Methane Challenge Accomplishment Calculation Methods

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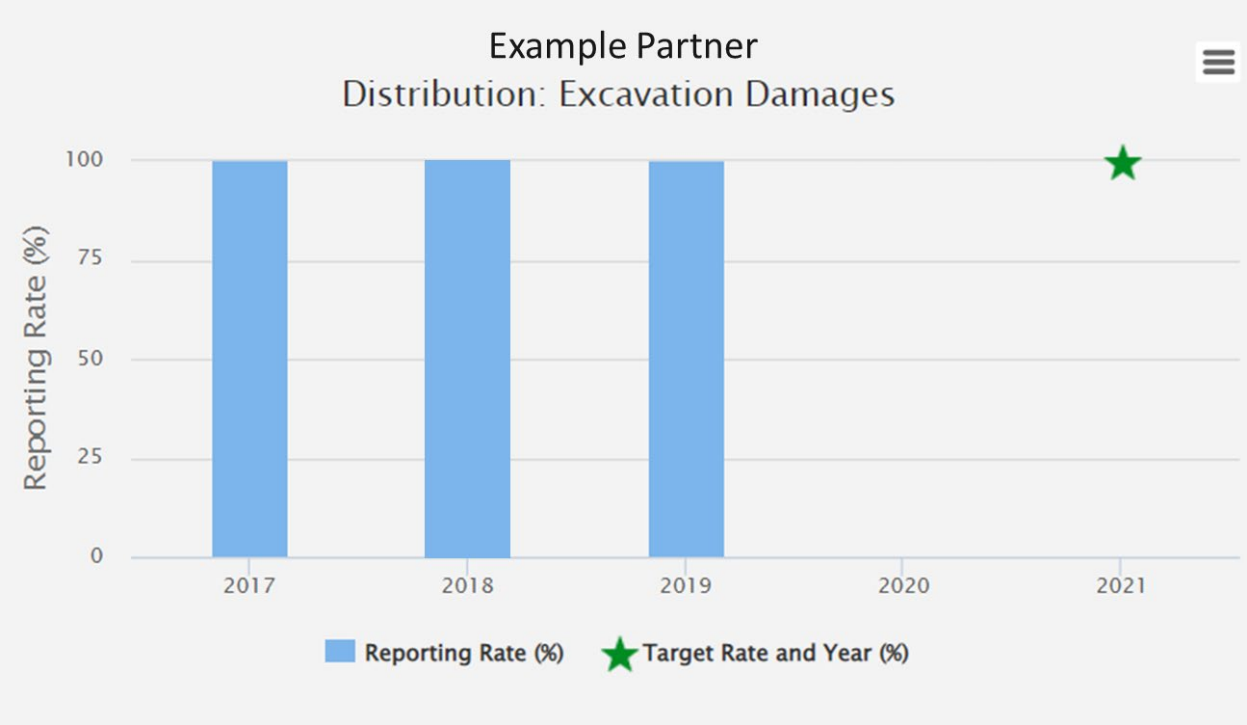
1. Introduction

This document describes how EPA analyzes Partner-submitted data to calculate the program 'accomplishments', specifically, the partner commitment progress metrics shown on each Partner Profile webpage (Figure 1) as well as Methane Challenge program-level methane reductions.

Figure 1. Example Partner Commitment Progress Graph for an Excavation Damages Commitment



This document does not describe how Methane Challenge Partners calculate the data they report to EPA. Those calculation methods are detailed in the Methane Challenge Technical Documents (https://www.epa.gov/natural-gas-star-program/methane-challenge-program-technical-documents).

The intended audience of this document is users of the Methane Challenge Partner Profile and Accomplishments webpages, particularly those who use the program datasets (available at: https://www.epa.gov/natural-gas-star-program/methane-challenge-program-accomplishments#dataDownloads). The business rules and calculations outlined in this document ensure data are analyzed in a consistent, reproducible manner.

