CALIFORNIA
AIR RESOURCES BOARD

Measurement Accuracy and Missing Data Provisions
for California's Mandatory GHG Reporting Program

Introduction

This document provides guidance for complying with the measurement accuracy requirements and the missing data substitution provisions of the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions (title 17, California Code of Regulations, sections 95100-95158) (MRR). Section 1 of this document provides guidance related to measurement accuracy requirements. Section 2 of this document provides guidance related to missing data provisions. The full regulation is available here: https://ww2.arb.ca.gov/mrr-regulation.

Unlike MRR, this guidance does not have the force of law, does not establish new mandatory requirements for greenhouse gas (GHG) reporting, and in no way supplants, replaces, or amends any of the legal requirements of the Regulation. Conversely, an omission or truncation of regulatory requirements in this guidance does not relieve operators of their legal obligation to fully comply with all requirements of MRR.

The current version of this document contains minor revisions to text in section 1.4 to reflect the following changes resulting from MRR amendments that are applicable for 2018 data reported in 2019:

- Operators must notify CARB of methodology improvements by the reporting deadline of the applicable reporting year.
- CARB may determine whether a permanent change in methodology that is not an improvement can be applied to the current data year.

Attachment 1 was also removed. No other significant changes have been made.

1 Measurement Accuracy Requirements

- All meters that measure covered emissions or covered product data must meet the full measurement accuracy requirements in section 95103(k)(1).
- For non-covered emissions and non-covered product data, reporting entities must comply with the accuracy requirements in the United States Environmental Protection Agency (USEPA) Mandatory GHG Reporting Rule (section 40 CFR §98.3(i)).

- New Meters: If additional meters are installed for measuring covered emissions or covered product data, the meters must be initially calibrated prior to data collection, and re-calibrated according to the recalibration frequency specified in section 95103(k)(4).

1.1 Failed Calibrations and Missing Data

- Pursuant to section 95103(k)(10), if a meter fails calibration, recalibration, or a field accuracy assessment and the meter represents more than 5 percent of the total covered emissions or total covered product data, the operator must demonstrate by other means to the satisfaction of the verifier and/or CARB that the measurements used to calculate the covered emissions or covered product data still meet ±5 percent accuracy going back to the last successful calibration or field accuracy assessment. While the operator may demonstrate meter accuracy, the operator would still receive a finding of nonconformance for failing to calibrate the meter in accordance with MRR requirements. If the operator cannot demonstrate accuracy, missing data provisions must be used when reporting emissions data, or the data must be excluded pursuant to section 95103(l) when reporting covered product data.
- In the case in which a meter used to measure covered product data unexpectedly fails, the operator is not allowed to use missing data provisions and must either exclude the data as allowed pursuant to section 95103(l), or must use a temporary methodology that meets the requirements of section 95103(m)(4) to demonstrate conformance with covered product data accuracy requirements. These accuracy requirements are discussed in Section 1.4 of this document. If an operator has one or more equivalent meters directly upstream or downstream of the failed meter that are calibrated pursuant to the requirements in section 95103(k), the operator may use these meters to quantify covered product data and thereby avoid the necessity to use a temporary method or exclude the product data. The operator may contact CARB for additional guidance on failed meters. For more information related to covered product data measurement accuracy and meter calibration requirements, see the Covered Product Data General Reporting Guidance document.
- Pursuant to section 95103(l), operators, except for operators of cement plants, must exclude inaccurate covered product data in order to avoid an adverse verification statement. When covered product data are excluded, the operator must provide a description of the excluded data and an estimation of covered product data quantities using best available methods. Missing data provisions cannot be used to substitute for missing or inaccurate covered product data. Allocation under the Cap-and-Trade Program is based on

covered product data that meets the accuracy requirements of MRR and reasonably assured to be free of material misstatement. Data excluded and reported per 95103(l) are not used for allocation purposes and would not result in a finding of nonconformance. For information on data substitution for operators of cement plants, see Cement Producers Covered Product Data Guidance document.

- Operators may use the missing data provisions pursuant to section 95129(d) for fuel consumption data subject to the requirements in section 95103(k). Missing data provisions in this case must be used to substitute data for time periods when data is not collected, is invalid, or is collected by devices not meeting the calibration or accuracy requirements in section 95103(k). **Note**: The provisions in section 95129(d) must be used when total facility fuel consumption is necessary for emissions calculations and is not completely or accurately known. For more information related to missing data substitution provisions please refer to Section 2 of this guidance document.
- Pursuant to section 95129(h), if there is an unforeseen breakdown of fuel capture data CARB may approve an interim data collection procedure. CARB will determine whether the accuracy of data collected under the interim data collection procedure is reasonably equivalent to data collected from properly functioning monitoring equipment, and if it is not, the relative accuracy to assign for purposes of assessing possible material misstatement under section 95131. CARB would consider data collected under an approved interim data collection procedure to be captured data for purposes of compliance with the capture rate requirements in this section.
- Pursuant to section 95131(b)(13)(B), if an operator is missing less than 20 percent of a single data element, data substituted correctly using relevant missing data procedures is considered accurate and would not result in a nonconformance.
- Pursuant to section 95131(b)(13)(C), if an operator is missing more than 20 percent of a single data element and/or uses missing data procedures to substitute more than five percent of its total facility emissions, the result would be a nonconformance. For more information on calibration requirements and missing data procedures, please see Section 2 of this document and sections 95129 and 95131.

1.2 Recalibration Frequency Requirements

- Measurement devices subject to the requirements in section 95103(k)(4) related to recalibration frequency, must meet the full calibration requirements of section 95103(k).

1.3 Calibration Postponement

- A calibration postponement request is designed to apply to continuously operating units and processes where calibration or inspection is not possible without operational disruption. A calibration postponement request must meet the requirements of sections 95103(k)(8) and (9), and be approved by CARB. A postponement request may also be submitted for meters for which original equipment manufacturer (OEM) guidance explicitly specifies a calibration frequency that exceeds 3 years, as specified in section 95103(k)(4)(F).
- Operators must submit postponement requests to the Executive Officer following the procedures described in section 95103(k)(9).
- Pursuant to section 95103(k)(9)(B)(7), operators must include a proposed alternative method for assuring the accuracy requirements of section 95103(k)(6) are met for each meter for which a postponement is requested. Options for accuracy demonstration include, but are not limited to:
    - Engineering methods;
    - Upstream/downstream meters (mass or volume balance); and
    - Strap-on meters.
- MRR does not include specific metering calibration requirements for upstream/downstream or strap-on meters that are used for a proposed alternative accuracy demonstration methodology; however, CARB approval of a calibration postponement request is contingent on the operator providing sufficient evidence and/or documentation to CARB that the proposed accuracy demonstration method can reliably be used to provide reasonable assurance to the verifier during annual verification that the postponed meters are accurate within ±5 percent. As specified by CARB in the postponement approval letters, operators are required to demonstrate accuracy of the postponed meters annually to the satisfaction of the verifier using the accuracy demonstration methods approved by CARB.
- CARB recommends that operators include all necessary postponement requests for their facility under one global postponement request, rather than submitting a separate request for each individual meter.
- CARB will not review or approve incomplete postponement requests. To expedite review and approval, operators must include all required information for each meter included in the request. This includes a detailed description of how accuracy will be assured in the absence of inspections and/or transmitter calibrations.

- If CARB approves a postponement request, the operator must provide it to its verifier during verification. One method to do so would be to upload the request, any supplemental information pertinent to the request, and the CARB approval letter itself into Cal e-GGRT. Please see section 1.10 of this document for more information on requirements for postponement requests.

1.4 Changes in Monitoring Methods

- If an operator or supplier identifies a situation where conventional metering is not feasible or identifies an alternative method that achieves accuracy at an equivalent level to the ±5 percent required by section 95103(k)(6), the operator may submit a request for approval of an alternative measurement/monitoring method by following the requirements in section 95103(m). If an operator or supplier uses an approved alternate methodology, the operator must apply the methodology to an entire data year.
- Pursuant to section 95103(m)(1), an operator or supplier is allowed to permanently improve the measurement methods for emissions or product data monitoring. For improved emissions monitoring, including moving to a higher-tier measurement and calculation method or Continuous Emissions Monitoring System (CEMS), the operator or supplier is not required to seek pre-approval of the method by CARB. However, the operator or supplier must notify CARB by the reporting deadline for the applicable reporting year.
- Operators and suppliers seeking a permanent change that is not an improvement in method, or seeking to change a covered product data collection method must submit the method to CARB for approval as described in section 95103(m)(2) prior to the year that the operator or supplier will begin collecting data using the new method. In its submission, the operator or supplier must include a description of the alternative approach and why it is being proposed. In addition, the operator or supplier must describe the data affected by the method change and demonstrate the differences in estimated emissions or product data using the required metering methods in section 95103(k) and using the proposed alternative measurement methodology. Beginning with 2018 data, CARB may also determine whether the methodology can be applied to the current data year, pursuant to section 95103(m)(2). In order to apply the method to the current data year, the reporting entity must show that they have collected the necessary data to apply the method for the entire current data year.
- Pursuant to section 95103(m)(3), if CARB approves the use of an alternate methodology, an operator or supplier must implement the approved alternative measurement methodology after the completion of monitoring for a

data year and must apply the methodology to an entire data year, with the exception of temporary methods allowed in section 95103(m)(4) that do not have to be approved by CARB.

- An alternative methodology approved by CARB becomes the measurement standard for which accuracy is assessed.
- Pursuant to section 95103(m)(4), an operator or supplier is allowed to temporarily modify a monitoring method for the avoidance of missing data or to comply with the missing data provisions in MRR (e.g. in the event of an unexpected meter failure). As opposed to an alternate methodology approved by CARB, to use a temporary methodology an operator or supplier does not need approval by CARB; however, the operator or supplier can only use it on a temporary basis, meaning less than 365 days. The operator or supplier must notify CARB of the use of a temporary method prior to the annual reporting deadline, which is April 10 of the year following the year in which the data was collected. Additionally, an operator and supplier must be able to demonstrate that the temporary method is accurate to within ±5 percent to a verifier and CARB pursuant to section 95103(k)(6) during verification.
    - As an example, assume an operator experiences an unexpected failure on May 1, 2015, of an otherwise calibrated and accurate meter. The operator may elect to use a temporary method to report data during the interim period (not to exceed 365 days) until the meter is repaired and recalibrated. The operator must notify CARB per the requirements in section 95103(m)(4) prior to April 10, 2016 (the 2015 data reporting deadline), and must be able to demonstrate that the temporary method was accurate within ±5 percent during verification.

