Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2019: Updates Under Consideration for Natural Gas Customer Meter Emissions

This memorandum discusses updates under consideration for the 2021 *U.S. Inventory of U.S. Greenhouse Gas Emissions and Sinks* (GHGI) for industrial and commercial meters.

1 Current GHGI Methodology

EPA most recently updated the GHGI emissions calculation methodology for industrial and commercial meters in the 2016 GHGI by incorporating findings from a Gas Technology Institute (GTI) 2009 study[1] to estimate emissions. EPA's April 2016 memo *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2014: Revisions to Natural Gas Distribution Emissions*[2] documents the historical considerations and the full methodology used for industrial and commercial meters in the current GHGI.

In the current GHGI, EPA estimates industrial and commercial meter emissions using Energy Information Administration (EIA) meter counts in each year paired with the GTI 2009 study commercial meter emission factor (EF) of 9.7 kg/meter/yr for both commercial and industrial meter types.[3] EPA applied the commercial meter EF to both commercial and industrial meters due to the limitations of available industrial meters data for revising EFs and based on stakeholder feedback.

2 Available Data

Two available data sources, 2009 and 2019 studies from GTI, include emissions data for industrial and commercial meters.

The current emission factors in the GHGI come from a 2009 report by GTI and Innovative Environmental Solutions for Operations Technology Development (OTD) that investigated methane emission factors for select distribution sources (GTI 2009).[1] The emission sources included both metering and regulating (M&R) stations and customer meters. The GTI 2009 study conducted sampling of customer meters using screening and Hi-Flow Samplers to quantify total emissions from leaks and vents. The GTI 2009 study sampled 836 commercial meters at six companies and 46 industrial meters at five companies in five geographical regions across the United States. The study included both leak and vented emissions. An average EF was determined for each company and an overall average EF was then calculated based on the number of meters tested for each company.

[1] Gas Technology Institute and Innovative Environmental Solutions, *Field Measurement Program to Improve Uncertainties for Key Greenhouse Gas Emission Factors for Distribution Sources*, November 2009. GTI Project Number 20497. OTD Project Number 7.7.b.
[2] Available at <https://www.epa.gov/sites/production/files/2016-08/documents/final_revision_ng_distribution_emissions_2016-04-14.pdf>
[3] EIA defines the industrial sector as, "An energy-consuming sector that consists of all facilities and equipment used for producing, processing, or assembling goods… Overall energy use in this sector is largely for process heat and cooling and powering machinery, with lesser amounts used for facility heating, air conditioning, and lighting. Fossil fuels are also used as raw material inputs to manufactured products. This sector includes generators that produce electricity and/or useful thermal output primarily to support the above-mentioned industrial activities." EIA considers the commercial sector to include "service-providing facilities and equipment of businesses; Federal, State, and local governments; and other private and public organizations, such as religious, social, or fraternal groups. The commercial sector includes institutional living quarters. It also includes sewage treatment facilities. Common uses of energy associated with this sector include space heating, water heating, air conditioning, lighting, refrigeration, cooking, and running a wide variety of other equipment. Note: This sector includes generators that produce electricity and/or useful thermal output primarily to support the activities of the above-mentioned commercial establishments." https://www.eia.gov/tools/glossary/index.php?id=I

The 2019 GTI study[4] conducted sampling of customer meter sets using a combustible gas indicator (CGI) to screen for leaks and Hi-Flow Samplers to measure leak rates. Meter sets are defined as "the meter plus all components associated with that meter up to the point of transfer of hardware responsibility to the [gas] customer." This would include valves, flanges, tees, and other additional components associated with a meter. All components at a meter set were first scanned with the CGI to locate all leak indications with a concentration of at least 100 ppm. Depending on the campaign, leaks were then determined to be quantifiable when above either 22,500 ppm or 100 ppm. To quantify leak rates at the lower concentration threshold of 100 ppm, an ultraportable greenhouse gas analyzer (UGGA) was incorporated into the Hi-Flow Sampler to increase its measurement sensitivity. For eight of the thirteen campaigns, only leaks with indications above 22,500 ppm were quantified. For the remaining five campaigns, leaks above 100 ppm were quantified. Leaks that did not meet the concentration threshold of the campaign were not measured and quantified. Meters with a quantifiable leak were then measured using Hi-Flow Samplers. Unlike the 2009 study, the 2019 study only screened for leak emissions; vented emissions from regulators, pneumatic devices, or other sources were not included unless they were malfunctioning. An example of a malfunction included in the 2019 study would be a valve stuck in a position different from the intended vent position. The study sampled 186 meters at industrial locations and 337 meters at commercial sites in six geographic regions across the United States. An average EF was determined for each region as well as for the total population of commercial or industrial meters. The 2019 study also estimated leaker-only EFs and EFs specific to each meter type (rotary, diaphragm, etc.). Appendix B provides an overview of both the 2009 and 2019 study designs.