2. Dataset Business Rules

a. Converting Methane Emissions to Carbon Dioxide Equivalents

Methane Challenge uses a GWP of 25 to convert metric tons of methane to metric tons of carbon dioxide equivalents. See this webpage for more information: https://www.epa.gov/ghgemissions/understanding-global-warming-potentials#Learn%20why

b. Estimating Dollars Saved

Methane Challenge provides a high-level estimate of the monetary value of the methane not emitted by Partner companies (that is, the value of their reductions). To calculate this value, Methane Challenge:

1. Calculates the average of daily Henry Hub spot prices during the most recent year (from the U.S. Energy Information Administration-EIA[a]); these data are provided in dollars per million Btu ($/MMBtu).
2. The program then converts the $/MMBtu value to dollars per thousand cubic feet natural gas ($/mcf) using the "U.S. annual average heat content of natural gas delivered to consumers" (MMBtu/mcf) value provided by EIA for the year[b] .
3. The program then rounds the $/mcf value to the nearest dollar.
4. The program converts the $/mcf value to dollars per metric ton of methane ($/MT CH_4)[c] using the density of methane at standard conditions (60 °F and 14.7 psia) – 0.0192 kg/ft^3 (which is equivalent to metric tons methane/mcf methane)[d].
5. This $/MT CH_4 value is finally multiplied by the partner-reported reductions (MT CH_4).

c. Avoiding Double Counting

Due to the way a few Partners structured their commitments in the program, when creating program-level summary statistics, data should be filtered to ***not include*** BMP data from the Partners with MC Partner ID MC001, MC003, MC004, MC005, and MC031.[e]

3. Data Resubmission Policy

Each reporting season, Methane Challenge's reporting system supports the submission of:

- Data for the 'current reporting year'
    - Example: in 2022, Methane Challenge will collect data from calendar year 2021; 2021 would be the 'current reporting year'
- Resubmissions of data from up to five years prior to the 'current reporting year'
    - Example: in 2022, Methane Challenge will accept resubmission of 2020, 2019, 2018, 2017, and 2016 calendar year data

When EPA analyses and publishes the data from each reporting season, it will analyze and publish all submissions received that reporting season, including resubmissions (e.g., in 2022, Methane Challenge will publish 2021 data as well as any resubmitted 2016-2020 data).

4. Data Structure and Nomenclature

EPA publishes partner-reported Methane Challenge data on the Methane Challenge Accomplishments page each year. The data are published in an Excel workbook and there is a separate workbook for each

[a] https://www.eia.gov/dnav/ng/hist/rngwhhdD.htm
[b] https://www.eia.gov/tools/faqs/faq.php?id=45&t=8
[c] Because this is meant to be a high-level estimate, the program does not convert from mcf natural gas to mcf methane given the variability in the methane content of natural gas.
[d] Subpart W § 98.233(u)(2)(v) (Eq. W-36)
[e] The data for NiSource subsidiaries MC001, MC003, MC004, and MC005 are also included in the data for NiSource, MC012. The BMP data for National Grid, MC031, are also included in the ONE Future data for National Grid, MC054.

commitment option (i.e., Best Management Practice and ONE Future). An additional Excel workbook, the 'data dictionary', accompanies each dataset to explain the data structure and every single data element in the dataset.

Methane Challenge data are organized by methane emission source (e.g., Pneumatic Controllers, Distribution Mains, etc.). For many emission sources, all data elements will be in a single tab of the workbook (e.g., Pneumatic Controllers). A few emission sources have multiple calculation methodologies (e.g., storage tanks) or include data at multiple levels of granularity (e.g., reciprocating and centrifugal compressors). These sources will have multiple tabs in the data download.

Within the data downloads, each row, or record, typically contains the data for a single reporting year and facility. There are two exceptions to this:

1. BMP Compressor data: In the compressor-level and vent-level tabs, each row corresponds to a reporting year, facility and compressor or vent, respectively
2. BMP Storage tank data: On the calculation methodology tabs, each row corresponds to a reporting year, facility, and sub-basin (Production) or county/state (Gathering & Boosting).

When explaining the logic for each metric calculation, this document will use the following notation/nomenclature:

Nomenclature	Definition
Reporting season	The year during which EPA collects data (e.g., in fall 2021, EPA collected partner data from 2020; this was "reporting season 2021")
Reporting year	The year during which a company's actions/activities took place (e.g., in fall 2021, partners reported their voluntary actions implemented in 2020; these are "reporting year 2020" data)
tabName$columnName	Representation of a data element in the data download that indicates which tab (*tabName*) the data element is on and, on that tab, which column it is in (*columnName*). The data dictionaries provide more detail on each of these data elements.
nrow	Number of rows
==	Logical operator to test if two things are equal

5. Partner Commitment Progress

BMP Commitment Progress

There will be a progress metric for each BMP commitment a partner makes. The definition/calculation of this metric varies by emission source. The metric calculation methodology for each emission source is described in the following sections. This document currently includes only emission sources that were reported on for calendar years 2016-2020.

