## Downstream Instructions

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Retail sites considered to be under operational control are those where Shell directly (or through a wholly/majority owned subsidiary company) operates the retail outlet including owning the stock, setting the retail prices and employing the staff. These are commonly referred to as CoCo (company owned/company operated) and DoCo (dealer owned/company operated) sites. CoDo (Company owned, Dealer operated) sites are deemed to be not under operational control because they are run by a third party. Typically CoDo sites are referred to by the terms 'RBA' (Retail Business Agreement) and 'Rental'. DoDo (Dealer Owned, Dealer operated) sites are also not under operational control.

When an employee/contractor of a Shell company (x) performs work for another Shell company (y) on a contract basis, the HSE management of the employee/contractor is the responsibility of the company that employs the person (company x). Similarly, when an employee of one Shell Class of Business (CoB A) performs work for another Shell Class of Business (CoB B) or for several Shell Classes of Business (CoBs A, B and C), the HSE management of the employee is the responsibility of the Class of Business that employs the person (CoB A). This principle of "effective management control" includes reporting of exposure hours and incidents. Such arrangements shall be covered by Service Level Agreements between the CoBs that are involved.

Examples of arrangements that might exist between Class of Businesses (CoB)

- Distribution operates an LPG cylinder filling plant on behalf of the LPG CoB – Distribution has effective management control.
- Distribution undertakes road transport activities on behalf of the Lubricants CoB – Distribution has effective management control.
- Lubricants operate a bitumen blending plant on behalf of the Bitumen CoB – Lubricants has effective management control.
- Employees in a customer service centre work for the Lubricants, Commercial Fuels, LPG and Bitumen CoBs, reporting to a line manager in the Commercial Fuels CoB – Commercial Fuels has effective management control.
- A sales force manages accounts for the Commercial Fuels and Lubricants, reporting to a line manager in the Lubricants CoB – Lubricants has effective management control.

## Shell Business that share financial interest in a site

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In determining how data shall be reported from sites where more than one Shell Business or class of Business has a financial interest, the principle of operational control applies. Businesses that have operational control over a site will report all HSE data to the Group. A deviation from this principle will require documentation (approved by the relevant Business Executive Committees) that describes the split of HSE accountabilities and reporting responsibilities. The aim of this principle is to ensure that there are no reporting gaps or double counting of HSE data.

## Acquisitions and Disposals

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Data from companies that were acquired during a reporting year are included only for the period that the companies were under Shell's operational control. For these companies, a plan shall be made with the Business Organisation to evaluate the HSE data management systems and make them compliant with this document and Shell business requirements. For disposals, data shall be included up to the time of the disposal taking effect and not thereafter.

## APPENDIX 6: PROTOCOL FOR SELF-ASSESSMENT OF HSE DATA MANAGEMENT

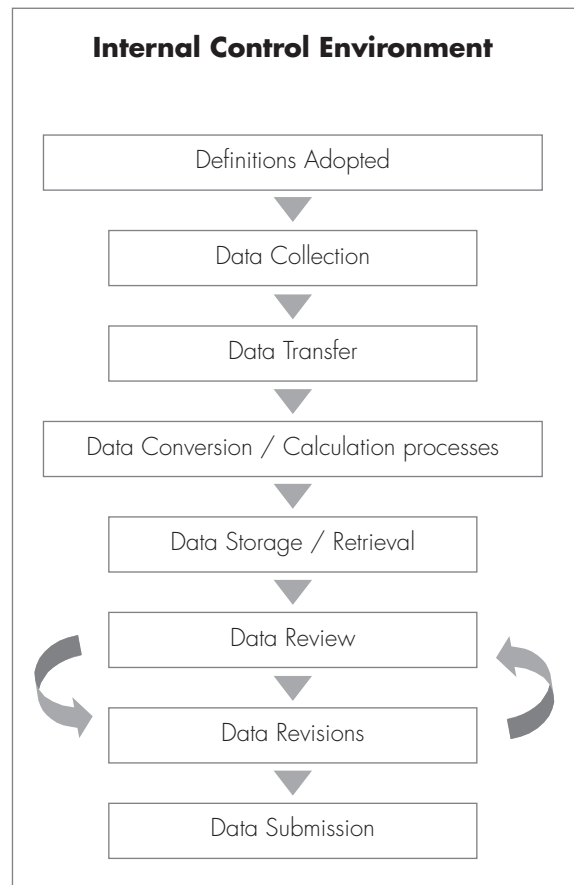
This data management self-assessment protocol has been developed to assist Business Units (BU), Class of Businesses (CoB), and Regions in their signing of their year end HSE Representation Letters due in mid January to the Business.