The GTI 2019 commercial meter EF (leaks only) is six times higher than the GTI 2009 study (which included both leaks and venting emissions). The 2009 value was quantified from a survey of 836 commercial meters, while the 2019 study surveyed 337 meters. GTI 2009 quantified an EF for industrial meters leaks and venting emissions that is higher than what was quantified by GTI 2019 for only leak emissions. The 2009 study surveyed 46 industrial meters, while the 2019 study surveyed 186. The small sample size of the GTI 2009 study and the wide variation observed among industrial meters led EPA to use the commercial EF for both commercial and industrial meter emissions estimates in 2016.

3 Analysis of Available Data

This section summarizes EPA's analyses of the recently published GTI 2019 study and considerations toward using data from either or both the 2009 and 2019 GTI studies to update the customer meters methodology in the 2021 GHGI.

3.1 GTI 2019 Study

GTI 2019 presented multiple approaches for calculation of national emissions for potential use in the GHGI. Each approach is discussed in the following sections.

3.1.1 Population Emission Factors

GTI 2019 measured emissions rates at commercial and industrial meters in six regions across the country and calculated population EFs from the complete population of data. Meters that did not have a quantifiable leak, at the threshold used for each measurement campaign, were considered to have zero emissions in the population EF calculation. GTI found that adding the non-quantified leaks (e.g., leaks with a concentration less than 22,500 ppm but the particular measurement campaign was only quantifying leaks greater than 22,500 ppm) had a negligible impact on the mean population emission rate. Of the meter sets sampled, 82 percent of commercial meters and 87 percent of industrial meters were found to be leaking. Of those meter sets with

[4] Gas Technology Institute and US Department of Energy, *Classification of Methane Emissions from Industrial Meters, Vintage vs Modern Plastic Pipe, and Plastic-lined Steel and Cast-Iron Pipe.* June 2019. GTI Project Number 22070. DOE project Number ED-FE0029061.

leaks, 53 percent of commercial meters with leaks and 49 percent of industrial meters with leaks had quantifiable leaks. In the 2019 study, GTI recommends EPA use separate EFs for commercial and industrial meters. Table 1 presents the study's population EFs and sampling data.

Table 1. GTI 2019 Commercial and Industrial Meter Population CH_4 EFs and Sampling Data

Parameter	Commercial Meters	Industrial Meters
EF (kg/meter/yr)	57.4	117.8
# Meter Sets Sampled	337	186
# Meter Sets with Leak Indication	278	161
# Meter Sets with Quantifiable Leak	146	79

3.1.2 Regional Emission Factors

GTI 2019 conducted regional sampling of both commercial and industrial meters and found regional variation in EFs for both. Table 2 below shows the number of meter sets sampled and calculated EFs for each region. GTI recommends that EPA use regional EFs separated by commercial and industrial meter types. GTI stated that regional variation in EFs is in part due to differences in the main meter set type commonly used in a region. For example, in the Southeast region 75 percent of meters measured were turbine meters (which GTI found to have the highest emissions). Additionally, GTI noted it is possible that differences in leak identification and repair procedures in each region explain the variation. Their analysis found that the regions with the highest EFs also had the highest likelihood of finding a large leak.