For ALL emission sources, the data should be aggregated over:

- Reporting Year
- Partner (i.e., facility-level data must be aggregated to the partner level)

Most emission source commitments are structured such that a Partner would need to implement a BMP annually to fulfill its commitment (e.g., route gas from all storage tanks to vapor recovery every year;

reduce emissions from planned pipeline blowdowns by a certain amount every year; etc.). The progress metrics for these sources are thus 'annual' metrics and a Partner's commitment progress metric for a given year is based on voluntary actions from that year. The exception to this is when a BMP entails replacing equipment, as is the case for pneumatic controllers. For these emission sources, a BMP can only be applied to each source once, so this is a 'cumulative' metric. For a cumulative metric, the commitment achievement rate for a given year is based on the number of devices the Partner had when they joined the program (unless the Partner installs new high bleed pneumatic devices mid-commitment, which the program checks for) and *voluntary actions from that year and all previous years*.

Unless otherwise stated in the methodologies in this document, EPA uses data from a given year to calculate a Partner's progress rate for that year (e.g., to calculate 2017 blowdowns progress, EPA uses voluntary action data from 2017). Throughout this document we've used yellow highlighting to point out any time the metric requires looking at data from years other than the given year.

About the ONE Future Emission Intensity Rates

These values are the purview of ONE Future; EPA does not calculate them. Partners that wish to share their company's intensity rate on their Methane Challenge Partner Profile Page send their ONE Future-calculated emissions intensity rates to EPA.

a. Pneumatic Controllers

The commitment:

Under the Methane Challenge, this source focuses on continuous high-bleed controllers (i.e., those with a natural gas bleed rate greater than 6 standard cubic feet (scf) per hour). Partners commit to implement one or more of the following Methane Challenge mitigation options on all high-bleed pneumatic controllers included in their commitments, by the company's designated commitment achievement date.

- Utilize natural gas-actuated pneumatic controllers with a continuous bleed rate less than or equal to 6 scf of gas per hour ("low-bleed" controller), or
- Utilize zero emitting controllers (e.g., instrument air, solar, electric, or mechanical controllers), or
- Remove natural gas pneumatics controllers from service with no replacement

The metric:

- Data in tab *Pneumatic_Devices*
- Metric Calculation

$$\frac{\text{cumulative count of high bleed controllers converted or removed from service}}{\text{total count of high bleed controllers}} * 100$$

- For a given year, the Metric Numerator equals the cumulative replacements/removals of high bleeds reported by the partner, through that year
    - For year of interest and all previous years:
        - Sum(PNEUM_TS_HIGHTOLOW_COUNT + PNEUM_TS_HIGHTOZERO_COUNT)
- Metric Denominator – total count of high bleed pneumatic controllers
    - This count should include all high-bleed pneumatic controllers the company started with and any new devices the company installed while in the program (minus any the company claimed an operational exemption for) up to the year for which we are calculating the metric

b. Fixed Roof, Atmospheric Pressure Hydrocarbon Liquid Storage Tanks

The commitment:

Partners commit to implement one or more of the following Methane Challenge mitigation options on all atmospheric pressure fixed roof storage tanks included in their commitment, by their designated commitment achievement date.

- Route gas to a capture system (e.g., a vapor recovery unit or VRU) for beneficial use to achieve at least a 95% reduction in methane emissions, or
- Route gas to a flare or control device to achieve at least a 95% reduction in methane emissions.