The aim of this process is to ensure accurate and complete reporting of HSE performance data to local/regional management, the Business and Group as well as to regulatory authorities.

The focus of this checklist is on the **data management system**. It is an aid, not a replacement for a full review by competent internal or external staff. A full review should include sample checking of individual data trails from the sources to final aggregation.

The structure and content of the data management system checklist follows:

- (Statement 1 below) **The Internal Control Environment** provides the minimum overview on data management. The HSE-MS should provide the framework for HSE performance data management as part of the sections Procedures, Implementation and Monitoring, Audit and Management Review. The questions under Statement 1 below aim to focus on the general control and quality of HSE data management.
- Statements 2-7 go into the details of various aspects of data management and reporting and can be seen as a second step.
- Each section includes an expectation, which aims to describe in one sentence what must be in place and must be signed off or qualified in the representation letter.
- A quick scan may be done by using Statement 1 questions in combination with the expectations for the other Statements.
- As part of the self-assessment, the questions below should be followed up by testing one or more major data trails from one or more sources, for completeness, calculation factors and formulae, calculation, aggregation, correction and review to submission of aggregated results (e.g. incidents, working hours, CO<sub>2</sub>, etc.). This could also be done by requesting the relevant focal points (line and HSE data coordinators) to prepare and demonstrate the data trails on paper or on screen. The ease of doing this is also an indication of system transparency and control. Checking will be relatively simple for a BU with a centralised database as compared to the more onerous checking of decentralised spreadsheet based reporting systems.
- Terminology: throughout this document reference is made to the Group PMR Manual. The PMR is the Group HSE Performance Monitoring and Reporting Guide). In addition there may be BU requirements, i.e. at country level so as to cover other methodologies and calculations used.



## Statement 1: General – Internal Control Environment

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### Expectation:

HSE data management and performance reporting internally and externally is included in the internal control system (HSE-MS); as such, it is an integral part of HSE performance management, controls and management review. The effectiveness of the data controls is assured.

### Checks:

- 1 There is an organisational overview that describes where the relevant HSE data is generated, collected and aggregated within the BU, asset, OPCO or COB. This shall be in the form of listed data sources and flow scheme(s) covering all HSE parameters being monitored and reported.
- 2 There is an internal procedure that describes how data reporting should take place in accordance with the latest Group PMR and other relevant documents. *(This could vary from an extensive document for an operation without a central database and using local calculation factors and measured gas compositions, to a simple reference to the Group PMR for an operation where still only default factors and compositions are used.)*
- 3 Data completeness and quality is assured, e.g. by quarterly spot-checks (by e.g. the HSE data collector) with departmental or activity focal points. This must include data from contractors under operational control.
- 4 HSE data collection focal points in the organisation have been identified by name. Their responsibilities are described and are known to them (e.g. in annual tasks and/or job description).
- 5 It has been established that these focal points have the required competence to deliver complete and correct data and can spot abnormalities in data trends or related parameters.
- 6 The Critical Review process described in Appendix 7 of the current Group PMR is carried out and documented for each reporting period.
- 7 The HSE Manager is involved in the final data quality assurance for the report to management, the Business and Group. He/She is authorized to sign for approval of the HSE data reported to management, Region, the Business and Group.
- 8 There is a quarterly HSE management review that includes a review of the key HSE performance data and their accuracy and completeness.
- 9 There is an annual assessment of the effectiveness of the HSE data controls.
- 10 Additional controls are considered where there is the potential for reporting materially inaccurate or incomplete data (greater than 5% at Group and 10% at business).