Table 2. GTI 2019 Commercial and Industrial Meter Regional CH4 EFs (kg/meter/yr) and Sampling Data

Region	Commercial Meter Sets Sampled	Commercial Meter EF	Industrial Meter Sets Sampled	Industrial Meter EF
Midwest	99	28.4	77	52.3
Northeast	75	20	13	172.5
Pacific	63	4	52	17.4
Rocky Mountain	12	108.4	9	322.5
Southeast	5	139.3	15	291.7
Southwest	83	153.9	20	372.9
All	337	57.4	186	117.8

3.1.3 Leaker Emission Factors

In the 2019 study, GTI found that 43% of the meter sets sampled had a quantifiable leak. GTI's analysis found that the Pacific region had the highest likelihood of having no leaks or small leaks, and that the Rocky Mountain, Southeast, and Southwest regions had the highest likelihood of finding substantial leaks. This difference is reflected in the leaker EFs for these regions. Table 3 shows the leaker EFs by region.

Table 3. GTI 2019 Commercial and Industrial Meter Regional Leaker CH_4 EFs (kg/meter/yr) and Sampling Data

Region	Commercial Meter Sets with Quantifiable Leak	Commercial Meter Leaker EF	Industrial Meter Sets with Quantifiable Leak	Industrial Meter Leaker EF
Midwest	58	48.5	35	260.0
Northeast	20	75.1	6	564.9
Pacific	28	9.0	9	233.3

Region	Commercial Meter Sets with Quantifiable Leak	Commercial Meter Leaker EF	Industrial Meter Sets with Quantifiable Leak	Industrial Meter Leaker EF
Rocky Mountain	4	325.3	5	745.9
Southeast	4	174.1	15	707.1
Southwest	32	399.1	9	1045.8
All	146	132.4	79	277.4

3.2 Combined GTI 2009 and GTI 2019 Dataset

In addition to considering options that use the 2019 GTI dataset alone to update the GHGI, EPA is considering options to combine the results from both the 2009 and 2019 studies to develop weighted average population EFs. EPA used the number of samples in the respective studies to weight the EFs.

When considering both datasets, EPA evaluated leak versus vented emissions; the GTI 2009 study measured leak and vented emissions and the GTI 2019 study focused on leak emissions only. The inclusion of vented emissions leads to significantly higher industrial meter EFs in the GTI 2009 study compared with the 2019 study. The GTI 2009 study did not report leak and vented emissions separately for commercial meters. As the GTI 2009 commercial meter EF is lower than the GTI 2019 EF, vented emissions may not have a noticeable impact for commercial meters. Table 4 presents the commercial meter weighted average CH_4 EF.

Table 4. Commercial Meter Weighted Average Population CH_4 EF (kg/meter/yr)

Study	Data Points	Commercial Meter CH_4 EF
GTI 2009	836	9.73
GTI 2019	337	57.4
Weighted Average EF		**23**

As noted previously, industrial meter EFs from the GTI 2009 study were not incorporated in the 2016 GHGI customer meters updates, due to the limited sample size. EPA re-evaluated these data for the current analyses. Industrial meter emissions from "Company B" in the GTI 2009 data account for 95% of the total industrial meter emissions of the data set. The 2009 GTI study noted that the meter emissions measured for Company B are largely due to pneumatic controller vented emissions. GTI 2009 also noted that the meter type of Company B was similar to a metering and regulating station, versus a traditional meter (e.g., turbine, rotary).

EPA discussed vented versus leak emissions with the GTI 2019 study authors, and the authors noted that for the 2019 study data set (1) pneumatic controllers were not observed to be venting during the measurement campaigns and (2) some regulators were observed to be venting during the measurement campaigns but their emissions were variable and not quantified.

Table 5 presents the GTI 2009 industrial meters data, including the breakdown between leak and vented emissions. Table 6 presents the resulting industrial meter weighted average CH_4 EFs for the 2009 and 2019 GTI studies, including separate weighted average EFs for leak and vented emissions. The vented emissions EF presented in Table 6 incorporates the default assumption that vented emissions were zero during all GTI 2019 study measurements (i.e., it uses the data as-reported in each study). EPA is considering whether that is a reasonable assumption, or if vented emissions data should be calculated only from the GTI 2009 study data or with some other approach.