The metric:

- Data in tabs - *Storage_Tanks_Calc1_2* and *Storage_Tanks_Calc3*
    - *NOTE – in these tabs, each record/row corresponds to a subbasin (production) or county/state (gathering and boosting); a facility can have several records in either tab for each year*
- Metric Calculation

$$\frac{\text{annual count of storage tanks with a BMP}}{\text{annual count of all storage tanks}} * 100$$

- Metric Numerator – for a given year, count of tanks with a BMP applied

```
Sum(Storage_Tanks_Calc1_2$AST_CALC1OR2_COUNT_VRU +
    Storage_Tanks_Calc1_2$AST_CALC1OR2_COUNT_FLARING)
+
Sum(Storage_Tanks_Calc3$AST_CALC3_COUNT_VRU +
    Storage_Tanks_Calc3$AST_CALC3_COUNT_FLARING)
```

- Metric Denominator – for a given year, count of all tanks

```
Sum(Storage_Tanks_Calc1_2$AST_CALC1OR2_COUNT_VENTING +
    Storage_Tanks_Calc1_2$AST_CALC1OR2_COUNT_VRU +
    Storage_Tanks_Calc1_2$AST_CALC1OR2_COUNT_FLARING)
+
Sum(Storage_Tanks_Calc3$AST_CALC3_COUNT_VENTING +
    Storage_Tanks_Calc3$AST_CALC3_COUNT_VRU +
    Storage_Tanks_Calc3$AST_CALC3_COUNT_FLARING)
```

- Note that beginning in reporting year 2021 (i.e., data to be collected in 2022), EPA is adding a data element for partners to report on the total number of tanks each year. This will replace the metric denominator for 2021 data and beyond.

c. Reciprocating Compressors - Rod Packing Vent—Gathering & Boosting

The commitment:

Partners commit to implement one or more of the following Methane Challenge mitigation options on all reciprocating compressor rod packing/rod packing vents included in their commitment, by their designated commitment achievement date.

- Replace the reciprocating compressor rod packing every 26,000 hours of operation, or
- Replace the reciprocating compressor rod packing prior to every 36 months, or
- Route rod packing vent to a capture system for beneficial use to achieve at least a 95% reduction in methane emissions, or
- Route rod packing vent to flare or control device to achieve at least a 95% reduction in methane emissions.

The metric:

- Data in tabs *GB_RecipComp_Summary* and *GB_RecipComp_CompLevel*
- *NOTE – in the 'CompLevel' tab, each record/row corresponds to a compressor unit; a facility can have several records in this view for each year*
- The current structure of the data collection from this source does not allow for a compressor-by-compressor check of "BMP implementation". EPA can (and does) check each individual compressor to see if has the rod packing replacement BMP implemented, however, to incorporate data on the BMPs that route the gas to flare or VRUs, EPA must use the summary data. In this way, we cannot prevent potential double counting of compressors with BMPs applied (e.g., if a compressor is both having its rod packing replaced *and* vented gas is routed to VRU). Thus, if the calculated progress metric exceeds 100%, we set the progress metric to 100%.
- Note that beginning in reporting year 2020, EPA is adding a data element that will allow us to track BMP implementation at the compressor level. This will allow us to calculate the progress metric for Gathering and Boosting compressors similar to how we calculate it for Processing and Transmission & Storage compressors on the next page.
- Metric Calculation

$$\frac{\text{annual count of recip compressors with a BMP applied}}{\text{annual count of all recip compressors}} * 100$$

- Metric Numerator – count of compressors with a BMP applied in a given year

  nrow(GB_RecipComp_Summary), **where**:

  RCOMP_GB_ISPACKINGREPLACED == "Yes"

  PLUS

  GB_RecipComp_Summary$RCOMP_GB_COUNT_TOFLARE

  PLUS

  GB_RecipComp_Summary $RCOMP_GB_COUNT_PACKINGREPLACED

- Metric Denominator – count of reciprocating compressors

  nrow(GB_RecipComp_Summary)

- *If progress exceeds 100%, set progress to 100%*

d. Reciprocating Compressors - Rod Packing Vent— Processing and Transmission & Storage

The commitment:

Partners commit to implement the one or more of the following Methane Challenge mitigation options on all reciprocating compressor rod packing/rod packing vents included in their commitment, by their designated commitment achievement date.

- Replace the reciprocating compressor rod packing every 26,000 hours of operation, or
- Replace the reciprocating compressor rod packing prior to every 36 months, or
- Route rod packing vent to a capture system for beneficial use to achieve at least a 95% reduction in methane emissions, or
- Route rod packing vent to flare or control device to achieve at least a 95% reduction in methane emissions.