1.5 Meter Components

A meter refers to the sum of the components used to generate an accurate measurement. For example, at an oil refinery, a flow meter may consist of an orifice plate (or other primary element), differential pressure measurement device, static temperature and pressure measurement devices, and one or more data transmitters. Individual components of a meter are not individually required to meet the accuracy requirements of section 95103(k); however, section 95103(k)(1) requires that the overall meter be maintained to ensure the accuracy requirements are met. As an example, if static pressure measurements associated with a differential pressure meter are found to have an error of seven percent, but the overall accuracy of the flow and volume measurement is still within ±5 percent accuracy, as determined by

the operator and confirmed by the verifier, the fuel flow would be considered ±5 percent accurate.

1.6 Use of "Prover" Method for Calibration of Turbine Meters

- For the purposes of calibrating turbine meters, section 95103(k)(6)(A) permits use of the "prover" method, if the method is referenced in the OEM documentation for calibrating the turbine meter.

- If the "prover" method is not specifically referenced in the turbine meter OEM documentation, or the OEM documentation is not available, and other specified methods for calibration are not possible, then section 95103(k)(6)(A) requires the operator to use the procedures in section 95109(b) to obtain approval for an "alternative test method" for calibrating the turbine.

1.7 Instances where the Calibration Requirements of section 95103(k) Do Not Apply

- Temporary methods are not subject to specified calibration requirements in §95103(k), but measurement accuracy must still be shown to be within ±5 percent during verification.
- Measurements performed using best available methods (BAM), when permitted pursuant to section 95103(h), are not subject to the specific calibration requirements of section 95103(k) but must meet the ±5 percent accuracy requirements.
- Pursuant to section 95103(k)(7)(A), financial transaction meters are exempt from meeting the requirements of section 95103(k), provided that the supplier and the purchaser do not have any common owners and are not owned by subsidiaries or affiliates of the same company.
- Financial transaction meters, where the supplier and the purchaser do have common owners or are owned by subsidiaries or affiliates of the same company, are exempt from meeting the calibration requirements of section 95103(k), if:
    - The financial transaction meter is also used by other companies that do not share common ownership with the fuel supplier;
    - The financial transaction meter is sealed with a valid seal from the county sealer of weights and measures or from a county certified designee; or
    - The financial transaction meter is operated by a third party.

- Pursuant to section 95103(k)(7)(B), upstream ethanol and additive meters that are used to ensure a proper blendstock percentage for a finished gasoline are also exempt from meeting the requirements of section 95103(k).
- Pursuant to section 95103(k)(7)(C), non-financial transaction meters used by Public Utility Gas Corporations (PUGCs) for purposes of reporting natural gas fuel supplier emissions are exempt from meeting the calibration requirements in sections 95103(k)(1) through (6), provided that the supplier can demonstrate that the meters are operated and maintained in conformance with a standard that meets the measurement accuracy requirements of the California Public Utilities Commission General Order 58A.

1.8 Guidance for Performing Field Accuracy Assessments

- A field accuracy assessment (FAA) provides operators a mechanism to demonstrate that meters are operating within the ±5 percent accuracy threshold on an annual basis. The requirements for FAA can be found in section 95103(k)(6)(B).
- FAA is an optional procedure that gives operators flexibility in determining which meters should have annual FAAs and allows operators to determine the appropriate method to demonstrate accuracy. FAA can be used to demonstrate accuracy without necessitating removal of the device and/or inspection of the primary element.
- The methods for demonstrating accuracy will vary by each type of metering device, as well as the specifics of the system engineering. FAA methods are categorized into the following four groupings:
    - Engineering Analysis: Various engineering techniques can be used to demonstrate the accuracy of a device. These techniques include, but are not limited to, comparison with upstream or downstream meters, and/or analysis of flow trends prior to and post calibration events.
    - OEM calibration guidance or other OEM recommended methods: Manufacturers may have procedures designed specifically for "in-situ" assessments of meter accuracy without necessitating device removal or inspection. For example, some types of thermal mass flow meters are designed to allow for "in-situ" calibration checks, which confirm whether a meter has drifted or shifted from the original National Institute of Standards and Technology traceable calibration.
    - Standard industry practices: Various industry practices may already be commonly used to confirm meter accuracy for reasons other than GHG emissions monitoring. For pressure differential metering devices

for instance, some industries rely on meter temperature and pressure transmitter calibration checks (which demonstrate accuracy of the transmitters) combined with demonstration of orifice plate/primary element integrity (i.e. cleanliness and minimal corrosion).

- Portable Instruments: Portable flow "comparison" instruments such as strap-on ultrasonic meters, meter "provers," and/or portable pitot tubes *may* be adequate to demonstrate accuracy of certain metering devices. In some instances, meter systems may not be engineered in a manner that allows for accurate use of portable equipment.

- The method and procedure that an operator employs for demonstrating accuracy for a particular device must be adequate to provide reasonable assurance to the verifier that the device is operating within the 5 percent accuracy requirements in MRR.
- Reporters and verifiers should contact CARB with questions related to specific FAA methods and procedures.

1.9 Verification of Measurement Accuracy Requirements

- Verifiers must establish reasonable assurance of conformance with measurement accuracy requirements in section 95103(k) for measurements used to calculate covered emissions and covered product data. Verifiers are expected to include meter conformance checks into the larger sampling plan, focusing more effort on higher risk metering devices. If one or more metering devices are found not in conformance with the requirements, yet overall accuracy of measurements used for covered emissions and covered product data are within 5 percent, the verifier would note a nonconformance at a minimum.
- Because covered product data are used to determine allowance allocation for most industrial facilities, the verifier's risk analysis and sampling plan must include *all* covered product data. The verifier *must* conduct an in-depth review for covered products identified as the highest risk, including detailed data checks and review of data management systems. For all other covered products the verifier should, at a minimum, review the data management systems for data collection and review data as needed to reach reasonable assurance that each covered product meets the accuracy requirements of section 95103(k). For more information on how verifiers should apply the measurement accuracy and metering requirements to covered product data, please see the General Covered Product Data Reporting Guidance document.

- All data collected using approved postponement methods, approved alternative methods, and/or temporary methods as allowed by section 95103(m)(4) must meet the ±5 percent accuracy requirements and be referenced in the entity's GHG Monitoring Plan. Verifiers must use professional judgment when assessing the accuracy of data collected using these methods, and should contact CARB staff for guidance on assessing specific accuracy demonstration methods and results, as needed. Verifiers must also verify that data collected by an operator or supplier using an approved postponement or alternate method are collected in accordance with the approved methodology as specified in the approval letter from CARB.
- For metering devices subject to U.S. EPA rule section 40 CFR §98.3(i) that are used to collect other data for non-covered emissions or non-covered product data, including data collected for Cost of Implementation (COI) Fee purposes, verifiers must verify conformance with applicable requirements in 40 CFR §98.3(i). If one or more metering devices measuring non-covered emissions or non-covered product data are found not in conformance with the requirements of 40 CFR §98.3(i), the verifier must note a nonconformance at a minimum.
- For financial transaction meters and upstream ethanol and additive meters exempt from the measurement accuracy requirements, as specified in section 95103(k)(7), verifiers must confirm meters claimed to be exempt meet the specified exemption requirements. Because there may be many meters used at multiple locations, the verifier may choose to verify a sample of meters based on total throughput or some other criteria, as justified in the sampling plan.
- Verifiers are expected to use professional judgment when assessing both the procedures and results of all FAAs performed by an operator. Should an operator not be able to provide reasonable assurance that a metering device is measuring within 5 percent accuracy, the device would be deemed to be out of calibration. Verifiers should contact CARB for guidance on assessing specific FAA procedures and results, as needed.
- In the event of a failed calibration or FAA, verifiers are to use professional judgment when assessing the demonstration of accuracy of the metering device 'by other means' as specified in section 95103(k)(10). Verifiers should contact CARB staff for guidance on assessing specific accuracy demonstration methods and results, as needed.

For specific meter calibration questions, please contact ghgreport@arb.ca.gov.

1.10 Frequently Asked Questions – Metering, Postponements, and Method Changes

This section provides answers to frequently asked questions that CARB has received from reporting entities regarding measurement accuracy. These answers may be based in part on case-specific factual circumstances and are offered here only as guidance that does not supplant the requirements of MRR.

1.10.1 What steps can an operator take to expedite the verification process with regards to meter accuracy?

It is very important for operators to maintain a comprehensive tracking system for all meters used for reporting covered emissions and covered product data. As early as possible in the verification schedule, the operator should provide the verifier with a comprehensive list that includes, at a minimum, all GHG and product data meters, the dates of the last calibrations and primary element inspections for those meters, each meter's role in the reported data, and the postponement status of each meter, if applicable. In addition, the operator must provide all materials associated with each postponement request to the verifier. This includes the original request letter, supplemental information provided per CARB request during the review process, and the final approval letter for each postponement. Lastly, the operator must demonstrate accuracy for all postponed meters using the methods described in the approved postponement request by CARB.

1.10.2 Our facility annually calibrates all pressure differential meter transmitters. Does this count as a "full calibration" per the requirements in section 95103(k)(6)?

No. A "full calibration" for a pressure differential meter entails both the three-point calibration of the transmitters, as specified in section 95103(k)(6)(A), as well as removal and inspection of the "primary element" (i.e., the orifice plate) as specified in section 95103(k)(6)(A)(1). While it is acceptable, and good practice, to calibrate transmitters on an annual basis, a "full calibration" entailing both the transmitter calibration and inspection of the primary element must be performed at the applicable frequency specified in section 95103(k)(4).

1.10.3 Our facility removes and replaces the orifice plates on all meters at least once every compliance period according to the frequency required by MRR. The new plates are designed and inspected prior to installation as specified in the AGA Report No 3. Part 2, and the old plates are discarded upon replacement. Does this procedure conform to the requirements in section 95103(k)(6)(A)(1)?

No. When performing plate inspections, the plate that is removed from service must be inspected and photographed prior to being returned to service or replaced to determine the "as found" condition of the plate. In the absence of documentation of the "as found" condition, it is not possible for a verifier to confirm that the plate was not corroded, plugged, or otherwise damaged in a manner that would affect the overall accuracy of the measurements. Pursuant to section 95103(k)(6)(A)(1), if plate inspection fails any of the specified tests, the meter is considered to be out of calibration. This would lead to a non-conformance with MRR and result in, at best, a qualified positive emissions data or product data verification statement. An adverse verification statement would result if the operator could not demonstrate accuracy of the measured data and is unable or refuses to exclude the data (for covered product data) or use appropriate missing data provisions (for covered emissions data). See Question 4 below in this document for further discussion of failed plate inspections.

1.10.4 How can operators demonstrate meter accuracy in the event an orifice plate that met the inspection criteria when it was installed is subsequently removed and inspected, and does not meet the specifications in ISO 5167-2 or AGA Report No. 3?

