

Hydrogen Producer Reporting Guidance for California's Mandatory Greenhouse Gas Reporting Regulation

Introduction

This document provides guidance to California hydrogen producers for the reporting required by the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions (title 17, California Code of Regulations, section 95100 *et seq.*) (MRR), including information on changes to MRR for hydrogen producers and instructions on submitting production and emissions data in Subpart P of the California Electronic Greenhouse Gas Reporting Tool (Cal e-GGRT). This guidance applies to 2014 data reported in 2015 for both merchant hydrogen plants and refineries that produce hydrogen.

For additional information about product data reporting, including the requirement to exclude inaccurate product data, the use of financial transaction meters, how product data are evaluated during verification for accuracy and conformance with the regulation, and other topics, please refer to the [General Product Data Reporting Guidance](#) document.

This guidance document describes the requirements of MRR. This guidance document does not, and cannot, create or vary any legal requirements of MRR.

Summary of MRR Changes for Hydrogen Producers for Data Year 2014

- For 2014 data reported in 2015, operators may no longer use best available methods for reporting any data pursuant to MRR section 95114.
- Reporters must report the molecular hydrogen (H₂) content of all feedstocks used to produce hydrogen (section 95114(e)).
- Operators must identify the purchaser (or receiver) of all gaseous and liquid hydrogen sold or transferred off-site, and must report the annual mass of hydrogen sold or transferred to each entity (section 95114(j)).

These changes, specific reporting guidance, and the entry of data into Subpart P of Cal e-GGRT are discussed in detail below.

1 Definitions and General Reporting

Section 95102(b) of MRR defines by-product hydrogen gas, liquid hydrogen, and on-purpose hydrogen gas as follows:

“By-product hydrogen gas’ means pure hydrogen gas produced as a result of a process or processes dedicated to producing other products (e.g. catalytic reforming).”

“Liquid Hydrogen’ means hydrogen in a liquid state.”

“On-purpose hydrogen gas’ means pure molecular hydrogen gas produced by a process or processes dedicated to producing hydrogen (e.g., steam methane reforming).”

Because the reported annual masses of on-purpose hydrogen gas produced and liquid hydrogen sold are used to allocate allowances in the Cap-and-Trade Regulation, these values are covered product data and are subject to material misstatement assessment during the verification process. Reporting the annual mass of by-product hydrogen gas produced is required, but these data are not covered product data and are not subject to material misstatement assessment.

On-purpose hydrogen gas production and liquid hydrogen production are classified by the North American Industrial Classification System (NAICS) as Industrial Gas Manufacturing (NAICS 325120). Facility operators must report this NAICS code in the general facility information reporting in Subpart A of Cal e-GGRT to qualify for allowance allocation for hydrogen production under the Cap-and-Trade Program. Petroleum refineries that also produce hydrogen must report the code for Industrial Gas Manufacturing as a secondary NAICS code in Subpart A.

2 Details for Reporting Product Data

This section provides details for reporting product data and other data in the “Other Facility Reporting Information” section of Subpart P within Cal e-GGRT. Figure 1 shows the input screen for entering facility-level data into Subpart P of Cal e-GGRT.

2.1 Annual Mass of On-Purpose Hydrogen Gas Produced

Section 95114(j) of MRR requires facility operators to report the annual mass (metric tons) of on-purpose hydrogen gas produced. This mass produced must be reported in the “Annual mass of on-purpose hydrogen gas produced (covered product data)” field in the facility level of Subpart P in the Cal e-GGRT reporting tool shown in Figure 1. The reported mass of on-purpose hydrogen gas must reflect actual on-site production, not sales.

Molecular hydrogen (H₂) in the feedstock to the hydrogen production unit (e.g., steam methane reformer) that passed through the production unit should be included in the annual mass of on-purpose hydrogen gas produced, but any molecular hydrogen sent to the hydrogen purification unit after bypassing the hydrogen production unit must be excluded. Chemicals other than molecular hydrogen (i.e., impurities, such as CH₄ or steam) also must be excluded from the reported annual mass of on-purpose hydrogen gas produced. Any produced hydrogen gas that is later used to make liquid hydrogen must also be excluded from the annual mass of on-purpose hydrogen gas produced.