## Statement 2: Definitions adopted for parameters reported

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### Expectation:

Parameter definitions and reporting scope used are consistent with those of the Group PMR and any deviations are documented.

### Checks:

- 1 The Group PMR has been followed and is referenced in the local procedure. Deviations from the definitions in the PMR have been documented, justified and approved
- 2 Contractors have confirmed understanding of the data they are expected to report and know how to derive/collect it (scope, definitions etc.) .
- 3 Changes and updates in definitions or procedures are communicated formally and in a timely way to focal points. This should be reflected in the local procedure.
- 4 There is a drive to improve the data quality (moving up tier levels, e.g. from default calculation factors and compositions/densities to measured asset/location and material factors (gas composition, actual diesel sulphur content etc.), compositions and to better data models, where actual measurements cannot be made. Where this has been done the local procedure should reflect this.

## Statement 3: Data collection systems

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### Expectation:

The data capture system has been described including the responsible parties, data sources, data transfer methods, and controls to ensure that data are as accurate and complete as practicably possible.

### Checks:

- 1 The nature of the data collection systems is either e-mail with attached Excel spreadsheets, web-based Excel spreadsheets or a Business database. The controls and authorisations for data entry are described in relation to the nature of the system in use.
- 2 The frequency of data collection is embedded in the local procedures and operations. There are quality checking/critical reviews using prescribed and agreed procedures and factors. Data collection and checking is incorporated in processes and procedures owned by the line
- 3 From the BU upward the data chain to Group, procedures for data management are consistent. The relevant line/HSE staff are familiar with these procedures.
- 4 There are data quality checkpoints in the procedures and these are applied in practice; such as: checks on historical trends and comparison of trends of related parameters. (Refer to the Critical Review Process (Appendix 7)
- 5 The HSE data focal points carry out final checks for completeness and quality of the data reported to them (e.g. through Critical Review) and evidence is recorded confirming consistency of data or explaining significant variance or unexpected trends.

#### Statement 4: Data conversions and calculations

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**Expectation:**

The methodologies used for deriving performance data (calculation, conversion, measurement) are in accordance with the Group PMR and any local deviations are documented.

**Checks:**

- 1 Conversion factors are clearly identified and their origin is documented in the local procedure (in particular, any conversion or calculation factors different from the default factors given in the PMR should be documented and be auditable as to their origin).
- 2 Conversion factors that have been developed on the basis of local conditions (e.g. measurements on equipment) are documented.
- 3 For spreadsheet systems: HSE and line data focal points check and provide assurance that conversion factors and calculations are correct (e.g. spreadsheets used in line departments are assessed in detail by HSE specialists and line focal points)
- 4 The contract holder or other Shell representative checks contractor-reporting systems for accuracy (e.g. for working hours, TRCF, energy use and CO<sub>2</sub> emissions).

#### Statement 5: Data review

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**Expectation:**

Data is checked and reviewed at various stages of the quarterly/annual data reporting process including a final management review before submission of aggregated data.

**Checks:**

- 1 A formal and documented Critical Review is carried out for each reporting period as defined in Appendix 7 of Group PMR).
- 2 The Critical Review is part of the HSE data reporting and is described in the BU/COB/Regional reporting procedure.
- 3 The Critical Review is carried out before management signs off and submits the data to BU management, the Business and Group.
- 4 There is documented evidence of review by appropriate management levels (including sign off by HSE managers))

**Statement 6: Data revisions**

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**Expectation:**

Errors, omissions or misstatements identified during the reporting and review process are addressed and corrected immediately; a process exists to control and document corrections as part of the overall data management and reporting procedure.

**Checks:**

- 1 There is a process to deal with correction of errors and omissions when identified after initial reporting and this process is applied and documented (audit trail).
- 2 There is an appropriate level for approval for significant/material data revisions and for reporting of these to the CoB/Business/Group.
- 3 The local procedures for data revisions follow PMR section 1.5 'Re-submission and Re-statement' in determining materiality of errors requiring formal data revisions and reporting.