Once the pressure and temperature measurement devices for a differential pressure meter have been calibrated, and the plate meets the specifications, the meter is "in calibration" and data subsequently acquired with the meter are defined as accurate. Upon subsequent calibration and inspection, if the measurement devices and the plate are determined to meet specifications, all of the data collected between the calibrations/inspections are considered accurate. However, if upon the subsequent removal and inspection of the plate, it does not meet specifications, the meter is determined to be out of calibration. In this case, the accuracy of the flow data must be further evaluated. If the effect of the plate's condition on flow rate is greater than 5 percent, or if the effect on the flow rate is not known, then an additional demonstration of accuracy for all of the flow data in question must be provided, using engineering analysis such as a mass balance utilizing additional upstream/downstream data. If the data in question cannot be otherwise demonstrated as accurate, they must be excluded (if covered product data) or substituted appropriately (if used to calculate covered emissions data). Operators are encouraged to contact CARB staff in the event of a failed meter calibration, as

staff can help determine whether other methods for assessing accuracy are appropriate and meet the requirements of MRR. Also, please note that minor cosmetic defects to the plate such as small surface scratches are unlikely to have an effect on the overall accuracy of the flow measurement but should be noted and disclosed to the verifier. See Question 10 below for further discussion on failed meter inspections and component calibrations. This guidance is consistent with the existing guidance in section 4.1 of the General Covered Product Data Reporting Guidance document. Please refer to this document for additional guidance regarding failed product data inspections/calibrations as it relates to covered product data.

1.10.5 When submitting a postponement request pursuant to section 95103(k)(9), are annual meter transmitter calibrations considered a sufficient demonstration of accuracy?

In most cases, annual meter transmitter calibrations alone are not a sufficient means to demonstrate accuracy of a postponed meter. Without plate inspections, the meter measurements cannot be assured to be accurate even when the transmitters are calibrated and functioning because the plate itself could be corroded or clogged in a manner that is altering the flow of material through the orifice. CARB will only approve postponement requests for meters for which there is some additional set of data or information available that can be used to corroborate meter accuracy during verification. See Question 6 below for more information on acceptable methods for demonstrating accuracy.

1.10.6 When submitting a postponement request, what methods are acceptable for demonstrating accuracy of postponed meters?

For each meter included in a postponement request, CARB expects operators to provide a detailed description of the accuracy assurance method in the postponement request. Note that CARB staff will not begin to review postponement requests until the operator has provided adequate descriptions of the proposed accuracy assurance method for each meter included in the request. In addition to the methods listed in section 1.8 of this document, operators may propose other methods. To expedite the review process, operators are also encouraged to provide additional supporting information (such as annual transmitter calibration records and/or recent plate inspection results from similar meters) that can be used to demonstrate that the operator has a strong program to ensure that meters are designed, installed, and maintained in a manner that ensures a high level of accuracy.

1.10.7 What are the operator's options when a postponement approval is set to expire prior to the date the meter can be fully calibrated and inspected?

Because meters and measurement devices are required to be calibrated and inspected once every compliance period, CARB typically approves meter postponements for a total of no more than three reporting years (36 months). For example, if a postponement request is submitted in November 2015 for meters that are required to be calibrated and inspected by January 1, 2016, the CARB approval would likely be granted through December 31, 2018. Therefore, it is incumbent upon a postponement requestor to be cognizant of relative calibration frequency to ensure that a CARB-approved postponement will cover the time period needed by the requestor. If meters and measurement devices cannot be inspected during the approved postponement period, the operator must submit a new postponement request for these meters no later than 30 days prior to the expiration of the original postponement (December 1, 2018 in the case of a postponement approval).

1.10.8 I received a postponement approval letter. Does this mean that CARB confirms that my meters meet the required 5 percent accuracy requirements?

No. Approval of a meter postponement request by CARB only means that the postponement was submitted in conformance with the requirements in section 95103(k)(9), and that the operator has adequately described their method for ensuring the accuracy of the meters in the absence of the calibration and/or inspection. The operator must continue to demonstrate annually that the postponed meters meet the 5 percent accuracy requirements to the satisfaction of the verifier using the method(s) specified in the CARB approval letter.

1.10.9 As a verifier, should I view meters with approved postponements as relatively low-risk given that CARB has already reviewed the accuracy of these meters?

No. To the contrary, CARB highly recommends that all postponed meters and measurement devices be viewed by the verifier as high risk when conducting the risk assessment and determining a sampling plan. Postponed meters are considered higher risk because they are lacking current inspection and/or calibration results, therefore, accuracy must be assured through other means. Verifiers must verify accuracy consistent with the methods described in the postponement approval letter from CARB and the operator's postponement submittal documentation. Please contact CARB if the operator's described method is inadequate for demonstrating accuracy during verification.

1.10.10 Can an operator use covered emissions or covered product data from a meter where either the orifice plate or one of the transmitters fails calibration or inspection?

If a transmitter is found to be outside of the specified accuracy bound at one or more of the three calibration points, or if a plate fails one of the tests specified in the AGA or ISO guidelines referenced in section 95103(k)(6)(A)(1), then the meter shall be deemed out of calibration. At a minimum, a verifier must note a non-conformance for instances of failed calibration. However, this does not preclude the operator from using the data from the meter in question if the operator can demonstrate using objective evidence to the satisfaction of the verifier that the component failure did not affect the accuracy of the volume data collected by the device by more than 5 percent. When meters that measure fuel consumption for the purposes of calculating covered emissions fail calibration or inspection, the operator must use the missing data provisions in section 95129(d)(1) through (3) for any periods where the total facility fuel consumption data cannot be reported using a combination of other calibrated meters. Operators cannot use missing data provisions for covered product data and must exclude all inaccurate covered product data as required by section 95103(l) (which does not allow covered product data exclusion for cement plant operators). Operators may also use a temporary method to report covered product data or to avoid using missing data provisions for emissions data as specified in section 95103(m)(4). The operator must demonstrate that the temporary method is accurate within 5 percent to the satisfaction of the verifier, and must notify CARB by the reporting deadline

As an example, the calculated volumetric flow using a differential pressure meter is proportional to the square root of the measured differential pressure. If, during calibration of a differential pressure transmitter, an operator finds an error of 13 percent in the measured differential pressure from the "true" value, they may be able to demonstrate accuracy by showing that all other parameters in the flow equation are accurate, and that all other meter elements meet specifications. This would provide assurance that the total error of the calculated volumetric flow is not greater than $\sqrt{13}$, or 3.6 percent.

1.10.11 As a verifier, how do I know which meters at a facility have been granted postponements by CARB?

The operator must provide the verifier with all materials related to meter postponements (see response to Question 9 above). The verifier should not consider a meter to have an approved postponement unless that meter is specifically listed in a CARB postponement approval letter. If the operator cannot produce a postponement approval letter for a specific meter, the verifier must

assume that meter does not have an approved postponement. The verifier may contact CARB staff as necessary to inquire about the status of any pending postponement requests.

1.10.12 Our facility is replacing an orifice plate meter with an ultrasonic meter. The point of measurement will not be changed, nor will the overall accuracy of the measurement. Does this constitute a permanent change in method that must be approved pursuant to section 95103(m)(1) prior to the new meter being installed?

No. CARB would not consider this case to be a change in methodology that requires CARB approval. In general, a permanent change in method is a change that results in collection of different data, information from different data points, or an alteration of a previously used calculation. As an example, changing from a carbon content emissions calculation method to a measured HHV emissions calculation method would be considered a change in method, but simply changing the instrumentation used to collect carbon content samples would not be considered a change in method. Note that CARB highly recommends that operators contact CARB when implementing metering or calculation changes to determine if the change would constitute a change in method that requires notification or approval by CARB pursuant to section 95103(m).

1.10.13 Our facility cannot repair a meter that is directly metering covered product data; however, we have developed an alternate method for measuring the covered product data that we believe is accurate within ±5 percent. How soon can we implement this new method?

Pursuant to section 95103(m)(1), all covered product data method changes must be approved by CARB. To propose a permanent change in method, the operator must submit a change in method request that includes the information required in section 95103(m)(2) to CARB prior to the year data will be collected under the new method. The operator must implement the alternate method at the beginning of the next data year as specified in section 95103(m)(3). In the interim period, the operator has the option of using the alternate method as a temporary method pursuant to section 95103(m)(4). The method cannot be used as a temporary method for longer than a 365-day period, and the operator must notify CARB of the use of the method as a temporary method by the reporting deadline for the data year in which the method is used.

As an example, suppose a meter measuring covered product data fails on February 1, 2016, and the operator determines it cannot be replaced without implementing a major engineering project. A mass balance approach using

upstream and downstream meters is developed and it is documented by the operator to be accurate within ±5 percent. In this scenario, the operator must submit the mass balance method to CARB for approval as an alternate method as soon as possible, but no later than December 31, 2016. If the change in method request is approved by CARB, the operator would be able to use the method for the entirety of the 2017 data year and all years moving forward. For 2016 data, the operator has the option of using the method as a temporary method for the period between February 1 and December 31, 2016. The operator must notify CARB by April 10, 2017, of the use of the method as a temporary method for the 2016 data year. Note that in the above example, the operator must be able to demonstrate ±5 percent accuracy of the alternate method to the satisfaction of the verifier for 2016 data and beyond.

1.10.14 For orifice plate meters and other differential pressure flow measurement devices, do operators need to provide the underlying mass or volume flow equations in order to provide reasonable assurance to the verifier that the reported mass/volume data meet ±5 percent accuracy?

Differential pressure meters are often used to calculate the flow of refinery fuel gas and complexity weighted barrel throughputs at refineries, and are often used by operators of oil and gas production facilities to quantify associated gas production and fuel consumption. These meters require ongoing maintenance to ensure that measured data are accurate.

If any of the measured inputs or equation parameters are not accurate, large data errors can be introduced into the flow calculations. To minimize the risk of reporting inaccurate data, reporting entities should ensure appropriate staff are available during verification to answer questions from verifiers regarding the underlying flow equations and calculations that convert differential pressure measurements to mass or volume flow. Reporting entities should also be prepared to provide the verifier with documentation of the measured parameters and other factors relevant to the flow calculations.

Reporting entities may be asked by their verifier to provide evidence that calculation parameters, including static pressure, temperature, density/molecular weight, and gas compressibility are documented and appropriate for the particular calculation being used in the operator's data management system to calculate flows. It is possible that the data measurement system being used to calculate flow relies on outdated default assumptions on gas characteristics, and has not been updated to reflect more recent measured values. To facilitate verification, the operator may

want to perform a comparison between the most recent measured data and the data actually being used in the calculation, before the site visit.

