ICC
Indian Chemical Council

Responsible Care®
OUR COMMITMENT TO SUSTAINABILITY

RESPONSIBLE CARE – KPI FILLING AND REPORTING

Introduction

Key Performance Indicator (KPI) is an important part of Responsible Care (RC) program by Environmental, Health, Safety, Security (EHS&S) and Resources performance monitoring and reporting.

The International Council of Chemical Associations (ICCA) is an association[1] of the global chemical industry coordinating the work of individuals from member associations and their member companies around the globe. ICCA represents chemical companies which account for more than 75% of the global production capacities.

ICCA is the steward of RC. It is a Global Chemical Industry's voluntary initiative to drive continuous improvement in safe chemical management and achieve excellence in environment, health, safety, and security (EHS&S) performance.

Responsible Care had been launched by the Chemistry Industry Association of Canada in 1985. At the 2006 International Conference on Chemicals Management, Responsible Care was extended through a Global Product Strategy and a Global Charter.

Every Responsible Care member of the Indian Chemical Council (ICC) annually provides metrics on environmental, health, safety and security (EHS&S) performance on operations within India. After aggregating with the rest of ICC RC Signatories Companies' data, ICC provides this data to the ICCA. By collecting aggregated metrics from associations worldwide, ICCA is able to communicate global industry performance and advancement to international stakeholders such as the United Nations, International Labor Organization, and others.

It is of utmost importance that associations report completely and accurately on an annual basis. In India, the RC Signatory Companies send performance metrics on EHS&S and Resources utilization to ICC, on annual (calendar year) basis, in a format prescribed[2,3] covering the following parameters. Apart from reporting, these KPIs must lead to specific actions for continual improvement.

All these core performance parameters can be broadly categorized into 4 Major groups:

a. Health & Safety Performance

1. Number of Fatalities (Own & Contractor Employees)
2. Lost Time Injuries Rate (Own & Contractor Employees)
3. Reportable Injury Rate (Own & Contractor Employees)
4. Process Safety Incidents
5. Transportation incidents

b. Environmental Performance

6. Hazardous Waste for Disposal
7. Sulphur Oxides (SOx)
8. Nitrogen Oxides (NOx)
9. Chemical Oxygen Demand (COD)
10. Carbon Dioxide (CO_2)
11. Other Greenhouse Gases

c. Resources Utilization

12. Energy Consumption
13. Water Consumption

d. Security Performance

14. Thefts/ damages to non-chemical items.
15. Thefts/ theft attempts, damages and misuse of chemicals.
16. Cyber-attack/ information leak

Estimation of these parameters is detailed as below.

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RC KPI Guideline

Health and Safety Performance

1. Number of Fatalities (Reported separately for Own Employees & Contractor Employees)

A fatality is an accident in the factory leading to death

- Expressed as number of fatalities within one year.
- Applies only to persons working within company premises.

2. Lost Time Injury Rate (Reported separately for Own Employees & Contractor Employees)

An accidental exposure which, according to opinion of the doctor indicates that the worker is unfit to perform his duty and that period is of minimum one day (but less than 48 hrs.)

- Frequency rate[4] = Number of lost time injuries per million working hours.
- Applies only to persons working within company premises.

The injuries include illness resulting from occupational health issues.

3. Reportable Injury Rate (Reported separately for Own Employees & Contractor Employees)

An accidental exposure which according to opinion of doctor indicates that the worker is unfit to perform his duty for at least 48 hours is Reportable Injury as per Factories Act.

- Frequency rate = Number of reportable injuries per million working hours.
- Applies only to persons working within company premises.

The injuries include illness resulting from occupational health issues.