Figure 1. Input screen for the Cal e-GGRT Subpart P “Other Facility Reporting Information” section.

Section 95114 (Subpart P): Hydrogen Production (2014)

[Subpart Overview](#) » [Other Facility Reporting Info](#)

SUBPART P OTHER INFORMATION
Please complete the required information included below.

Is the hydrogen plant part of an integrated refinery operation? Yes No

Annual mass of on-purpose hydrogen gas produced (covered product data)* (metric tons)
* On-purpose hydrogen means the total amount of molecular hydrogen (H₂) contained in the product stream coming from a process or processes dedicated to producing hydrogen (e.g., steam methane reforming).

Annual mass of by-product hydrogen gas produced (metric tons)

Annual mass of liquid hydrogen sold (covered product data) (metric tons)

Hydrogen Sold or Otherwise Transferred to Another Facility [95114(j)]

Purchaser or Receiver of Hydrogen	ARB ID (if available)	Annual Quantity of Gaseous or Liquid Hydrogen Sold or Transferred (MT)
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>

[+ Add a row](#)

2.2 Annual Mass of By-Product Hydrogen Gas Produced

Section 95114(j) of MRR requires facility operators to report the annual mass (metric tons) of by-product hydrogen gas produced. This mass produced must be calculated and reported in the “Annual mass of by-product hydrogen gas produced” field in the facility level of the Cal e-GGRT Subpart P reporting tool shown in Figure 1. The reported mass must be pure molecular hydrogen gas (H₂), and chemicals other than molecular hydrogen (i.e., impurities, such as CH₄ or steam) must be excluded.

2.3 Annual Mass of Liquid Hydrogen Sold

The annual mass of liquid hydrogen sold to other entities must be reported in the “Annual mass of liquid hydrogen sold (covered product data)” field in the facility level of Subpart P in the Cal e-GGRT reporting tool. The reported mass of liquid hydrogen sold may be determined directly from annual sales records.

2.4 All Hydrogen Sold or Transferred to Another Facility

Beginning with 2014 data reported in 2015, facility operators must report the annual mass (metric tons) of all gaseous and liquid hydrogen sold or otherwise transferred to another facility pursuant to section 95114(j) of MRR. The operator must enter the purchaser (or receiver) of the hydrogen and the annual mass of hydrogen sold or transferred to each purchaser or receiver in the “Hydrogen Sold or Otherwise Transferred to Another Facility [95114(j)]” field in the facility level of Subpart P in the Cal e-GGRT reporting tool. The reported masses may be determined directly from annual sales records.

3 Details for Reporting Emissions Data

This section provides guidance on the emissions data reporting required for hydrogen producers pursuant to section 95114 of MRR. Additional requirements in section 95123 that pertain to hydrogen producers that supply carbon dioxide are also discussed.

3.1 CO₂ Captured and Transferred Off-Site

Section 95123 of MRR requires facilities that transfer more than 10,000 MT CO₂e off-site to report emissions as CO₂ suppliers. Hydrogen production facilities which capture CO₂ and transfer it off-site must report these emissions as specified in section 95123. The annual mass of CO₂ transferred off-site must be reported in the “Annual mass of all CO₂ captured, transferred off-site, and reported by the hydrogen production facility as a supplier of CO₂ as described in section 95114(i)” field in the facility level of Subpart P in the Cal e-GGRT reporting tool shown in Figure 2. This facility-level mass of CO₂ captured and transferred off-site should equal the sum of the unit-level masses of CO₂ captured and transferred off-site. The mass of CO₂ captured and transferred off-site at the unit level is reported as a contribution to the S Factor in the Equation P-1 unit-level reporting spreadsheets (see section 3.5). The S Factor may also include the mass of CO₂ emissions reported elsewhere. The mass of CO₂ captured and transferred off-site

reported here should not be subtracted from the facility-level emissions; that subtraction is done using the S Factor when reporting unit-level emissions.