If additional adjustments, bias factors, or other empirical data are being used to support flow calculations, operators should make them available to their verifier for the selected meters. CARB suggests that operators identify the procedures and personnel that are necessary for providing the above flow calculation parameters and data to the verifier during verification, and include these in the GHG monitoring plan.

1.10.15 Revisions made to section 95103(k)(6)(A)(1) in the 2017 MRR, which became effective on January 1, 2018, allow refineries and hydrogen plants to inspect meter primary elements at a frequency of once every 6 years. When are these changes implemented, and how do they affect meter calibration and inspection?

Amendments to the MRR adopted by the Board in 2017 are effective on January 1, 2018, with most provisions applicable to 2018 data reported during 2019 (see section 95103(h) of the regulation for details). The changes made to section 95103(k)(6)(A)(1) allow refineries and hydrogen plants to perform primary element inspections at a frequency no longer than once every six year period. The following examples provide additional information regarding the timelines for meter calibration and inspection:

Example 1: Meters inspected in 2014 at a refinery or hydrogen plant that were required under the 2014 version of the MRR to be inspected again by the end of the second Cap-and-Trade compliance period ending December 31, 2017.

In this scenario, all meters located at refineries and hydrogen plants that were previously inspected in 2014 must have been inspected consistent with the schedule prescribed by section 95103(k)(4) of the 2014 MRR that was valid through the end of 2017. Therefore, all meters inspected in 2014 should have been inspected at least once during the three year Cap-and-Trade compliance period that ended on December 31, 2017. If the meter could not be inspected by the end of the second compliance period, reporters should have submitted a postponement request at least 30 days prior to the end of 2017 to be in conformance with MRR.

Example 2: Meters inspected during the second compliance period (2015, 2016, or 2017).

Meters located at refineries and hydrogen plants that were inspected anytime during the second compliance period and were not required under section 95103(k)(4) to be inspected again prior to December 31, 2017, must be re-inspected no more than

6 years following the previous date they were last inspected in 2015, 2016, or 2017. A postponement request must be submitted at least 30 days prior to the 6 year deadline for all meters that cannot be inspected within the 6 year timeframe to be in conformance with MRR.

Example 3: Meters included in an approved postponement request that were required to be inspected by December 31, 2018.

All meters that are currently covered under an existing approved postponement request must adhere to the inspection date specified in the postponement approval letter. For example, if a meter is included in an approved postponement valid through December 31, 2018, the reporter must either inspect the meter prior to the end of 2018, or submit another postponement request no more than 30 days prior to the end of 2018 if the meter cannot be inspected by that date to be in conformance with MRR.

Note: In all scenarios, meters that are not inspected and do not have an approved postponement request as laid out above still must meet +/-5 percent accuracy requirements. If the operator can provide evidence of +/-5 percent accuracy for the meter but does not meet other MRR requirements, the meter is not in conformance with MRR, and the verifier would be required to identify a nonconformance leading to a qualified positive verification statement, absent other issues. If the operator cannot provide evidence of +/-5 percent accuracy for the meter, the operator would be required to use appropriate missing data substitution methods (for emissions data) or exclude the data (for covered product data) for the time period for which no evidence of accuracy can be provided.

2 Missing Data Substitution Procedures

This section provides guidance on the missing data substitution requirements as specified in section 95129 of the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions (reporting regulation or MRR), title 17, California Code of Regulations, sections 95100-95158. This section discusses requirements for both reporters and verifiers.

2.1 Overview of Missing Data Substitution Procedures

Section 95129 provides requirements for missing data substitution for stationary fuel combustion (SFC) sources, including electricity generating units, and emissions reported using a Continuous Emissions Monitoring System (CEMS). Missing data provisions only apply to emissions data. Missing data provisions and methods are not allowed for covered product data. Pursuant to section 95103(l), if covered

product data is missing or inaccurate the operator must exclude it from the emissions data report. See the Covered Product Data General Reporting Guidance for additional information.

While this guidance document only pertains to the data substitution procedures in section 95129 for emissions data, the regulation also provides additional missing data substitution procedures in sections of the regulation pertaining to each specific industry sector for process and vented emission sources. Table 1 provides a list of references to all the missing data procedures in MRR so reporters can easily find applicable regulatory provisions.

In addition to the reporting requirements, verifiers must review whether the required capture rates have been met for all sources of missing data observed; risk of whether all missing data observed represents more than 5 percent of the total emissions; and whether the operator has documented its system to manage data substitution in its GHG Monitoring Plan. A nonconformance in any of these areas would trigger a qualified positive emissions data verification statement. More detailed verification information can be found in section 2.7 of this document.

Table 1. Missing Data Substitution Procedure References for Emissions Data

Rule Section	Emission Source or Data Element
95129(a)	Part 75 units
95129(b)	Units equipped with CEMS (Tier 4 of Subpart C)
95129(c)	Fuel characteristic data for stationary fuel combustion (SFC) sources
95129(d)	Fuel consumption data for SFC sources
95129(e)	Steam production data that are used as the basis for emissions calculation
95129(f)	Procedure for establishing load ranges
95129(g)	Alternate load range (must be approved by CARB Executive Officer)
95129(h)	Interim fuel analytical data collection procedure during equipment breakdowns
95129(i)	Interim data collection procedure during breakdown for unit equipped with CEMS (Tier 4 of Subpart C)
95110(c)	Cement production, non-SFC sources
95113(k)	Petroleum refinery, non-SFC sources
95114(h)	Hydrogen production, non-SFC sources
95115(l)	points to section 95129 for all SFC sources
95116(c)	Glass production, non-SFC sources
95117(c)	Lime manufacturing, non-SFC sources

95118(c)	Nitric acid production, non-SFC sources
95119(c)	Pulp & paper manufacturing, non-SFC sources
95120(c)	Iron & steel production, non-SFC sources
95121(e) / 40 CFR §98.395	Supplier of transportation fuel
95122(e) / 40 CFR §98.405	Supplier of natural gas, natural gas liquids, liquefied petroleum gas
95123(b)	Supplier of CO_2
95124(c)	Lead Production
95155(a)(2)	Oil and gas system, non-SFC sources

Note: This guidance document pertains only to the missing data substitution procedures in section 95129. Also, missing data provisions cannot be used for covered product data.

2.2 Application of Missing Data Substitution Procedures

A missing data period is defined by section 95102(a) as a time period when a piece of data is:

- not collected;
- invalid; or
- collected while the measurement device is not in compliance with the applicable measurement and monitoring accuracy requirements in section 95103(k).

Not all missing data situations require the use of data substitution procedures in section 95129. In some situations, the procedures in section 95129 are specified as one of the options for missing data substitution that the facility operator may choose. Facility operators should check whether the missing data substitution requirements are triggered before applying the methods in section 95129. Guidance for determining whether a situation requires the use of the section 95129 procedures is provided in the following sections.

2.3 Sources Not Required to Meet the Calibration and Accuracy Standard

For the following emission sources that are not required to meet the calibration or accuracy standards specified in section 95103(k), facility operators have the choice of either following section 98.35 of Title 40 of the Code of Federal Regulations (40 CFR) or the methods in section 95129:

- Any emission sources in a facility that qualifies for abbreviated reporting;

- For entities that are covered under the Cap-and-Trade Regulation, emissions from units that combust only exempt biomass-derived fuels, as long as CH_4 and N_2O emissions are reported as de minimis;
- For entities that are not covered under the Cap-and-Trade Regulation, all emissions from biomass-derived fuels;
- De minimis sources; and,
- Sources identified in section 95103(h) that are allowed to use best available methods when new requirements are phased in.

2.4 Fuel Characteristic Data

For fuel characteristic data (carbon content, high heat value, and molecular weight) that are used to calculate emissions that are subject to the calibration and accuracy standards, the facility operator must first demonstrate every reasonable effort to obtain a fuel characteristic data capture rate of 100 percent. Time periods during which fuels were not combusted are not included in the calculation of the data capture rate. However, a missing data period must include the entire sampling period (e.g., week, month, or quarter) for which corresponding fuel characteristic data are not obtained – it is not limited to just the specific times that there was missing data.

The procedures specified in section 95129(c) are required only if all of the following alternatives for obtaining valid data have been exhausted:

- The original sample is still available and the original sample has been reanalyzed.
- A backup sample from the same sampling period is available and the backup sample has been analyzed.
- The sampling period has not passed and valid data from a replacement sample has been obtained and analyzed. For a semiannual sampling frequency, consecutive samples must be taken at least 4 months apart. For a quarterly sampling frequency, consecutive samples must be taken at least 30 days apart (40 CFR §98.35(a)-(b)).
- The fuel supplier maintains fuel characteristic data that meet the requirements of the regulation and the data has been obtained from the fuel supplier.

2.5 Fuel Consumption Data - Applicability

For fuel consumption data used to calculate emissions that are subject to the calibration and accuracy standard of section 95103(k), the facility operator must

demonstrate every reasonable effort to obtain a total facility fuel consumption data capture rate of 100 percent. Time periods during which fuels were not combusted are not included in the calculation of data capture rate. The requirements in section 95129(d) are triggered only during time periods when the *total facility* fuel consumption is not completely and accurately known. Facility operators may use any combination of fuel measurement devices to demonstrate that the total facility fuel consumption is completely and accurately known for any given time period, but all fuel measurement devices used to sum to the facility total must *individually* be in compliance with the applicable data accuracy requirements in section 95103(k). For relevant examples please see Section 2.8 of this guidance document.

The circumstances that lead to missing data periods generally fall into two categories as described in the situations below. The applicability of the missing data substitution provisions under the two categories are also described below:

Situation 1: *A time period during which the total facility fuel consumption data are completely and accurately known, but fuel consumption data at the unit-level are missing or invalid.*

In this situation, the requirement to use the procedures in section 95129(d)(1)-(3) is not triggered for this time period. Facility operators have the following options to fill in the missing unit-level data.

- If there are upstream or downstream fuel measurement devices that meet the calibration and accuracy requirements of section 95103(k), the operator may use any combinations of these upstream/downstream devices to reconstruct the missing unit-level data for this time period. (See Examples 1 and 2 in Section 2.8 of this document)
- Along the main fuel line and its downstream branches of fuel lines, if there are measurement devices that meet the requirements of section 95103(k) that would enable the operator to triangulate the missing unit-level fuel consumption, the operator may calculate the missing unit-level fuel consumption by subtracting the upstream fuel quantity by the fuel quantities measured at parallel branches of the fuel line. (See Examples 5 and 7 in Section 2.8 of this document)
- If there is an upstream fuel measurement device that meets the requirements of section 95103(k) for the time period, but there are no lower-level fuel measurement devices available for directly triangulating the missing unit-level data, the operator may use an engineering estimation to calculate the missing data (section 95129(d)). Acceptable engineering estimation methods should utilize other available data parameters that are routinely measured at the

facility (e.g., electrical load, steam production, operating hours, or production output). The operator must be able to demonstrate to the verifier that the chosen engineering estimation method is reasonable and based on good engineering principles, and the estimated fuel quantities at the lower level must add up to the accurate upstream total. (See Examples 5 and 7 in Section 2.8 of this document)

- If the facility operator chooses not to use any of the above options, they can follow the procedures in sections 95129(d)(1)-(3) for substituting missing data.