4. Process Safety Incidents

Reporting of Process Safety Incident:

- The criteria that determine whether a process-related event qualifies as a process safety event or not depends on loss of primary containment of a chemical or a release of energy triggering any one of four impact areas:
  I. Safety/ human health consequences; OR
  II. Direct cost due to damage from incident; OR
  III. Community impact; OR
  IV. Chemical release quantity

- A process safety event has occurred when:
  a) A chemical substance or a chemical process is directly involved; AND
  b) The incident occurred is in production, distribution (i.e. transportation), storage, utility, pilot plant within the site boundaries of factory; AND
  c) There was a release of material or energy (e.g. fire, explosion, implosion) from a process unit; AND
  d) One or more of the following conditions have been met:

1. Safety / Injury

Injury resulting in a Reportable, Lost Time Accident or Fatality; or Hospital admission of anyone on or off site; **OR**

2. Direct Damage Cost

A fire, explosion or clean up necessary to avoid/remediate environmental damage resulting in a direct cost equal to or greater than Rs. 1,50,000 ($2,500 USDs); **OR**

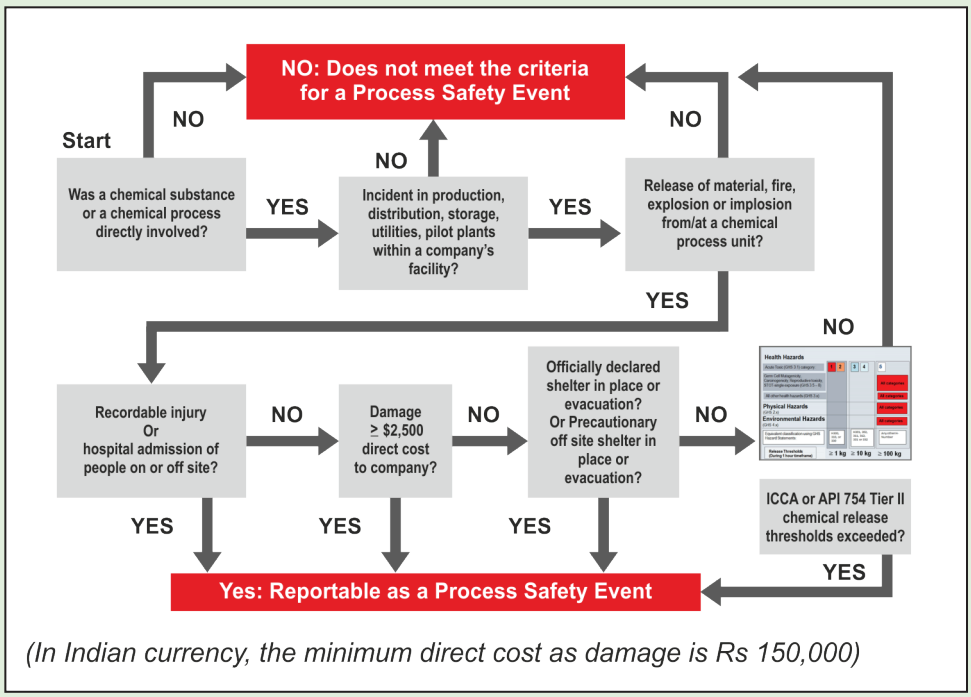
3. Shelter in Place / Evacuation

- An officially declared shelter in place (on or off site); **OR**
- An officially declared evacuation (on or off site); **OR**
- A precautionary off-site shelter in place or evacuation **OR**

4. Threshold Release

The material released meets one of the GHS thresholds in **Table 1**. (Measured in amount released during one hour).

The following flowchart[5] also explains when a process safety event has occurred.



(In Indian currency, the minimum direct cost as damage is Rs 150,000)

Table-1 (GHS Thresholds):

Health Hazards					
Acute Toxic (GHS 3.1) category	1	2	3	4	5
Germ Cell Mutagenicity, Carcinogenicity, Reproductive toxicity, STOT-single exposure (GHS 3.5-8)					All categories
All other health hazards (GHS 3 x)					All categories
Physical Hazards (GHS 2 x)					All categories
Environmental Hazards (GHS 4 x)					All categories
Equivalent classification using GHS Hazard Statements:	H 300, 310, or 330		H 301, 302, 311, 312 331 or 332		Any other H - Number
Release Thresholds (During 1 hour timeframe)	≥ 1 kg		≥ 10 kg		≥ 100 kg

If material released (during one hour) meets one of GHS thresholds[6] as above or the API 754 Tier II threshold[7].