**Statement 7: Data submission**

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**Expectation:**

Data submitted to CoB/Region/Business has been reviewed and signed off by appropriate management.

**Checks:**

- 1 Data accuracy and completeness have been reviewed before submission by qualified staff other than the HSE data focal points). The HSE manager is accountable for the review process.
- 2 There is documented evidence that management review (at the appropriate level) has taken place.
- 3 There is procedural guidance for the handling of data submissions (i.e. to prevent unauthorized not signed-off data being reported to the COB and Business).



## APPENDIX 7: HSE CRITICAL REVIEW PROCESS

The Critical Review process describes the steps that must be followed at the BU, CoB, Region and Business level to check the accuracy and completeness of the data. This process must be applied quarterly to HSE data listed below.

- Step 1: Predict or estimate the period results and explain your prediction (a prediction is defined as a target, estimate based on multiple trends, trend of previous data or same as last period if no change is anticipated).
- Step 2: Obtain actual data for the period and make sure the data are complete;
- Step 3: Compare the actual data for the period with your prediction. Check if the data looks reasonable when considering events that occurred during the period. If the actual is reasonable and varies less than 10% (5% for special circumstances<sup>1</sup>) from the prediction, then data may be reported with no explanation. If the actual data appears to be unreasonable and/or varies more than 10% from the prediction then the reasons for the variance must be explained.
- Step 4: Submit the data and if necessary an explanation of the variance from you prediction.

Critical Review is audited and must be documented. Spreadsheets for each period filled-out with the following headings and saved electronically will provide adequate documentation for the audit trail.

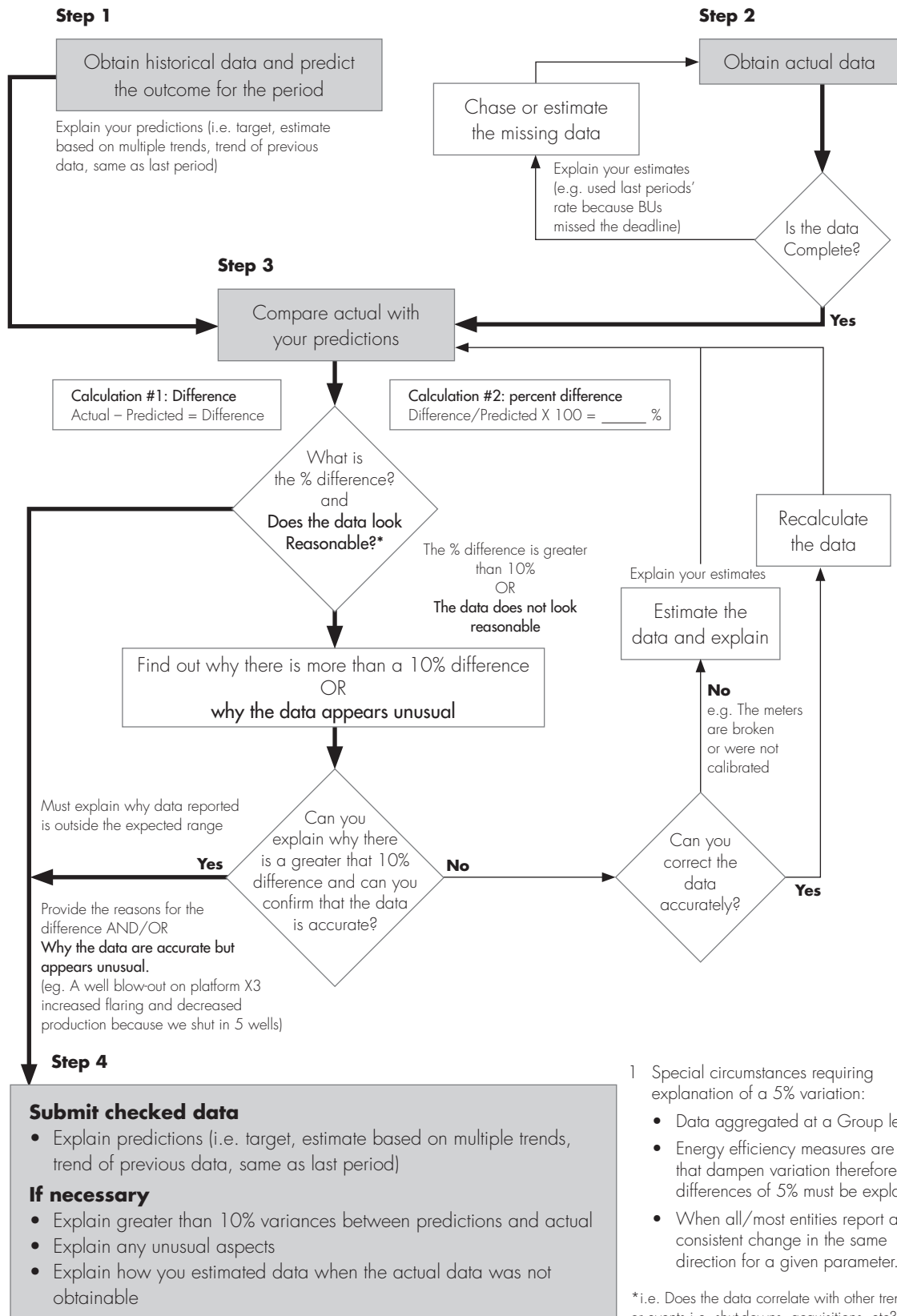
Parameter (Businesses)	Prior Period	Predicted outcome – estimated results	Actual Data	% difference between prediction and actual (variance)	Explanation of: variance greater than 10% (5%) <sup>1</sup> OR Accurate data that appears unusual	Explanation of prediction (i.e. target, past period, data trend etc.)
CHG						
CO <sub>2</sub>						
CH <sub>4</sub>						
Activity						
Energy Use						
Energy Efficiency						
Flaring (EP Only)						
Exposure Hours						
TRC <sup>2</sup>						