Situation 2: *A time period during which the total facility fuel consumption data are not completely and accurately known, and there is no combination of other fuel measurement devices that meet the calibration and accuracy standard for the operator to reconstruct the total facility fuel consumption quantity.*

In this case, the facility operator should immediately take corrective action to bring the missing data period to an end as quickly as possible. This could include installing a temporary meter that meets the calibration and accuracy standard of section 95103(k) to collect accurate fuel consumption data while the existing meter is down (See Examples 3, 4, and 6 of Section 2.8 of this document). Alternatively, the operator may calibrate any combinations of existing upstream or downstream meters so Situation 1 applies (See Examples 4 and 6 of Section 2.8 of this document). Otherwise, the operator is required to use the procedures in section 95129(d)(1)-(3) for this time period.

If the facility operator opts for using a temporary meter or chooses to calibrate existing upstream/downstream meters, the fuel quantities measured by the temporary meter and the calibrated upstream/downstream meters are considered valid data that are not missing. However, for the time period after the failure of the original meter and before the complete installation of the temporary meter or the calibration of existing upstream/downstream meters, the use of the procedures in sections 95129(d)(1)-(3) is required because this time period is considered a missing data period.

The facility operator must keep calibration records of meters (including temporary meters and upstream/downstream meters that are calibrated during the missing data event) to demonstrate compliance with the calibration and accuracy requirements of MRR. If the operator is not able to demonstrate the accuracy of the fuel measurements to the satisfaction of the verifier and CARB the operator is required to use the procedures in sections 95129(d)(1)-(3).

2.6 Fuel Consumption Data - Eligibility for Each of the Three Procedures

Section 95129(d) provides three procedures for substituting missing data. Before using any of these procedures, the operator must have met the eligibility criteria of the procedure. If the operator is eligible for more than one method in sections 95129(d)(1)-(3), the operator has the option to choose one of the applicable methods. The eligibility criteria for each of the three procedures are summarized below:

1. Eligibility Criteria for the method specified in section 95129(d)(1) - Continuous Fuel Flow Rate Data Using Load Ranges
    - A source must meet all of the following criteria to be eligible for using the method specified in section 95129(d)(1):
    - The source combusts gaseous or liquid fuels;
    - The source produces electrical or thermal output;
    - The source uses a fuel flowmeter system to continuously measure fuel flow rate; and
    - The source is equipped with a data acquisition and handling system (DAHS) that continuously records fuel flow rates and measured electrical and thermal output on an hourly basis (which enables segregation of the fuel flow rate data into bins).
2. Eligibility Criteria for 95129(d)(2) - Fuel Consumption Data Without Load Ranges

    A source must meet all of the following criteria to be eligible for using the method specified in section 95129(d)(2). Eligibility is determined on a per-fuel basis:

    - The facility operator has established and implemented a fuel monitoring plan as a part of the GHG Monitoring Plan specified in section 95105(c)(10).
    - The facility operator has monitored fuel measurement equipment and maintained records of its proper operation by recording fuel consumption quantities at least weekly. For fuels that are combusted less than 180 days in a calendar year, the operator must record fuel consumption at least daily on each day the fuel is combusted. Data collected by a DAHS at a measurement frequency shorter than weekly can be used to meet this criterion.
    - The facility operator has compiled records of fuel consumption that are sufficient for the application of the procedures in this paragraph.

3. Eligibility Criteria for 95129(d)(3) - Alternate Missing Data Procedure for Fuel Consumption Data
    - If a source does not meet the eligibility criteria for using the procedures in sections 95129(d)(1) and (2), the operator must use the method in section 95129(d)(3) to substitute missing data. All stationary fuel combustion sources are eligible to use the method in section 95129(d)(3). However, facility operators should attempt to use the options described in sections 95129(d)(1) and (2) before using the missing data method described in section 95129(d)(3), which requires use of maximum potential fuel consumption rates.

2.7 Frequently Asked Questions for Missing Data

This section provides answers to frequently asked questions that CARB has received from reporters regarding missing data substitution procedures. These answers may be based in part on case-specific factual circumstances and are offered here only as guidance that does not supplant the requirements of MRR.

2.7.1 A stationary fuel combustion unit does not produce electricity or steam, and there are no other fuel meters upstream or downstream. The unit has some fuel consumption data missing and is subject to the substitution procedure in section 95129(d)(2)(A). If the data capture rate is ≥95 percent, is it acceptable to use the average of the data points before and after the missing data period?

Yes, the operator may use the average of the data points before and after the missing data period if the data capture rate is ≥95 percent.

Alternatively, the operator may also use other estimation approaches. The best available estimation must be based on operational data actually measured/recorded at the unit. The data recorded in the "before and after" hours and unit operating hours both fall into that category. If there is reason to think that the "before and after" average may not be representative of the data period, the operator should look to other available process data or production data that are routinely measured and recorded at the unit, and use those as the basis for estimation. The operator must demonstrate to a verifier that their chosen estimation method is reasonable and based on good engineering principles, and is expected to produce a reasonably accurate estimate.

2.7.2 For a fuel combustion source, if the regulation requires at least a daily fuel characteristic data measurement, but the facility has instrumentation and DAHS that collect hourly data, should the data capture rate be determined based on the hourly data or based on the number of days with at least one valid data point?

This emission unit potentially has 8,760 hourly fuel sample data points (in a non-leap year). The facility operator may choose to use all the available hourly data in the calculation to get a more accurate representation of actual data capture rate. If a daily average can be calculated that is representative of that day's operations, the daily average could be used to replace the missing data for that day if more than 90 percent of the data was captured based on the hourly data (section 95129(c)(1)). If the operator chooses to identify a daily average by taking a weighted average for each 24-hour period, the number of samples would be the number of operating days (or partial operating days) in the year.

2.7.3 The missing data substitution procedures in section 95129(d)(2)(A) require reporters to use the 90th and 95th percentile values of the data collected during the current reporting year and the previous two reporting years. Should hours with zero fuel use be included or ignored? Should invalid data be ignored? Should substituted data (after missing data substitution procedure is applied) from the past two years be used in computing the 90th and 95th percentile values?

The historical data set should only include data that were directly measured when the unit was actually combusting fuel. Hours with 0 fuel use should be ignored in the historical data look-back. Hours with invalid data and substituted numbers (after a missing data substitution procedure was applied) should also be excluded from the historical data look-back.

2.7.4 What is the difference between "data capture rate" and "emission capture rate," and how do they affect a conformance determination?

"Data capture rate" as identified in sections 95129(c), (d)(2), and (e), is the number of valid data points collected, divided by the total number of data points when the unit is in operation. Data capture rate determines which progressively-more-stringent data substitution method should be used.

The term "emissions capture rate" is not explicitly defined in the regulation, and it is not used for determining which data substitution method should be used. However, the concept is inherent in section 95131(b)(13)(C), which requires the verifier to note at least a nonconformance if more than 5 percent of a facility's emissions are being

calculated using missing data substitution procedures. Data capture rates are evaluated for each data element used in performing emission estimates.

2.7.5 It is possible that more than one data element may be missing during the same timeframe (e.g., fuel use data and high heat value data). Each data element or each emission source with a missing data element represents some fraction of the total facility emissions. For these reasons, reporters and verifiers should not calculate the emissions capture rate by summing the data capture rates for the purpose of section 95131(b)(13)(C). Instead, they must first calculate the amount of emissions that are substituted, then divide the total substituted emissions by the total facility emissions (including both the substituted emissions and the emissions directly measured/calculated from valid data) to get the emissions capture rate for the facility. See Example 8 in Section 2.8 of this document for guidance on data capture rate and emissions capture rate calculations. How does a verifier evaluate conformance with section 95129?

Verification bodies review whether the 80 percent data capture rate has been met for all sources of missing emissions-related data; whether all missing data represents more than 5 percent of the total emissions; and whether the operator has a reasonable system to manage data substitution and has documented the system in their GHG Monitoring Plan. Note that missing data provisions and methods are not allowed for covered product data, which instead must be excluded. For more information on how verifiers should evaluate conformance for covered product data please see the Covered Product Data General Reporting and Verification document.

A nonconformance in any of these areas would trigger a qualified positive emissions data verification statement. However, if the data is substituted according to the requirements in MRR, the verifier must accept the substituted data as accurate and would not consider that data to be misreported in its material misstatement evaluation.

A nonconformance is automatically triggered if any emissions-related data element has a data capture rate of less than 80 percent regardless of the amount of emissions that are affected by the missing data. By correctly following the missing data substitution procedures in the rule, the reporter has complied with the specific requirements to substitute missing data, and avoided further consequences such as an adverse verification statement. However, it does not change the fact that the reporter was out of compliance with the applicable monitoring and recordkeeping requirements which led to a nonconformance.

The verification body should evaluate whether the operator made every reasonable effort to obtain a data capture rate of 100 percent, as required in sections 95129(c) through (d). Reasonable effort could include adherence to a written GHG Monitoring Plan, which describes steps the reporting entity takes to help ensure all data is captured.