Note that the sum of the facility-level mass of CO₂ captured and transferred off-site and the facility-level mass of CO₂ emissions reported elsewhere (section 3.3) should equal the sum of all S Factors reported at the unit level (section 3.5). This internal data check may be part of the verification process.

3.2 Transferred Carbon other than CO₂

The annual mass of carbon other than CO₂ that is transferred off-site in gas, liquid, or solid form must be reported in the data field "Annual quantity of carbon, other than CO₂, collected and transferred off site in either gas, liquid or solid forms" that can be seen in Figure 2. This requirement is included in Title 40, Code of Federal Regulation, section 98.166(d) of the U.S. EPA reporting rule, which is incorporated by MRR in the initial paragraph of section 95114.

3.3 CO₂ and CH₄ Emissions Reported Elsewhere

The facility-level annual mass of CO₂ and CH₄ emissions that are calculated for hydrogen production activities and also reported pursuant to other sections of MRR using other methods (*e.g.*, stationary fuel combustion methods in Subpart C) must be reported into the data fields "Amount of carbon dioxide calculated and reported using other methods in the regulation [95114(g)]" and "Amount of methane calculated and reported using other methods in the regulation [95114(g)]" seen in Figure 2, respectively. Because these emissions are reported elsewhere within Cal e-GGRT, they are excluded from the hydrogen facility emissions reported in Subpart P. The facility-level mass of CO₂ emissions that is calculated for hydrogen production activities and also reported elsewhere should equal the sum of the unit-level masses of CO₂ emissions that are calculated for hydrogen production activities and also reported elsewhere. The mass of CO₂ reported elsewhere at the unit level is reported as a contribution to the S Factor in the Equation P-1 unit-level reporting spreadsheets (see section 3.5 of this document). The S Factor may also include the mass of CO₂ captured and transferred off-site.

The mass of CO₂ reported elsewhere that is entered here should not be subtracted from the facility-level emissions; that subtraction is done using the S Factor when reporting unit-level emissions. The mass of CH₄ reported elsewhere that is entered here should equal the mass that is excluded when reporting CH₄ emissions pursuant to section 95114(k) (see section 3.6). Note that if a CEMS and/or mass balance approach is used to calculate emissions from a hydrogen production unit, operators must ensure that emissions are not reported twice in Cal e-GGRT.

Note that the sum of the facility-level mass of CO₂ emissions reported elsewhere and the facility-level mass of CO₂ captured and transferred off-site (section 3.1) should equal the sum of all S Factors reported at the unit level (section 3.5). This internal data check may be part of the verification process.

Figure 2. Input screen for Cal e-GGRT Subpart P “Other facility reporting information” section at the facility level.

Hydrogen Sold or Otherwise Transferred to Another Facility [95114(j)]		
Purchaser or Receiver of Hydrogen	ARB ID (if available)	Annual Quantity of Gaseous or Liquid Hydrogen Sold or Transferred (MT)
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
+ Add a row		
Annual mass of all CO ₂ captured, transferred off-site, and reported by the hydrogen production facility as a supplier of CO ₂ as described in section 95114(i)	<input type="text"/>	(metric tons)
Annual quantity of carbon, other than CO ₂ , collected and transferred off site in either gas, liquid or solid forms	<input type="text"/>	(kg carbon)
Amount of carbon dioxide calculated and reported using other methods in the regulation [95114(g)]	<input type="text"/>	(metric tons)
Amount of methane calculated and reported using other methods in the regulation [95114(g)]	<input type="text"/>	(metric tons)

An example of the need to avoid double counting is CO₂ and CH₄ in a waste stream from a hydrogen production unit (e.g., an off-gas stream from a pressure swing absorption (PSA) unit). The CO₂ and CH₄ would have been calculated as emissions from the hydrogen production unit by Equation P-1, but the CO₂ and CH₄ would also be calculated and reported as flaring or other combustion emissions within Subpart C of Cal e-GGRT. Because these emissions actually occur through flaring or other combustion, they must be reported there and subtracted from the hydrogen facility emissions by reporting them as part of the S Factor in the Equation P-1 unit-level reporting spreadsheets.