- Annual reporting of process safety incidents is done based on Process Safety Event Rate (PSER). It is ratio of:
  a) Total Number of Process Safety Events.
  b) Total Number of working Hours (own employee and contractor) normalized to 100 employees (each employee works 2,000 hours/Yr.).

$$\text{Process Safety Event Rate (PSER)} = \frac{\text{Total Process Safety Events}}{\text{Total Working Hours}} \times 200{,}000$$

5. Transportation incidents

These are incidents taking place during transportation of chemicals expressed as : Number of incidents / million Tons transported.

Incidents meeting at least one of the following criteria are considered (according to ADR 2015 files[8]):

Death/ Injury

An occurrence where the injury:
- Requires intensive medical treatment,
- Requires a stay in hospital of at least one day, or
- Results in the inability to work for at least three consecutive days.

This is irrespective of whether or not the chemical product contributed to the death and/or injury.

Spill/Leak

Loss of product i.e. release of dangerous goods
- of transport category 0 or 1 in quantities of 50 kg / 50 L or more,
- of transport category 2 in quantities of 333 kg / 333 L or more, or
- of transport category 3 or 4 in quantities of 1000 kg / 1000 L or more.

(The transport categories detailed in Annexure-1)

Property Damage

Material damage or environmental damage exceeding Rs 50 lacs through release of dangerous goods. *(Damage to vehicle containing dangerous goods and to the modal infrastructure shall not be taken into account)*

Public Disruption

Direct involvement of authorities and/or emergency services in the incident involving dangerous goods, evacuation of people, closure of public traffic routes for at least 3 hours.

The transportation is through "In-transit" transport (air/ rail/ road/ sea/ inland waterway/ pipeline) of chemicals between the site of a supplier company and that of final customer.

The place of incidents includes transport and off-site loading/ unloading at ports, airports, warehouses, etc. and excludes transport and loading/ unloading activities at the premises of supplying chemical company and final customer.

5.1 Chemicals transported:

- All chemicals "owned" by the reporting chemical company are considered here.
- They include not only finished products, but also raw materials whether or not classified as hazardous according to the UN Recommendations for the Transport of Dangerous Goods.
- It is the quantity of chemicals transported expressed in million tons.

5.2 Chemicals Produced:

- It is the total quantity of chemicals produced which are marketable and expressed in million tons.
- This number is used for estimating
  i. specific consumption of energy & water and
  ii. various emissions per ton of production

Environmental Performance

6. Hazardous Waste for Disposal

Hazardous waste generation and disposal data as reported to the respective state pollution control board (The hazardous waste identified as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016)[9].

- Hazardous waste expressed as
  a. Tons of waste
  b. Kg / Ton of Production
- Reporting of SOx, NOx & COD done separately.

7. Sulphur Oxides (SOx)

Airborne emission of Sulphur and its compounds formed during combustion, production or treatment processes.

- Comprises SO_2 and SO_3 and is expressed as
  a. tons of SO_2.
  b. Kg SO_2/ Ton of Production

SOx may be estimated either from Sulphur content in the fuels used or from the stack gases' analysis.

8. Nitrogen Oxides (NOx)

Airborne emissions of compounds of nitrogen and oxygen from combustion, production or treatment processes.

- Comprises NO and NO_2 and is expressed as
  a. tons of NO_2.
  b. Kg NO_2/ Ton of Production

NOx is known to be formed from nitrogen content in the fuels (called Fuel NOx) and from oxidation of nitrogen in atmospheric air (called Thermal NOx). The kinetics in both the cases are quite complex and the stack gases' analysis gives a fair picture of total NOx generated.

9. Chemical Oxygen Demand (COD)

Amount of oxygen required for chemical oxidation of compounds in water, as determined using a strong oxidant (most standard methods use dichromate).

- To account for COD released to environment at the end of treatment process (expressed as tons of oxygen).
  - Nil in case of ZLD.
  - If wastewater is treated at a shared third-party unit and cannot obtain individual data, the efficiency factor of the wastewater treatment unit should be taken into consideration when calculating the amount.