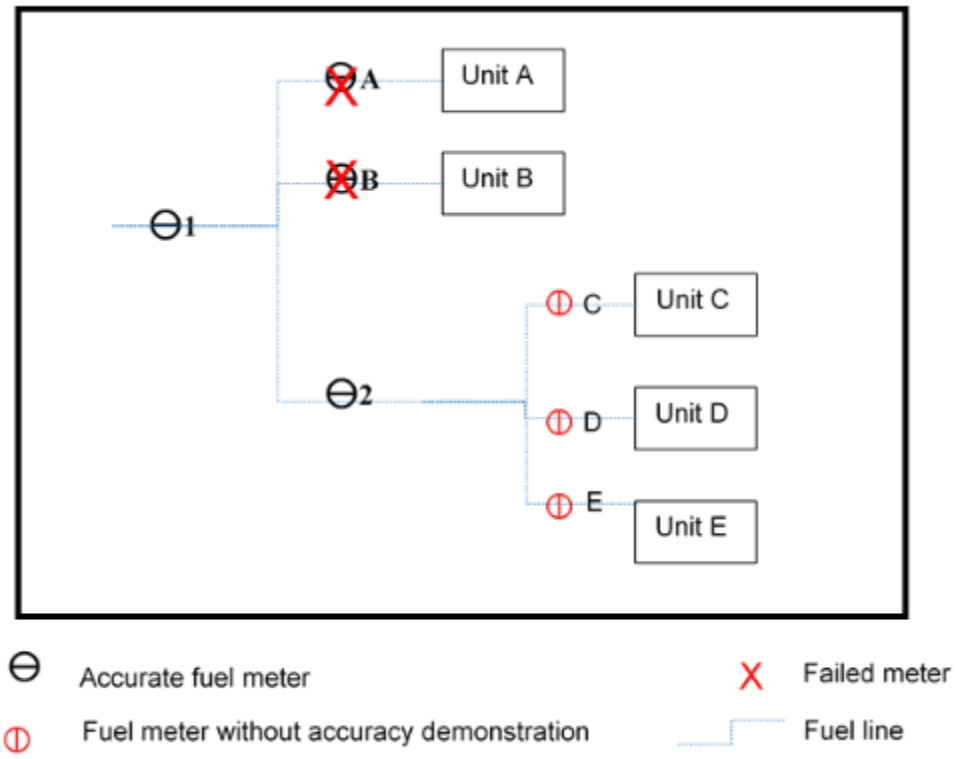
The verification body should also evaluate whether the operator has systems in place to prevent loss of data, which could help inform the verification team on whether the operator understands the regulation and whether other aspects of their emissions data report are likely reported accurately.

2.7.6 Examples for Using the Missing Data Provisions

The examples in this section are provided as additional guidance for the application of the missing data substitution procedures specified in section 95129. Each example describes whether the requirements in section 95129 are triggered for the specific scenario and provides an explanation of how the requirements would apply, if applicable.

In the scenarios that follow, a "Failed meter" is a meter in which no data are available from the meter due to a failure. A "Fuel meter without accuracy demonstration" is a functioning meter, but the accuracy of the meter has not been established, or has not met the meter accuracy requirements specified in section 95103(k).

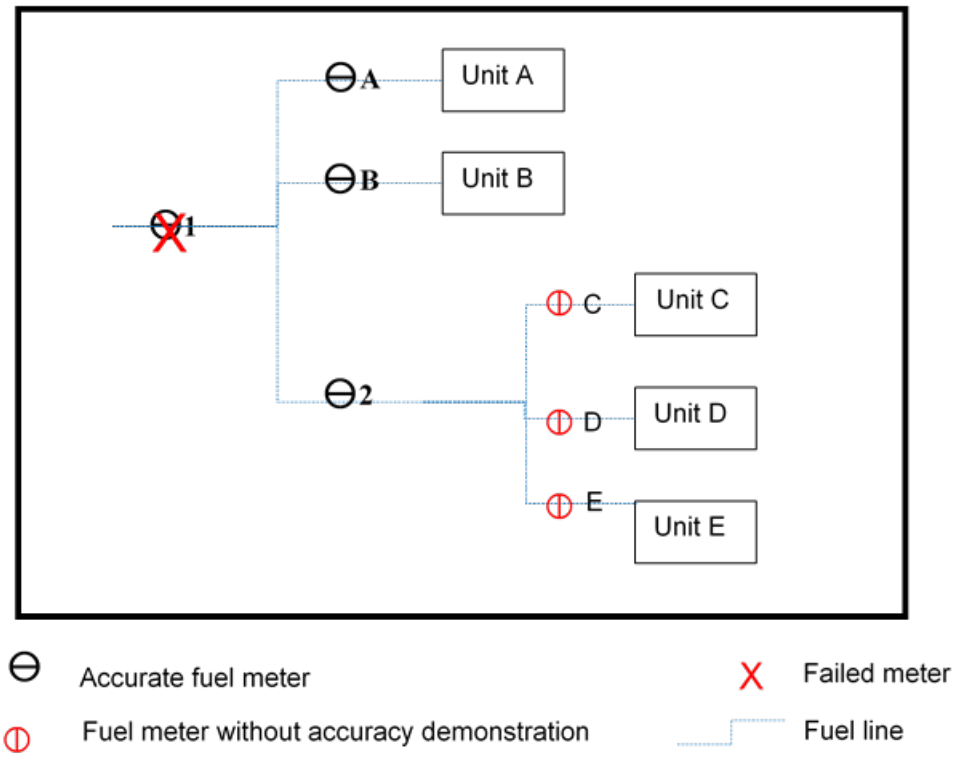
Example 1: Accurate Upstream Meters with Failed and Unknown Accuracy for Downstream Meters



Description of scenario: In this scenario, Meters 1 and 2 have met all accuracy requirements or are financial transaction meters. Meters A and B have failed the accuracy requirements, and the accuracy of Meters C, D, and E is unknown.

Are section 95129(d)(1)-(3) requirements triggered for this time period? **No**. The total facility fuel consumption is completely and accurately known during this time period because Meter 1 is in proper operation. The operator may use engineering estimation methods to calculate the combined fuel consumption of Unit A and Unit B. Acceptable estimation methods may include (but are not limited to) calculating the difference between Meter 1 and Meter 2 measurements. If Unit A and Unit B are individually reported (i.e. not aggregated), then proportioning the difference between Meter 1 and Meter 2 by the ratio of historical fuel use or production data of Unit A and Unit B can be used to estimate the unit-specific fuel use. The operator must be able to demonstrate to the verifier that the estimation method is reasonable and based on good engineering principles, and the estimated fuel quantities at Unit A and Unit B and Meter 2 add up to the accurate total measured by Meter 1.

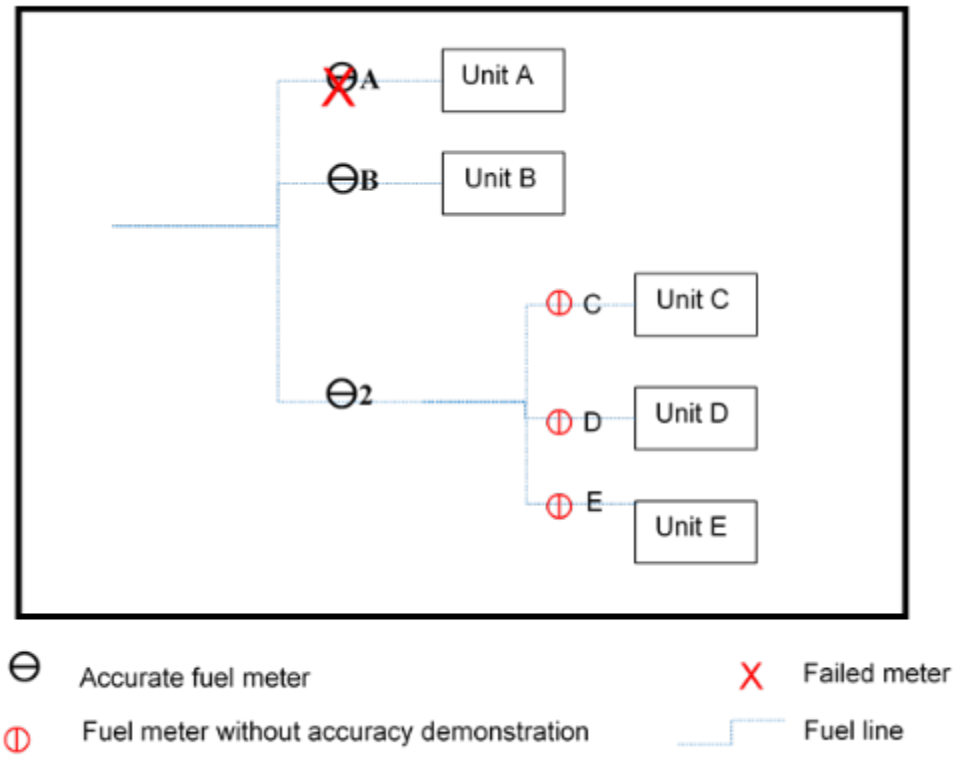
Example 2: Inaccurate Upstream Meter with Accurate Downstream Meters



Description of scenario: In this scenario, the primary upstream meter is inaccurate. However, each major downstream meter serving emitting units does meet the full accuracy requirement.

Are section 95129(d)(1)-(3) requirements triggered for this time period? **No.** The total facility fuel consumption is completely and accurately known because Meter A, Meter B, and Meter 2 are functioning properly and accurate. The operator may use Meter A, Meter B, and Meter 2 to report fuel consumption quantities for the emission units.

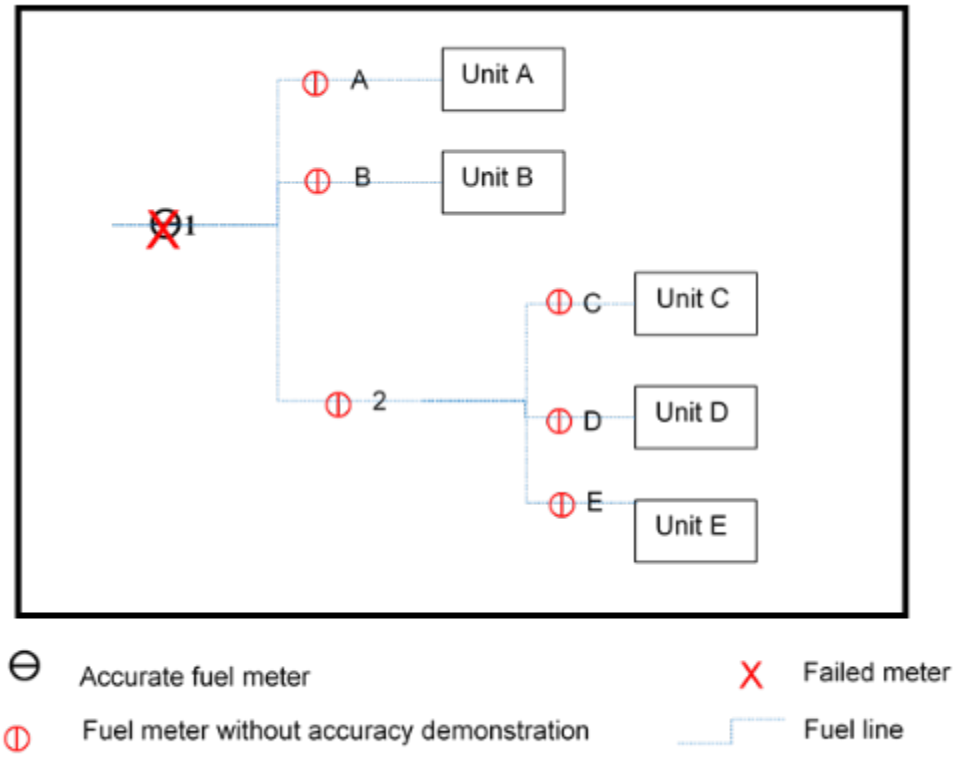
Example 3: Unit with Failed Meter and No Alternate Upstream Data



Description of scenario: In this scenario, a unit has a failed meter, and there is no alternate data available to accurately compute the fuel delivered to the unit.