<sup>1</sup> Special circumstances requiring explanation of a 5% variation:

- Data aggregated at a Group level
- Energy Efficiency measures are ratios that dampen variation therefore differences of 5% must be explained.
- When all/most entities report a consistent change in the same direction for a given parameter.

<sup>2</sup> Variance review of TRCs shall be done at a statistically significant level in the organization (the OU for Exploration and Production and the Class of Business for Downstream except Manufacturing where variance review shall be done at the Refinery and Chemical Plants).

**Critical Review Process**



## APPENDIX 8: HSE FINANCIAL DATA DEFINITIONS

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Please also reference the reporting definitions included within the Group Financial Information Manual (GFIM) because the Finance definitions take precedence to the definitions abstracted below:

### HSE fines, penalties and compensation payments – current year (FIRST line 7369)

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**Definition:** Fines, penalties and compensation charged to the Profit and Loss in the current year, resulting from non-compliance with HSE regulations or caused by HSE incidents.

**Units:** Total amount paid (US \$).

**Scope:** Fines, penalties or other such assessments resulting from non-compliance with HSE regulations should be reported under this category.

Compensation is defined as amounts paid/payable to third parties as a result of alleged loss, injury or adverse health effects caused by past HSE incidents. These may be determined by judicial decree or by out-of-court settlements. All such costs recognised in the current year are to be included. Compensation examples include, but are not limited to the following:

- Payments for a spill on a third party premises
- Payments made for personal property damages that resulted from environmental incidents.
- Health related payments or settlements due to illness associated with chemical exposure (i.e. asbestos, benzene, etc.)
- Payments made for occupational health related injuries or illnesses (e.g., US workers compensation payments which should include the dollars paid for lost wages and medical treatment).
- Payments made for property damage caused by a collision, explosion or other unsafe acts.