COD=COD Discharged to External ETP (CETP)×Efficiency Factor of External ETP (CETP)

- COD is expressed as
  c. tons of O_2.
  d. Kg O_2/ Ton of Production

10. Carbon Dioxide (CO_2)

The contribution to CO_2 emissions by the chemical industry is from

- The combustion of fuels both directly and indirectly associated with the usage of electricity, steam, and process heating.
- Certain chemical processes which generate CO_2 as a byproduct. Also, credit is given for capturing and utilizing CO_2

10.1 Direct Carbon Dioxide (CO_2) emissions

- Tons of CO_2-equivalent of solid, liquid and gaseous fuels used for energy use and for generation of self-produced electricity (by multiplying the amount by corresponding CO_2-emission factors[10] in Table-1).

- Tons of CO_2 generated in a process as a byproduct. (e.g. some of oxidation processes)
- CO_2 captured and utilized in-house or exported to other users proposed to be deducted while estimating net emissions.

Net Direct CO_2 Emissions = **CO_2 Emissions from all Fuels** + **CO_2 Emissions from Process** - **CO_2 Captured for use**

- CO_2 generated from bio/ renewable sources is to be estimated but reported separately for reference[11,12] as per IPCC guidelines. Similarly, CO_2 generated in a process from raw materials of bio/ renewable nature is also to be reported separately.

10.2 Indirect Carbon Dioxide (CO_2) emissions

Indirect emissions are from energy purchased (e.g. net purchased electricity and steam).

- From Steam Purchased:
  Tons of CO_2 equivalent of Steam purchased:

  ⏩ The steps involved are

  a. Steam quantity is converted to Tons of Oil equivalent (toe).
  = (Steam, Tons) X (Fuel used, tones per ton of steam) X (Calorific value of fuel)/ 10000 The toe value depends mostly on the steam generation efficiency.
  At a generation efficiency of 85%, a default value of 0.082 toe/ ton of steam may be used.

  b. The toe is converted[18] to energy in GJ
  (1 toe = 41.868 GJ)

  c. The energy (GJ) is multiplied by the emission factors (Table-1) to estimate CO_2 emissions.

- From Net electricity purchased:

  Tons of CO_2-equivalent of net purchased electricity (by multiplication of the amount by average factor of CO_2 emissions per kwh)

  ⏩ To get CO_2 per kwh factor from the electricity supplier based on fuel mix and proportion of renewable energy component in the supply.

  A default value (Indian Power Sector)[13] of 0.82 tons CO_2/ MWh (i.e. 228 Kg CO_2/ GJ) may be used. Similar values are observed in other references[14,15,16]

  ⏩ *Energy* generation by Atomic, hydro, solar, wind, biomass is CO_2 neutral and should not be added.

  Net purchased electricity = Purchased electricity – Exported electricity.

All the CO_2 emissions are also expressed as Kg CO_2/ Ton of Production

Table-2 (CO_2-emission factors[10,20])

Fuel	Carbon Emission Factor (Kg CO_2/GJ)	Fuel	Carbon Emission Factor (Kg CO_2/GJ)
Crude Oil	73.3	Steam Coal	98.3
Motor Gasoline	69.3	Coking Coal	94.6
Kerosene	71.9	Lignite	101.0
Light Diesel Oil	74.1	Sub Bituminous Coal	96.1
Furnace Oil	77.4	Peat	106.0
LSHS	73.3	Coke	107.0
HSD	74.1	Natural Gas (Dry)	56.1
Residual Fuel Oil	77.4	Natural Gas Liquids	64.2
Bitumen/ Coal Tar	80.7	LPG	63.1
Lubricants	73.3		

11. Other Greenhouse Gases (GHGs)

The other GHGs (i.e. CH_4, N_2O, HFCs, PFCs and SF_6) expressed as equivalent CO_2 corresponding to their Global warming Potential.

As listed in the Kyoto Protocol, the other GHGs and corresponding Global Warming Potentials are (Table-2):

	GHG	GWP*
	CO_2	1
i	Methane (CH_4)	28
ii	Nitrous Oxide (N_2O)	265
iii	Hydrofluorocarbons (HFCs)	97-12000
iv	Perfluorocarbons (PFCs)	5700-11900
v	Sulphur hexafluoride (SF_6)	23500

**Based on effects of GHGs over a 100-year time horizon (IPCC). Values revised for CH_4, N_2O and SF_6 based on IPCC Fifth Assessment Report[17], 2014 (AR5)*

The emissions of these GHGs depend on many factors like

- Type of industry/ processes
- Type of fuels used
- No. and type of electrical and refrigeration equipment used.

and are, in general, estimated through mass balance and/ or measuring their content in emissions.