The metric:

- Data in tab - *RecipComp_CompLevel*
    - *NOTE – in this tab, each record/row corresponds to a compressor unit; a facility can have several records in this view for each year*
- Metric Calculation

$$\frac{\text{annual count of recip compressors with a BMP}}{\text{annual count of all recip compressors}} * 100$$

- Metric Numerator – for a given year, count of reciprocating compressors with a BMP

    nrow(RecipComp_CompLevel), **where**:

    RCOMP_TS_COMPVENT_LOCATION=="Vapor Recovery"
    OR
    RCOMP_TS_COMPVENT_LOCATION=="Combustion (fuel or thermal oxidizer)"
    OR
    RCOMP_TS_COMPVENT_LOCATION=="Flare"
    OR
    RCOMP_TS_ISPACKINGREPLACED=="Yes"

- Metric Denominator – for a given year, count of reciprocating compressors

    nrow(RecipComp_CompLevel)

e. Centrifugal Compressors -- Venting

The commitment:

Partners commit to implement one or more of the following Methane Challenge mitigation options on all centrifugal compressors with wet seals included in their commitment, by their designated commitment achievement date.

- Route wet seal degassing to a capture system for beneficial use to achieve at least a 95% reduction in methane emissions, or
- Route wet seal degassing to flare or control device to achieve at least a 95% reduction in methane emissions, or
- Convert wet seals to dry seals or use centrifugal compressors with dry seals.

The metric:

- Data in tab - *TS_CentComp_CompLevel*
    - *NOTE – in this tab, each record/row corresponds to a compressor unit; a facility can have several records in this tab for each year*
- Metric Calculation

$$\frac{\text{annual count of centrifugal compressors with a BMP}}{\text{annual count of all centrifugal compressors}} * 100$$

- Metric Numerator – for a given year, count of centrifugal compressors with a BMP

nrow(TS_CentComp_CompLevel), **where**:
TS_CentComp_CompLevel$CCOMP_TS_COMPVENT_LOCATION =="Flare"
OR
TS_CentComp_CompLevel$CCOMP_TS_COMPVENT_LOCATION =="Vapor Recovery"
OR
TS_CentComp_CompLevel$CCOMP_TS_COMPVENT_LOCATION =="Combustion (fuel or thermal oxidizer)"

- Metric Denominator – for a given year, count of reciprocating compressors

nrow(TS_CentComp_CompLevel)

f. Transmission Pipeline Blowdowns between Compressor Stations

The commitment:

Partners commit to reduce methane emissions from non-emergency blowdowns by at least 50% from total potential emissions[f] each year by using one or more of the mitigation options listed below.

- Route gas to a compressor or capture system for beneficial use, or
- Route gas to a flare, or
- Route gas to a low-pressure system by taking advantage of existing piping connections between high- and low-pressure systems, temporarily resetting or bypassing pressure regulators to reduce system pressure prior to maintenance, or installing temporary connections between high and low-pressure systems, or
- Utilize hot tapping, a procedure that makes a new pipeline connection while the pipeline remains in service, flowing natural gas under pressure, to avoid the need to blow down gas.

The metric:

- Data in tab - *Transmission_Blowdowns*
- Metric Calculation

$$\frac{\text{annual emission reductions}}{\text{annual potential emissions}} * 100$$

- Metric Numerator – emission reductions

  Transmission_Blowdowns$T_BLOWDOWNS_EMISSIONREDUCTIONS

- Metric Denominator – potential emissions

  Transmission_Blowdowns$T_BLOWDOWNS_POTENTIALEMISSIONS

[f] Total potential emissions equal calculated emissions from all planned maintenance activities in a calendar year, assuming the pipeline is mechanically evacuated or mechanically displaced using non-hazardous means down to atmospheric pressure and no mitigation is used.

g. Distribution Pipeline Blowdowns

The commitment:

Partners commit to reduce methane emissions from non-emergency blowdowns of pipelines operating greater than 60 psi by at least 50% from total potential emissions[g] each year by using one or more of the mitigation options listed below.

- Route gas to a compressor or capture system for beneficial use, or
- Route gas to a flare, or
- Route gas to a low-pressure system by taking advantage of existing piping connections between high- and low-pressure systems, temporarily resetting or bypassing pressure regulators to reduce system pressure prior to maintenance, or installing temporary connections between high and low pressure systems, or
- Utilize hot tapping, a procedure that makes a new pipeline connection while the pipeline remains in service, flowing natural gas under pressure, to avoid the need to blow down gas, or
- Use stopoff/stopple equipment and fittings to reduce the length of pipe and the associated volume of gas being blown down.