Are section 95129(d)(1)-(3) requirements triggered for this time period? **Yes.** The total facility fuel consumption is not completely and accurately known during this time period because the quantity of fuel delivered to Unit A, via Meter A, is not accurately known, and cannot be accurately determined from the available data. If the operator cannot repair or substitute the Meter A immediately, they could install a calibrated temporary meter at the Meter A location to bring the missing data period to an end. For any time period during which Meter A was not working properly and there was no temporary meter, the operator must use the applicable missing data procedures in sections 95129(d)(1)-(3) to substitute missing data. Also, refer to Section 2.7 of this document which discusses what actions are required when different percentages of data are missing, and the consequences if missing data represents more than 5 percent of the total emissions.

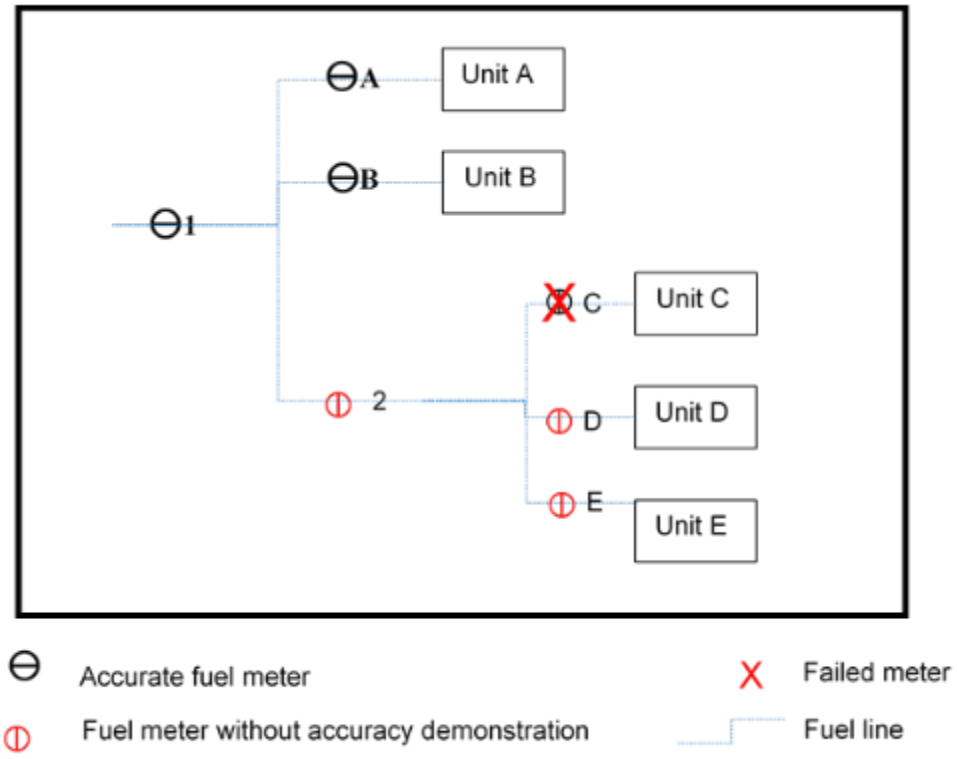
Example 4: Failed Upstream Meter and No Accuracy Determination for All Other Meters



Description of scenario: In this scenario, none of the meters used to monitor fuel consumption to individual units meet the accuracy requirements, and there is no valid upstream meter data available.

Are section 95129(d)(1)-(3) requirements triggered for this time period? **Yes.** The total facility fuel consumption is not completely and accurately known during this time period because none of the downstream meters are accurate. The operator may end the missing data period by installing a temporary meter that meets the calibration and accuracy standard of MRR at the Meter 1 location. The operator may also calibrate Meter A, Meter B, and Meter 2 so the situation depicted in Example 2 applies. Otherwise, the operator must use the applicable procedure in sections 95129(d)(1)-(3) to substitute missing data at all five units A-E. For any time period during which Meter 1 was not working properly and there was no temporary meter, or any time period before Meter A, Meter B, and Meter 2 are calibrated, the operator must use the applicable procedure in sections 95129(d)(1)-(3) to substitute missing data.

Example 5: Accurate Facility-Level Meter and Failed and Unknown Downstream Meters



Description of scenario: In this scenario, the facility-level meter is accurate, but a downstream meter does not have an accuracy determination, and a unit meter failed.

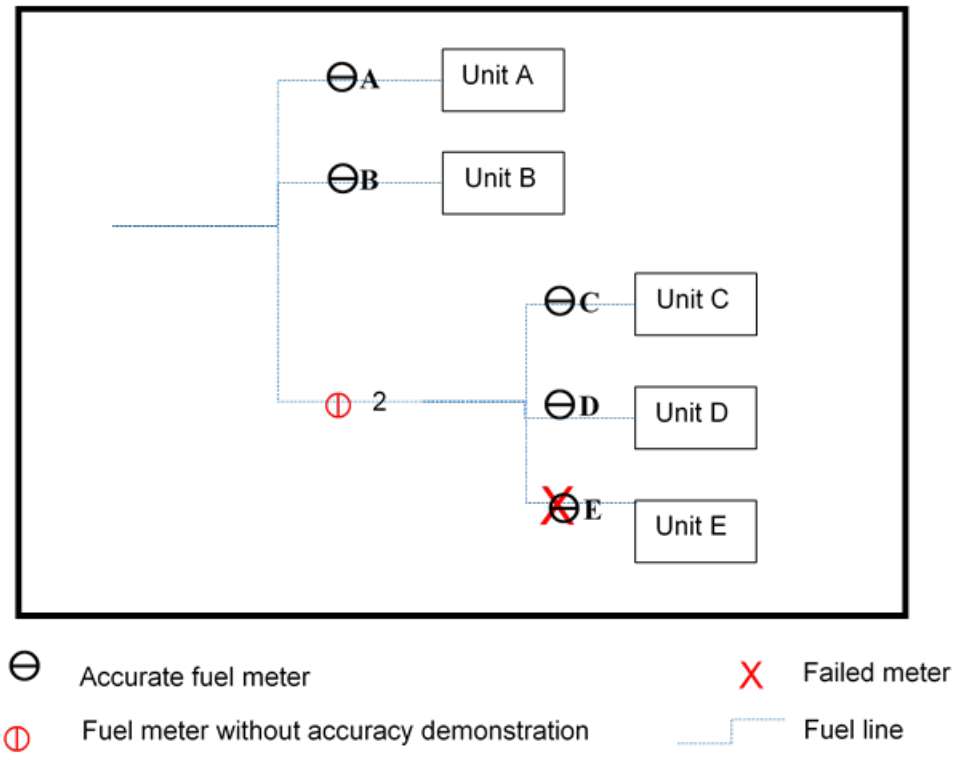
Are section 95129(d)(1)-(3) requirements triggered during this time period? **No.** The total facility fuel consumption is completely and accurately known during this time period because Meter 1 is working properly. The operator may calculate the fuel consumption of Unit C using an unbiased estimation method which may be satisfied by one of the following two methods:

Fuel consumption of Unit C = Meter 1 – Meter A – Meter B – Meter D – Meter E

Fuel consumption of Unit C = Meter 2 – Meter D – Meter E

The calculated fuel values at the unit-level must be computed, using appropriate ratios and scaling, such that they add up to the accurate total upstream measured fuel use. The operator must be able to demonstrate to the verifier that the estimation method is reasonable and based on good engineering principles.

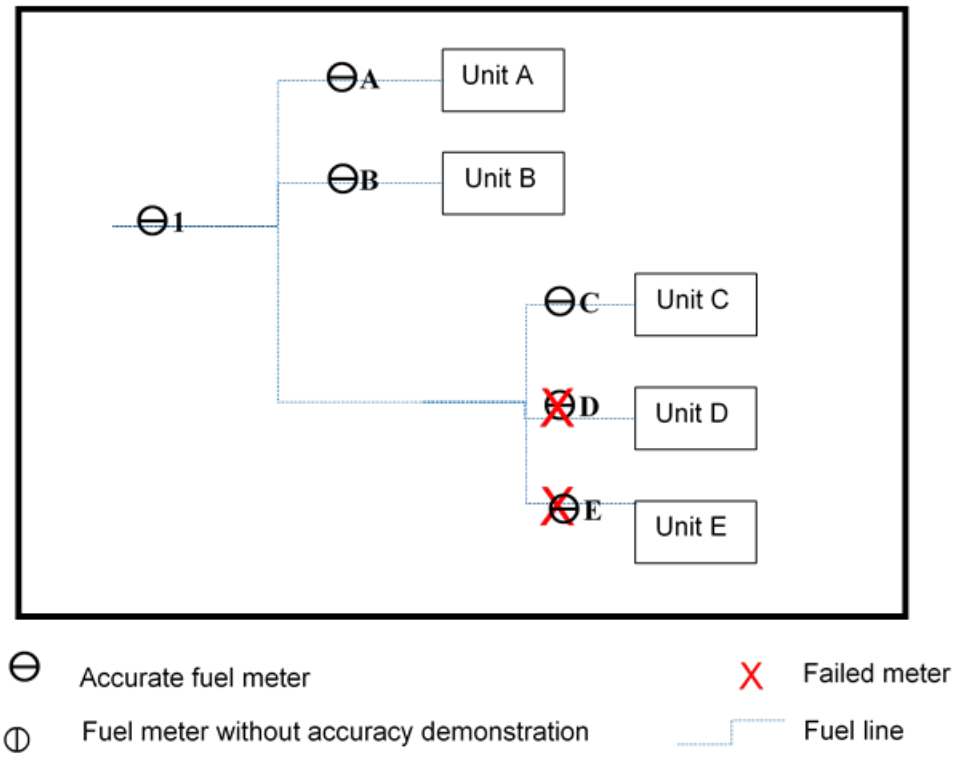
Example 6: Upstream Meter without Accuracy and Insufficient Upstream or Downstream Replacement Data



Description of scenario: In this scenario, a group meter does not have an accuracy determination, and there is no accurate upstream or downstream data available to calculate the fuel provided to the units.

Are section 95129(d)(1)-(3) requirements triggered during this time period? **Yes.** The total facility fuel consumption is not completely and accurately known during this time period. The operator may end the missing data period by installing a temporary meter that meets the calibration and accuracy requirements of MRR at the Meter E location. The operator may also calibrate Meter 2 so the fuel consumption of Unit E can be calculated by subtracting Meter C and Meter D measurements from the calibrated Meter 2 measurement. Otherwise, the operator must use the applicable procedure in sections 95129(d)(1)-(3) to substitute missing data at Unit E. For any time period during which Meter E was not working properly and there was no temporary meter, and for any time period before Meter 2 was calibrated, the operator must use the applicable procedure in section 95129(d)(1)-(3) to substitute missing data.