Methane, N_2O:

Methane emissions are from anaerobic processes and incomplete combustion esp. of biomass. One important source of N_2O emissions in industries is from the burning of biomass. In case of stationary combustion of various fuels, default values for emission factors of these GHGs may be obtained from the reference[20] given.

HFCs, PFCs & SF_6:

PFCs are used for dielectric applications (e.g. transformer oil etc.), semiconductor manufacturing and in formulation of the electronic cooling liquid/ insulator. HFCs are used as refrigerants. SF_6 is used as an insulation medium in circuit breakers. The releases of these GHGs are estimated through mass balance from

- Quantities procured directly and through equipment containing them.
- Difference in inventories (beginning and end of the year)
- Quantities sold (esp. through equipment containing them)

Quantities of these GHGs that cannot be accounted for are also assumed to have been emitted to the atmosphere.

Impact of release of all these GHGs on Climate Change is calculated (as tons of CO_2-equivalents) by multiplying the tons released per year by its GWP relative to carbon dioxide. It is expressed as

a. tons of other GHGs (as eq. CO_2)
b. Kg eq CO_2/ Ton of Production

Resources

12. Energy Consumption

Net energy consumption expressed as tons of fuel oil equivalent (toe). It is the sum of

- Fossil fuels i.e. Coal, Low Sulphur Heavy Stock (LSHS), Furnace Oil (FO), High Speed Diesel (HSD), Gases (LNG, CNG etc.).
- Plant residue/ waste streams,
- Renewable fuels like biogas, biomass etc.
- Purchased Steam
- Electricity (the result of purchased electricity plus self-produced renewable electricity* minus electricity exported/ sold to the network).

Total Use of Energy	=	Use of all Fuels (fossil, waste streams, residues, biogas, etc.)	+	Self-produced Renewable Energy	+	Purchased Energy	–	Exported Energy

* Self-produced renewable electricity (or energy) includes inhouse generation of solar/ wind electricity etc.

The conversion factors for converting to toe are

- **Fuels[18]:**
  1 toe = 41.868 gigajoules (GJ) or 1 GJ = 0.023885 toe = 2.3885^{-05} ktoe
- **Electricity:**
  1 toe = 11.63 MWh or 1 MWh = 0.085985 toe (theoretical[14])
  With a typical generation efficiency[19,21] of 40%, the default values may be taken as
  1 MWh = 0.21496 toe or 1 GWh = 214.96 toe

  However, if more accurate information on overall generation efficiencies or toe is available from the electricity suppliers, those numbers should be used to estimate toe.
- **Purchased Steam:**
  Converted to toe as described under "CO_2 emissions"

  The net energy consumption is expressed as
  a. Million toe/ year
  b. toe/ Ton of Production

13. Water Consumption

Information on water balance comprising of intake from different sources, return to nature and consumption by different users.

The water balance (in cubic meters) is provided as below.

- Input water from different sources:
  a. Continental water i.e.
     i. Direct Surface Water (river, lake etc.),
     ii. Plant-operated Well or Ground Water and
     iii. Public supply Water
  b. Sea Water
  c. Others (e.g. Rainwater)
- Return of water to nature i.e. Return to
  a. Surface water after treating to specific discharge standards (e.g. discharge to river/ sea where allowed), Note: Effluents to CETP are also added here as they are eventually discharged to surface water/ other uses after treatment.
  b. Ground water (where allowed) and
  c. Purchased water sources/ Public supply.
- Net water consumption = Input water – Return water
  Net water consumption is also expressed as
  a. Million Cu. Meters
  b. Cu. Meters water per ton of Production.

Data generated is compared with the water consumption in different manner/ areas i.e.
a. Cooling water (make-up)
b. Process water
c. Domestic (includes water used for drinking, sanitary purpose, irrigation of green belt, horticulture etc.)

Security Performance

Security incidents concerning the items directly related to production, R&D facilities and warehouse are to be reported as categorized below.