3.4 Atomic Carbon Content, Atomic Hydrogen Content, Molecular Hydrogen Content, and Molecular Weight of Feedstocks and Fuels

The atomic carbon content, atomic hydrogen content, molecular hydrogen content, and molecular weight of all feedstocks to a hydrogen production unit must be reported pursuant to sections 95114(e)(1) and 95114(e)(2). Figure 3 shows a screen shot of the Equation P-1 reporting spreadsheet used for calculating emissions from a hydrogen production unit with gaseous feedstocks. For each feedstock to a hydrogen production unit, the atomic carbon content, atomic hydrogen content, and molecular hydrogen content must be reported in the appropriate column of the Equation P-1 spreadsheet for each month of the year. Pipeline quality natural gas from a utility may be assumed to have a molecular hydrogen content equal to zero.

Emissions from fuel combustion in a hydrogen production unit are also calculated using the Equation P-1 spreadsheet. For each fuel combusted in a hydrogen production unit, the atomic carbon content and molecular weight must be reported in the appropriate column of the Equation P-1 spreadsheet for each month of the year pursuant to section 95114(e)(2). Multiple Equation P-1 spreadsheets may be completed for each hydrogen production unit; for example, one may be used to report process emissions from feedstock use, and another may be used to report emissions from fuels combustion. When using the Equation P-1 spreadsheet for fuel combustion emissions, the atomic hydrogen and molecular hydrogen contents of fuels need not be reported. The spreadsheets for Equations P-2 and P-3, used for liquid and solid fuels, respectively, are similar to the Equation P-1 spreadsheet, and all of the spreadsheets are available at the [Cal e-GGRT Calculation Spreadsheet Instructions](#) website.

The atomic carbon content of the hydrogen production unit feedstock means the monthly weighted average mass fraction of carbon atoms in the total feedstock introduced to the hydrogen production unit. This includes carbon atoms which are part of molecules such as CH_4 or CO_2 that are contained in the feedstock. Similarly, the atomic hydrogen content of a feedstock means the monthly average mass fraction of hydrogen atoms in the total feedstock introduced to the hydrogen production unit. This includes hydrogen atoms that are part of molecular hydrogen (H_2) contained in the feedstock, but it excludes hydrogen atoms in steam (H_2O). Steam is not considered to be a hydrogen production unit feedstock in these calculations.

The monthly average molecular hydrogen content of the total feedstock to the hydrogen production unit must also be reported each month. The molecular hydrogen content of a feedstock means the monthly average mass fraction of hydrogen molecules (H_2) in the total feedstock introduced to the hydrogen production unit.

For operators with CEMS on the hydrogen production unit, the Equation P-1, P-2, or P-3 spreadsheets are not required for estimating CO_2 emissions. However, the appropriate Equation P-1, P-2, or P-3 spreadsheet(s) must be uploaded to Subpart A of Cal e-GGRT under "Additional Attachments" to report the required monthly average atomic carbon content, atomic hydrogen content, molecular hydrogen content, and molecular weight of each feedstock.

Figure 3. Equation P-1 reporting spreadsheet used for calculating emissions from a hydrogen production unit with gaseous feedstocks.