The metric:

- Data in tab - *Distribution_Blowdowns*
- Metric Calculation

$$\frac{\text{annual emission reductions}}{\text{annual potential emissions}} * 100$$

- Metric Numerator – emission reductions

Distribution_Blowdowns$D_BLOWDOWNS_EMISSIONREDUCTIONS

- Metric Denominator – potential emissions

Distribution_Blowdowns$D_BLOWDOWNS_POTENTIALEMISSIONS

[g] Total potential emissions equal calculated emissions from all planned maintenance activities in a calendar year, assuming the pipeline is mechanically evacuated or mechanically displaced using non-hazardous means down to atmospheric pressure and no mitigation is used.

h. Mains - Cast Iron & Unprotected Steel

The commitment:

Partners commit to replace or rehabilitate cast iron and unprotected steel mains at an annual rate they designate, using one or more of the mitigation options listed below.

- Replace cast iron mains with plastic or cathodically protected steel and replace or cathodically protect unprotected steel mains, or
- Rehabilitate cast iron and unprotected steel pipes with plastic pipe inserts, also referred to as sliplining or u-liners, or cured-in-place liners

The metric:

- Data in tab - *Mains*
- Cast Iron = CI; Unprotected Steel = UPS
- Metric Calculation

$$\frac{\text{annual miles of CI and UPS mains replaced}}{\text{initial inventory of CI and UPS mains (miles)}} * 100$$

- Metric Numerator – miles of CI and UPS mains replaced in current year

  Mains$MAINS_CI_REPLACE_PLASTIC +

  Mains$MAINS_CI_REPLACE_PS +

  Mains$MAINS_CI_RECOND_LINERS +

  Mains$MAINS_CI_RETIRED +

  Mains$MAINS_UPS_REPLACE_PS +

  Mains$MAINS_UPS_REPLACE_PLASTIC +

  Mains$MAINS_UPS_REHAB_LINERS +

  Mains$MAINS_UPS_RETIRED

- Metric Denominator – initial inventory of CI and UPS mains (miles) when the Partner joined
  - Find the year the partner most recently reported, and use the values reported in these columns when calculating the metric for all years

    Mains$MAINS_INTIALINV_UPS +

    Mains$MAINS_INTIALINV_CASTIRON

i. Services - Cast Iron & Unprotected Steel

The commitment:

At a minimum, Partners commit to replace or rehabilitate cast iron and unprotected steel services using one or more of the mitigation options listed below when the main is replaced or rehabilitated. Partners do not set a target replacement rate for services in the Methane Challenge Program.

- Replace unprotected steel and cast iron services with copper, plastic, or protected steel that meet the manufacturing requirements and qualifications provided in 49 CFR Part 192, Subpart B67, or
- Rehabilitate cast iron and unprotected steel services with plastic pipe inserts or liners

The metric:

- EPA calculates and publishes Partners' annual services replacement rate though Partners do not set a target replacement rate for services as explained above.
- Data in tab – *Services*
- Cast Iron = CI; Unprotected Steel = UPS
- Metric Calculation

$$\frac{\text{annual count of CI and UPS services replaced}}{\text{inital inventory of CI and UPS services (count)}} * 100$$

- Metric Numerator – count of CI and UPS services replaced in current year

  Services$SERVICES_CI_REPLACE_PLASTIC +

  Services$SERVICES_CI_REPLACE_STEEL +

  Services$SERVICES_CI_REPLACE_COPPER +

  Services$SERVICES_CI_RECOND_LINERS +

  Services$SERVICES_UPS_REPLACE_PS +

  Services$SERVICES_UPS_REPLACE_PLASTIC +

  Services$SERVICES_UPS_REPLACE_COPPER +

  Services$SERVICES_UPS_REHAB_LINERS

- Metric Denominator – initial inventory of CI and UPS services when the Partner joined
  - Find the year the partner most recently reported, and use the values reported in these columns when calculating the metric for all years

  Services$SERVICES_INTIALINV_UPS +

  Services$SERVICES_INTIALINV_CASTIRON

- Note that beginning in reporting year 2021, EPA is adding data elements for partners to report on retiring cast iron and unprotected steel services without replacement. These will be included in the metric numerator for 2021 data and beyond.

j. Excavation Damages

The commitment:

Partners commit to report all Methane Challenge excavation damages data elements annually by their designated commitment achievement date.