Example 7: Accurate Facility-Level Meter and Failed Unit Meters



Description of scenario: In this scenario, the facility-level meter is accurate, but some of the unit-level meters have failed.

Are section 95129(d)(1)-(3) requirements triggered during this time period? **No.** The total facility fuel consumption is completely and accurately known during this time period because the facility-level upstream meter (Meter 1) provides accurate data. To apportion the total fuel use to units with missing data, the operator may calculate the sum of fuel consumptions of Unit D and Unit E as follows:

Unit D + Unit E = Meter 1 – Meter A – Meter B – Meter C

Next, the operator may use engineering estimation methods to calculate the fuel consumption of Unit D and Unit E during this time period because Meter 1 is working properly. Acceptable estimation methods may include (but are not limited to) calculating the difference between Meter D and Meter E measurements, and proportionating the difference by the ratio of historical fuel use or other production data at Unit A and Unit B. The operator must be able to demonstrate to the verifier that the estimation method is reasonable and the estimated fuel quantities at Unit D and Unit E, when combined with Meter A, B, and C data, add up to the accurate total measured by Meter 1.

Example 8: Analysis of Missing Data Scenario with Multiple Data Elements

This missing data example illustrates multiple data elements that are missing with overlapping timeframes and shows how the data is substituted pursuant to section 95129.

Description of scenario: A facility with a cogeneration system combusts field gas to produce electricity and steam from non-pipeline quality natural gas. Fuel data is provided by monthly invoices; carbon content and molecular weight are measured monthly by an off-site laboratory. It is determined that one month of fuel data, two months of carbon content data, and three months of molecular weight measurements are all invalid or missing. This missing data example is illustrated using sample data provided in Table 2, following the analysis steps below.

Step 1: Determine data capture rate for each data source (>90 percent; 80-90 percent; or <80 percent)

- According to Table 2, the missing fuel data represents 1 of 12 months of data, representing 8 percent of the data. For this situation, substituting the data with the 90th percentile of the current year captured fuel data and the prior two years of data conforms with the regulation (section 95129(d)(2)(A)2.) and the verifier must accept the substituted data as accurate for purposes of material misstatement assessment, assuming there are no other issues.
- According to Table 2, the missing carbon content data represents 2 of 12 months of data, representing 17 percent of the data. In this scenario, substituting the data with the highest valid value from the current data year and the prior two years conforms to the regulation (section 95129(c)(2), and the verifier must accept the substituted data as accurate, assuming there are no other issues.
- For the missing molecular weight data, because less than 80 percent of the data is captured (based on data in Table 2), this results in an automatic nonconformance with the single data element constraint in section 95131(b)(13)(D). In this situation the data must be substituted with the highest valid molecular weight value for that type of fuel from all previous years (see section 95129(c)(3)(A)1.) as required to be maintained pursuant to sections 95105(a) and 95105(c)(10).

Step 2: Identify data substitution method for each type of missing data (Fuel, CC, MW)

After determining the data capture rate (Step 1), it is now possible to apply the appropriate data substitution method for each type of missing data. The appropriate

method of data substitution for each case (i.e., missing fuel, missing carbon content, missing molecular weight) is shown in Table 3. Any historical data used as the basis for calculating the substituted data needs to be reviewed by the verification body for reasonableness.

Step 3: Integrate substituted missing data

The substituted data (A, B, and C) developed through Steps 1 and 2 are combined with the captured data as shown in Table 4.

Step 4: Calculate emissions using substitute data

Emissions are calculated using both the captured and substituted data as shown in Table 4. For this example, CO_2 emissions are calculated as:

$CO_2 = 44/12 * Fuel * CC * MW/MVC * 0.001$

Where the parameters are as defined in section 98.33(a)(3)(iii) of the U.S. EPA GHG Reporting Regulation. If the substituted data is computed correctly, the substituted data is assumed to be accurate by the verification body (i.e., 0 percent error) for the purposes of assessing material misstatement.

Step 5: Identify nonconformance with MRR requirements

The data capture rate for monthly molecular weight measurements used for the emissions calculation is less than 80 percent; therefore the result is a nonconformance pursuant to section 95131(b)(13)(C).

Also, the emissions associated with the substituted data represent greater than 5 percent of the total facility emissions; therefore, the result is also a nonconformance due to the emissions (section 95131(b)(13)(C)). This assumes that the emissions shown in the example represent total facility emissions.

If there are other emissions sources present at the facility, then the verifier must compare the "missing data" emissions with the entire facility emissions to determine if the missing data represent greater than 5 percent of the total facility emissions, and make a nonconformance determination accordingly.

Note that even though missing data may be used for more than 5 percent of the emissions data (leading to a nonconformance), the verifier may still find reasonable assurance of no material misstatement (≤5 percent error).

Table 2. Current and Previous Data for Evaluating Missing Data Substitution

Data from Current Reporting Year				Data from Previous Years				
	Fuel Quantity (scf)	Fuel Characteristics		Fuel Quantity		Fuel Characteristics		
Month	[**Fuel**] = Mass or volume of the fuel combusted, for the month (express mass in short tons for solid fuel, volume in standard cubic feet for gaseous fuel, and volume in gallons for liquid fuel).	[**CC**] = Measured carbon content of the fuel for the month (percent by weight, as a decimal fraction).	[**MW**] = Measured molecular weight of the gaseous fuel (kg/kg-mole).	Fuel (scf) (Reporting year -1 year)	Fuel (scf) (Reporting year -2 years)	CC (Reporting year -1 year)	CC (Reporting year -2 years)	Highest MW from each month for all years (individual years not shown)
January	52,060,504	0.36497	36.01	53,576,532	51,487,600	0.36001	0.34601	36.12
February	47,875,436	0.36011	36.02	49,984,322	49,434,232	0.38650	0.35032	36.02
March	49,506,054	0.39900	35.08	49,799,321	49,976,002	0.35706	0.35931	36.01
April	50,294,023	0.36467	**C** - missing	51,900,003	54,909,432	0.35512	0.37537	36.10
May	**A** – missing	**B** - missing		52,005,901	54,065,001	0.35212	0.40001	35.99
June	50,176,567			50,005,432	54,932,100	0.39911	0.3578	35.90
July	51,125,654	0.33237	36.01	50,400,921	49,928,714	0.36253	0.34587	36.02
August	54,687,800	0.36097	36.01	53,043,981	54,000,004	0.36251	0.38524	36.20
September	58,723,412	0.39570	36.13	57,032,871	59,021,590	0.34870	0.35289	36.28
October	57,923,235	0.36467	36.02	56,987,100	57,012,474	0.36041	0.39221	36.05
November	51,655,443	0.37876	36.31	50,443,254	52,009,201	**0.40002**	0.36212	36.31
December	52,006,553	0.37824	33.45	55,087,353	53,912,350	0.39951	0.40001	**36.32**
Total	**576,034,681**							
Data capture rate:	11 of 12 **(92%)** >90%	10 of 12 **(83%)** 80-90%	9 of 12 **(75%)** <80%					

90th percentile of fuel usage (current and previous 2 years)	57,024,712

Table 3. Methods Used for Substituting Missing Data Based on Type and Quantity of Missing Data

A: Data capture rate between 90 and 95 percent requires 90th percentile of monthly fuel usage from previous 3 years per section 95129(d)(2)(A)2. Computed using the Excel PERCENTILE.INC function with the 11 current year fuel use values, and the 24 fuel use values from the prior two years (35 values). Other computation methods are acceptable. Value = **57,024,712 scf**
B: Between 80 percent and 90 percent data capture rate requires highest monthly carbon content value from the current year and the previous 2 years per section 95129(c)(2). Highest value for three years is 0.040002. Value = **0.40002**
C: Less than 80 percent data capture rate requires the highest monthly molecular weight from all years per section 95129(c)(3)(A)1. Highest value from all previously measured valid values is 36.32. Value = **36.32**

Substituted Data Summary	
A:	**57,024,712**
B:	**0.40002**
C:	**36.32**

Table 4 – Current Year Data with Missing Data Substituted per MRR Requirements

	Fuel Quantity	Fuel Characteristics			
Month	**[Fuel]** = Mass or volume of the fuel combusted, for the month (express mass in short tons for solid fuel, volume in standard cubic feet for gaseous fuel, and volume in gallons for liquid fuel).	**[CC]** = Measured carbon content of the fuel for the month (percent by weight, as a decimal fraction).	**[MW]** = Measured molecular weight of the gaseous fuel (kg/kg-mole).	Emissions (MT)	% of total Emissions
January	52,060,504	0.36497	36.01	2,953.14	8.0%
February	47,875,436	0.36011	36.02	2,680.40	7.3%
March	49,506,054	0.39900	35.08	2,990.88	8.1%
April	50,294,023	0.36467	**36.32**	2,875.21	7.8%
May	**57,024,712**	**0.40002**	**36.32**	3,576.01	9.8%
June	50,176,567	**0.40002**	**36.32**	3,146.56	8.6%
July	51,125,654	0.33237	36.01	2,641.07	7.2%
August	54,687,800	0.36097	36.01	3,068.18	8.3%
September	58,723,412	0.39570	36.13	3,624.11	9.9%
October	57,923,235	0.36467	36.02	3,284.28	8.9%
November	51,655,443	0.37876	36.31	3,066.21	8.3%
December	52,006,553	0.37824	33.45	2,840.33	7.7%
Total	633,059,393			36,749.15	
Data capture rate:	11 of 12 **(92%)** >90%	10 of 12 **(83%)** 80-90%	9 of 12 **(75%)** <80%		
[CC annual] = Weighted annual carbon content of the fuel (percent by weight, expressed as a decimal fraction, e.g., 95% = 0.95). (for 2011)				0.375257	
[MW annual] = Weighted annual molecular weight of the gaseous fuel (kg/kg-mole). (for 2011)				35.842359	

>5% of emissions are missing

Non-Conformance

3 Additional Information

Detailed training materials for reporting using Cal e-GGRT: https://ww2.arb.ca.gov/mrr-tool.

The GHG Mandatory Reporting Regulation, with full requirements: https://ww2.arb.ca.gov/mrr-regulation.

Additional reporting and applicability guidance documents to assist reporters in complying with the MRR: https://ww2.arb.ca.gov/mrr-guidance.

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

For help with reporting or verification, please contact the appropriate staff member: https://ww2.arb.ca.gov/mrr-contacts.