**Method:** Liaise with the Area of Operation FIRST focal point to check that the data for line 7369 in the FIRST system is correctly allocated and that the totals are accurate and complete. A complete listing of FIRST focal points by Area of Operation can be found on the Group Controller's Web site:  
[http://swwhome.shell.com/corporate/finance/group\\_controller/](http://swwhome.shell.com/corporate/finance/group_controller/)

### Environmental Clean-up Obligations (reported through the finance line)

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Environmental Clean-up Obligations are defined by the financial policy C-76 which is concerned with environmental clean-up expenditure resulting from past operations. The complete policy can be found in the Group Financial Accounting Policies (GFAP) on the Corporate Finance web site:

[http://swwhome.shell.com/corporate/finance/group\\_controller/ias/ias\\_gfap/ias\\_gfap\\_home.html](http://swwhome.shell.com/corporate/finance/group_controller/ias/ias_gfap/ias_gfap_home.html).

This financial policy is based on International Accounting Standards: IAS 37 – Provisions, Contingent Liabilities and Contingent Assets. The C-76 policy is used to clarify the definitions of a number of financial lines in the Group accounts that relate to environmental liabilities (FIRST line 6740-6743 and 6750-6753) Included below is an abridged version of the C-76 policy followed by abridged definitions for FIRST lines 6740-6743 and 6750-6753.

### Financial Policy C-76 – Environmental Clean-up Obligations (an abridged summary)

The objective of the C-76 financial policy is to ensure that appropriate recognition criteria and measurement bases are applied to provisions, contingent liabilities and contingent assets and that sufficient information is disclosed in the notes to the financial statements to enable users to understand their nature, timing and amount. The following types of cost are considered “clean-up” costs for the purpose of this policy:

- 1) Costs of cleaning up existing soil and water pollution caused by spills, leaks, waste disposal or other means, and
- 2) Costs of fines and penalties assessed and damages awarded as a result of spills, leaks, waste disposal or other means in contravention of environmental protection regulations.

This policy does not deal with the types of expenditure listed in paragraph 3.5. Section C.72 (Provisions – Decommissioning and Site Restoration) covering the accounting for decommissioning and site restoration costs (mainly removal of structures on a site).

### Environmental Liabilities / Clean-up Obligations (abridged definitions)

Complete definitions for Environmental Liabilities can be downloaded from the Group Controllers Web site on the GFIM page – balance sheet line item definitions:

[http://swwhome.shell.com/corporate/finance/group\\_controller/ias/](http://swwhome.shell.com/corporate/finance/group_controller/ias/)

FIRST Line	Group Financial Information Manual (GFIM)
6740	<b>Environment Liability Long Term Opening Balance</b> represents outstanding environmental clean-up obligations exceeding 12 months of the balance sheet date.
6741	<b>Environment Liability Long Term Additions/Release</b> represents clean-up costs charged/credited to income which result in additions/reductions to outstanding environmental liabilities applicable to known periods exceeding 12 months of the balance sheet date. (mergers and acquisitions).
6742	<b>Environment Liability Long Term Other Moves</b> represents any other movement in outstanding environmental liabilities applicable to known periods exceeding 12 months of the balance sheet date.
6743	<b>Environment Liability Long Term Payments</b> represents decreases in outstanding environmental clean-up obligations resulting from the actual performance of environmental clean-up work.
6750	<b>Environment Liability Short Term Opening Balance</b> represents outstanding environmental clean-up obligations to known periods within 12 months of the balance sheet date.
6751	<b>Environment Liability Short Term Additions/Release</b> represents clean-up costs charged/credited to income which result in additions/reductions to outstanding environmental liabilities applicable to known periods within 12 months of the balance sheet date.
6752	<b>Environment Liability Short Term Other Moves</b> represents any other movement in outstanding environmental liabilities applicable to known periods within 12 months of the balance sheet date.
6753	<b>Environment Liability Short Term Payments</b> represents decreases in outstanding environmental clean-up obligations resulting from the actual performance of environmental clean-up work. within 12 months of the balance sheet date.