The metric:

- Data in tab - *Excavation_Damages*
- Metric Calculation

$$\frac{\text{annual count of data categories completely reported}}{\text{annual count of data categories}} * 100$$

- The excavation damages data set is grouped into 9 categories. To calculate this metric, EPA checks if a Partner has completed reporting for each of the following categories for each facility reporting on excavation damages in a given year:
    - Total Damages
    - Damages per 1000 locate calls
    - Damages resulting in release of natural gas
    - Damages resulting in pipeline shutdown
    - Damages where prior notification was given
    - Damages fully categorized by pipeline type and system part
    - Damages fully categorized by cause
    - Damages fully categorized by root cause
    - Actions taken to minimize excavation damages/reduce methane emissions from excavation damages
- Note that categorization by pipeline class is optional, so these data elements are not included in the metric calculation.
- Metric Numerator – data categories completely reported

    Count of categories completely reported

    Completely reported is defined as follows for each category and should be evaluated for each reporting year, for each facility reporting on excavation damages:

    - Total Damages *completely reported* IF

        EXDAMAGES_TOTALDAMAGES is not blank

    - Damages per 1000 locate calls *completely reported* IF

        EXDAMAGES_PERKLOCATECALLS is not blank

    - Damages resulting in release of natural gas *completely reported* IF

        EXDAMAGES_RELEASEOFNATGAS is not blank

    - Damages resulting in pipeline shutdown *completely reported* IF

        EXDAMAGES_RESULTEDINSHUTDOWN is not blank

- Damages where prior notification was given *completely reported* IF

  EXDAMAGES_GIVENPRIORNOTICE is not blank

- Damages fully categorized by pipeline type and system part *completely reported* IF

  sum(
  EXDAMAGES_STEEL_MAIN, EXDAMAGES_STEEL_SERVICE,
  EXDAMAGES_STEEL_INSIDEMR, EXDAMAGES_STEEL_OTHER,
  EXDAMAGES_CASTIRON_MAIN, EXDAMAGES_CASTIRON_SERVICE,
  EXDAMAGES_CASTIRON_INSIDEMR, EXDAMAGES_CASTIRON_OTHER,
  EXDAMAGES_COPPER_MAIN, EXDAMAGES_COPPER_SERVICE,
  EXDAMAGES_COPPER_INSIDEMR, EXDAMAGES_COPPER_OTHER,
  EXDAMAGES_PLASTIC_MAIN, EXDAMAGES_PLASTIC_SERVICE,
  EXDAMAGES_PLASTIC_INSIDEMR, EXDAMAGES_PLASTIC_OTHER,
  EXDAMAGES_OTHER_MAIN, EXDAMAGES_OTHER_SERVICE,
  EXDAMAGES_OTHER_INSIDEMR, EXDAMAGES_OTHER_OTHER
)

  IS GREATER THAN OR EQUAL TO

  EXDAMAGES_TOTALDAMAGES

- Damages fully categorized by cause *completely reported* IF

  sum(
  EXDAMAGES_CAUSEBY_CONTRACTOR, EXDAMAGES_CAUSEBY_RAILROAD,
  EXDAMAGES_CAUSEBY_COUNTY, EXDAMAGES_CAUSEBY_STATE,
  EXDAMAGES_CAUSEBY_DEVELOPER, EXDAMAGES_CAUSEBY_FARMER,
  EXDAMAGES_CAUSEBY_UTILITY, EXDAMAGES_CAUSEBY_MUNCIPALITY,
  EXDAMAGES_CAUSEBY_OCCUPANT,
  EXDAMAGES_CAUSEBY_UNKNOWNOTHER
)

  IS GREATER THAN OR EQUAL TO

  EXDAMAGES_TOTALDAMAGES

- Damages fully categorized by root cause *completely reported* IF

  sum(
  EXDAMAGES_ROOT_OCNINSUFF, EXDAMAGES_ROOT_LOCATEINSUFF,
  EXDAMAGES_ROOT_EXCAPRACINSUFF,
  EXDAMAGES_ROOT_OCNCENTERERROR,
  EXDAMAGES_ROOT_ABANDONEDFAC,
  EXDAMAGES_ROOT_DETERIORATEDFAC,
  EXDAMAGES_ROOT_PREVIOUSDAMAGE, EXDAMAGES_ROOT_OTHERMISC
)