14. Thefts/ damages to non-chemical items.

Thefts/ intentional damages to non-chemical itemsare to be reported.
To report briefly:

- Items subjected to theft or intentional damage.
- Value loss in Rs.
- Whether FIR was filed (Yes or No).

The cases are to be reported only when the loss is Rs 25000/- or more in this category.

15. Thefts/ theft attempts, damages and misuse of chemicals.

Theft/ theft attempt, subsequent misuse and intentional release of or sabotage to chemicals are to be reported.
To report briefly:

- Chemicals subjected to theft/ theft attempt, subsequent misuse, and intentional release of chemicals or sabotage.
- Whether FIR was filed (Yes or No).

16. Cyber-attack/ information leak

Cyber-attack/ information leaks are to be reported.
To report briefly:

- Cyber-attacks/ Software affected.
- Information lost/ leaked or Copyright violations.
- Whether FIR was filed (Yes or No).

The IT/ Computer hardware items not carrying any sensitive/ confidential information are to be categorized as 'non-chemical items.'

Additional information desired:

Apart from providing this information, it is desirable to

- Provide yearly trends of these data.
- Set goals for each of these parameters and compare the actual data against these goals
- Highlight achievements
- Further/ specific steps being taken to improve these numbers.

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Annexure -1[8]

Transport Category (1)	Substances or articles packing group or classification code/group or UN No. (2)	Maximum total quantity per transport unit in kg (3)
0	Class 1: 1.1A/1.1L/1.2L/1.3L/1.4L and UN No. 0190 0 Class 3: UN No. 3343 Class 4.2: Substances belonging to packing group I Class 4.3: UN Nos. 1183, 1242, 1295, 1340, 1390, 1403, 1928, 2813, 2965, 2968, 2988, 3129, 3130, 3131, 3134, 3148 and 3207 Class 6.1: UN Nos. 1051, 1613, 1614 and 3294 Class 6.2: UN Nos. 2814 and 2900 (risk groups 3 and 4) Class 7: UN Nos. 2912 to 2919, 2977, 2978 and 3321 to 3333 Class 9: UN Nos. 2315, 3151, 3152 and equipment containing such substances or mixtures and empty uncleaned packagings having contained substances classified in this transport category	0
1	Substances and articles belonging to packing group I and not classified in transport category 0 and substances and articles of the following classes: 20 Class 1: 1.1B to 1.1J a /1.2B to 1.2J/1.3C/1.3G/1.3H/1.3J/1.5Da Class 2: groups T, TC[a], TO, TF, TOC and TFC aerosols: groups C, CO, FC, T, TF, TC, TO, TFC and TOC Class 4.1: UN Nos. 3221 to 3224 and 3231 to 3240 Class 5.2: UN Nos. 3101 to 3104 and 3111 to 3120	20
2	Substances or articles belonging to packing group II and not classified in transport categories 0, 1 or 4 and substances of the following classes: 333 Class 1: 1.4B to 1.4G and 1.6N Class 2: group F aerosols: group F Class 4.1: UN Nos. 3225 to 3230 Class 5.2: UN Nos. 3105 to 3110 Class 6.1: substances and articles belonging to packing group III Class 6.2: UN Nos. 2814 and 2900 (risk group 2) Class 9: UN No. 3245	333
3	Substances and articles belonging to packing group III and not classified in transport categories 0, 2 or 4 and substances and articles of the following classes:1000 Class 2: groups A and O aerosols: groups A and O Class 8: UN Nos. 2794, 2795, 2800 and 3028 Class 9: UN Nos. 2990 and 3072	1000
4	Class 1: 1.4S unlimited Class 4.1: UN Nos. 1331,1345,1944,1945,2254 and 2623 Class 4.2: UN Nos. 1361 and 1362 packing group III Class 7: UN Nos. 2908 to 2911 Class 9: UN No. 3268 and empty, uncleaned packagings having contained dangerous goods, except for those classified in transport category 0	Unlimited

[a]For UN Nos. 0081, 0082, 0084, 0241, 0331, 0332, 0482, 1005 and 1017, the total maximum quantity per transport unit shall be 50 kg.

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