	A	B	C	D	E	F
1	Subpart P - Hydrogen Production - Calculating CO₂ Emissions Using Equation P-1					
2	<i>See the DATA EXPORT GUIDANCE tab for instructions on exporting your data in XML format.</i>					
3	Version:	Cal-e-GGRT V2014.R.0				
4	Today's date:	1/13/2015				
6	Equation P-1	$CO_2 = \left(\sum_{n=1}^n \frac{44}{12} * F_{dstrk_n} * CC_n * \frac{MW_n}{MVC} \right) * 0.001$				
10	General Information					
11	Facility Name:					
12	Reporter Name:					
13	Unit Name/ID:					
14	Reporting Period:					
15	Comments:					
16	Unit Type:	Hydrogen Production Process Unit				
17	Input Data					
	Month	F_{dstrk,n} Volume of gaseous fuel or feedstock used in month n (scf ³)	CC_n Average carbon content of gaseous fuel or feedstock during month n ¹ (kg C / kg of fuel or feedstock)	MW_n Average molecular weight of the gaseous fuel or feedstock during month n ² (kg / kg-mole)	Average atomic hydrogen content of the gaseous feedstock, excluding hydrogen atoms in steam, during month n³ (kg H / kg of feedstock)	Average molecular hydrogen content of the gaseous feedstock during month n³ (kg H ₂ / kg of feedstock)
19	January					
20	February					
21	March					
22	April					
23	May					
24	June					
25	July					
26	August					
27	September					
28	October					
29	November					
30	December					
32	¹ Standard conditions are 68 °F and one atmosphere.					
33	² Determined from the results of one or more analyzers for each month.					
35	Constants					
36	[MVC] - Molar volume conversion factor at standard conditions (scf/kg-mole)	643.5				
37	[44/12] - Ratio of CO ₂ molecular weight to carbon molecular weight (kg CO ₂ /kg C)	44/12				
38	[0.001] - Conversion factor (metric tons/kg)	0.001				
40	S Factor					
41	S Factor: Mass of CO ₂ emissions reported elsewhere and/or mass of CO ₂ captured and transferred off-site (metric tons)					
43	Annual CO₂ Emissions (metric tons) from Equation P-1					
44	[CO₂] - Annual CO ₂ emissions from fuel and feedstock consumption (metric tons)	0.00000				

3.5 S Factor for CO₂ Emissions Reported Elsewhere and CO₂ Captured and Transferred Off-site

The S Factor is used in the Equation P-1 spreadsheet to avoid double-counting CO₂ emissions that are captured and transferred off-site or that are reported elsewhere in Cal e-GGRT. The S Factor is equal to the mass of CO₂ that is captured and transferred

off-site and the mass of CO₂ emissions reported elsewhere. It is reported at the unit level in the Equation P-1 spreadsheet, and it is deducted from the total reported emissions for the unit. So if the S Factor is used, the unit-level emissions that are calculated by the Equation P-1 spreadsheet, which are automatically added to the hydrogen facility-level emissions in Cal e-GGRT, are adjusted to avoid double-counting and further adjustments to facility-level emissions are not needed for emissions that are captured and transferred off-site or that are reported elsewhere in Cal e-GGRT.

All CO₂ transferred off-site or reported elsewhere should be included in an S factor so that double-counting the emissions is appropriately avoided and facility-level emissions are accurate. In cases where CO₂ transferred off-site or reported elsewhere cannot be attributed to a single hydrogen unit, those emissions must still be subtracted from the facility total by including them in an S Factor. The reporter may either attribute all of the CO₂ transferred or CO₂ emissions reported elsewhere to a single designated hydrogen unit (or even a specific feedstock), in which case it would all be in one S factor, or the reporter may distribute the mass among the multiple units and feedstocks so that the sum of all S factors equals the sum total that should be subtracted from the facility-level emissions.

Note that the sum of all reported S Factors should equal the sum of the facility-level mass of CO₂ captured and transferred off-site (section 3.1) and the facility-level mass of CO₂ emissions reported elsewhere (section 3.3).