  IS GREATER THAN OR EQUAL TO

  EXDAMAGES_TOTALDAMAGES

- Actions taken to minimize excavation damages/reduce methane emissions from excavation damages *completely reported* IF
    i. EXDAMAGES_ACTIONSTOMINIMIZE is not blank

- Metric Denominator – data categories

  Total number of categories (i.e., 9) * Number of partner facilities reporting on excavation damages that year

6. BMP Emission Reductions

- Calculating the total methane reductions reported by BMP partners is straight-forward but note that the reductions data are included in separate tabs across the data download file for each emission source.
- Also note that there are no emission reductions reported for Excavation Damages. As explained in the BMP Technical Document, the program does not request quantification of emissions/reductions from Excavation Damages due to the lack of a quantification methodology that would result in consistent, comparable emissions calculations.
- The business rules described in Section 2 should be applied to the reduction calculations.
- The data can be aggregated in multiple ways, depending on the analyst's interests (e.g., reductions by emission source, reductions by partner, etc.).

The metric:

- Total BMP reductions are calculated as the sum of the data download columns listed in "Reductions Data Element" below:

Emission Source	Reductions Data Element
Pneumatic Devices	Pneumatic_Devices$PNEUM_TS_EMISSIONREDUCTIONS
Storage Tanks	Storage_Tanks_Summary$ AST_EMISSIONREDUCTIONS
Gathering & Boosting Reciprocating Compressors	GB_RecipComp_Summary$RCOMP_GB_EMISSIONREDUCTIONS
Processing and Transmission & Storage Reciprocating Compressors	RecipComp_Summary $RCOMP_TS_EMISSIONREDUCTIONS
Processing and Transmission & Storage Centrifugal Compressors	TS_CentComp_Summary$CCOMP_TS_EMISSIONREDUCTIONS
Transmission Pipeline Blowdowns Between Compressor Stations	Transmission_Blowdowns $T_BLOWDOWNS_EMISSIONREDUCTIONS
Distribution Mains	Mains$MAINS_EMISSIONREDUCTIONS
Distribution Services	Services$SERVICES_EMISSIONREDUCTIONS
Distribution Pipeline Blowdowns	Distribution_Blowdowns$D_BLOWDOWNS_EMISSIONREDUCTIONS

- Calculation for Total BMP Reductions:

```
Sum(
        Pneumatic_Devices$PNEUM_TS_EMISSIONREDUCTIONS,
        Storage_Tanks_Summary$ AST_EMISSIONREDUCTIONS,
        GB_RecipComp_Summary$RCOMP_GB_EMISSIONREDUCTIONS,
        RecipComp_Summary $RCOMP_TS_EMISSIONREDUCTIONS,
        TS_CentComp_Summary$CCOMP_TS_EMISSIONREDUCTIONS,
        Transmission_Blowdowns $T_BLOWDOWNS_EMISSIONREDUCTIONS,
        Mains$MAINS_EMISSIONREDUCTIONS,
        Services$SERVICES_EMISSIONREDUCTIONS,
        Distribution_Blowdowns$D_BLOWDOWNS_EMISSIONREDUCTIONS
)
```

7. ONE Future Emission Reductions

- Calculating the total methane reductions reported by ONE Future Partners is straight-forward as all reductions, by reporting year/facility/emission source, are in the TOC tab of the ONE Future data download.
- The business rules described in Section 2 should be applied to the reduction calculations.
- The data can be aggregated in multiple ways, depending on the analyst's interests (e.g., reductions by emission source[h], reductions by partner, etc).

The metric:

- Total ONE Future reductions are calculated as the sum of this column:

  Sum(toc$CH4_EMISSIONS_REDUCTIONS)

[h] Note that for Distribution Mains and Services, the number in the table of contents ("toc") tab is the total reductions from Mains and Services; to calculate reductions from these two sources separately, one would need to use data from distmainsservices_actions$DISTMS_CH4_REDUCTIONS_MAINS (Mains reductions) and distmainsservices_actions$DISTMS_CH4_REDUCTIONS_SERVICES (Services reductions)