3.6 Stationary Combustion CH₄ and N₂O Emissions

Operators must report CH₄ and N₂O combustion emissions associated with hydrogen production pursuant to section 95114(k). If not included as part of CEMS reporting within Subpart P of Cal e-GGRT, these CH₄ and N₂O emissions must be reported as stationary source combustion emissions in Subpart C of Cal e-GGRT. The operator may add a new unit configuration to Subpart C to include the CH₄ and N₂O combustion emissions associated with hydrogen production activities. When reporting these emissions, reporters should exclude any CH₄ and N₂O emissions that are reported elsewhere (*e.g.*, those that were reported as flaring emissions). The mass of CH₄ emissions that are excluded should equal the facility-level mass CH₄ emissions reported elsewhere (see section 3.3 and Figure 2).

3.7 Flaring Emissions Associated with Hydrogen Production

Section 95114(l) of MRR requires hydrogen producers to report annual mass of CO₂, CH₄, and N₂O emissions from flaring. Merchant hydrogen production facilities must report these emissions under the flaring section of Subpart P within Cal e-GGRT. Refineries must report flaring emissions associated with hydrogen production under Subpart P if these emissions can be disaggregated from flaring emissions associated with other refinery activities. If these emissions cannot be separated from flaring emissions associated with other refinery activities, then operators may report flaring emissions associated with hydrogen production in Subpart Y. Figure 4 shows the initial data entry screen when a flare is added within Subpart P of Cal e-GGRT. Subsequent

screens are displayed in Cal e-GGRT depending on the emissions calculation method that is selected for the flare.

Figure 4. Cal e-GGRT Subpart P flare emissions reporting screen for hydrogen producers.

Section 95114 (Subpart P): Hydrogen Production (2013)

[Subpart Overview](#) » [Add a Flare](#)

FLARE INFORMATION

Subpart P requires a facility to uniquely identify each flare and provide the information described below for each. Also use this page to enter the method used to calculate carbon dioxide (CO₂) emissions for this flare. For additional information about adding and editing a flare unit, please use the Cal e-GGRT Help link(s) provided.

* denotes a required field

UNIT INFORMATION

Name or ID*	<input type="text"/>	(40 characters maximum)
Description (optional)	<input type="text"/>	
Type	Flare	

FLARE DETAILS

Type of flare	<input type="radio"/> Steam assisted <input type="radio"/> Air-assisted <input type="radio"/> Unassisted <input type="radio"/> Other
Flare service type	<input type="radio"/> General facility flare <input type="radio"/> Unit flare <input type="radio"/> Emergency only flare <input type="radio"/> Back-up flare <input type="radio"/> Other (specify)

EMISSIONS CALCULATION METHOD

Method used to calculate the CO₂ emissions. Note that certain methods must be used if certain criteria are met. See the help section for details.	<input type="radio"/> 98.253(b)(1)(ii)(A) - Equation Y-1a Gas Composition Monitored <input type="radio"/> 98.253(b)(1)(ii)(A) - Equation Y-1b Gas Composition Monitored <input type="radio"/> 98.253(b)(1)(ii)(B) - Equation Y-2 Heat Content Monitored <input type="radio"/> ARB 95113(d) - Start-up, Shutdown, Malfunction Equation
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4 Additional Information

Detailed training materials for reporting using Cal e-GGRT:
<http://www.arb.ca.gov/cc/reporting/ghg-rep/tool/ghg-tool.htm>.

The GHG Mandatory Reporting Regulation, with full requirements:
<http://www.arb.ca.gov/cc/reporting/ghg-rep/regulation/mrr-regulation.htm>.

Contact the MRR reporting helpdesk: ghgreport@arb.ca.gov.

Contact the MRR verification helpdesk: ghgverify@arb.ca.gov.

For help with reporting, please contact the appropriate staff member:
<http://www.arb.ca.gov/cc/reporting/ghg-rep/ghg-contacts.htm>.

For help with verification, please contact the appropriate staff member:
<http://www.arb.ca.gov/cc/reporting/ghg-ver/ghg-ver-contacts.htm>.