Table 5. GTI 2009 Industrial Meters Data

Company	# Industrial Meters Sampled	Leak CH_4 Emissions (kg/yr)	Vented CH_4 Emissions (kg/yr)	CH_4 Emissions (kg/yr)
A	7	411	0	411
B	7	734	170,341	171,075
C	0	0	0	0
D	2	29	6,616	6,646
E	22	609	9	618
F	8	735	0	735
Total	**46**	**2,519**	**176,965**	**179,485**
EF (kg/meter/yr)		**55**	**3,847**	**3,902**

Table 6. Industrial Meter Weighted Average Population CH_4 EFs (kg/meter/yr)

Study	Data Points	Leak Emissions CH_4 EF	Vented Emissions CH_4 EF	Total CH_4 EF
GTI 2009	46	55	3,847	3,902
GTI 2019	186	117.8	N/A	117.8
Weighted Average		**105**	**763**	**868**

4 Regional Variability and Time Series Considerations

The update under consideration for the 2021 GHGI does not include changes to the activity data. EPA is considering applying the commercial and industrial meter EFs under consideration across the time series, along with EIA activity data for commercial and industrial meters. This is consistent with the approach for residential meters. If stakeholder information indicating that emission rates from commercial and industrial meters have changed over the time series, and data were available to do so, EPA would consider using different EFs over time.

GTI 2019 recommends using region-specific EFs based on their findings of different meter set types in different regions. The EIA dataset that EPA uses for industrial and commercial meter counts includes counts by state,[5] and EPA could apply region-specific EFs to the meter counts from states within each region. Due to the limited measurement data for each region, EPA is currently considering the use of national EFs and not regional EFs, but seeks stakeholder feedback on this topic.

5 Preliminary National Emissions Estimates for Customer Meters in the 2021 GHGI

Based on the data sources and considerations discussed in Sections 3 and 4, this section summarizes the approaches EPA is considering for the 2021 GHGI. As part of the update, EPA is proposing to no longer use a single EF to apply to both commercial and industrial meters. EPA calculated preliminary national-level CH_4 emission estimates for the update under consideration for commercial and industrial meters using multiple EF scenarios to account for leak and vented emissions.

For commercial meters, because there is less data available to distinguish between vented and leak emissions and the GTI 2019 study EF (which only measured leak emissions) is higher than the GTI 2009 study EF (which measured leak and vented emissions), EPA evaluated two scenarios. Although the first scenario, which uses

[5] http://www.eia.gov/dnav/ng/ng_cons_num_a_epg0_vn5_count_a.htm

the GTI 2019 population EF, only accounts for leak emissions, EPA would not add commercial meter vented emissions unless additional data from the GTI 2009 study can be ascertained or stakeholders provide additional information. Commercial meter EF scenarios:

1. GTI 2019 population EF in Table 1
2. Weighted average EF in Table 4

For industrial meters, EPA evaluated two scenarios for leak emissions and two scenarios for vented emissions. EPA would calculate total industrial meter emissions by summing leak plus vented emissions, dependent on the scenario selected for each. Industrial meter EF scenarios:

1. Leak – GTI 2019 population EF in Table 6
2. Leak – Weighted average EF in Table 6
3. Vented – GTI 2009 EF in Table 6
4. Vented – Weighted average EF in Table 6

EIA provides activity data in the form of meter counts divided into industrial and commercial meters. In the current GHGI, these values are summed. For the update under consideration, EPA used unique counts for industrial and commercial meters and applied the respective EFs.

Table 7 summarizes the results for each scenario for the commercial and industrial meters update under consideration for year 2018. Appendix A provides time series data for each scenario.

Note that the current 2018 values in the 2020 GHGI were based on an incorrect national industrial meter count due to a spreadsheet error. Both the 2018 value reported in the 2020 GHGI and the corrected value are included in the table below. The spreadsheet error only impacted year 2018 emissions.

Table 7. Year 2018 Customer Meters National Emissions Estimates Calculated by Various Approaches

Emissions Type (Leak / Vented)	EF Basis	EF (Kg/meter/year)	AD (# meters)	2018 Emissions (MT CH_4)
Commercial Meters				
Leak	GTI 2019	57.4	5,515,841	316,609
Leak + Vented	Weighted - GTI 2009 and 2019	23.43	5,515,841	129,227
Current GHGI - Leak and Vented	*GTI 2009 (commercial EF)*	*9.7*	*5,515,841*	*53,692*
Industrial Meters				
Leak	GTI 2019	117.8	184,943	21,786
Leak	Weighted - GTI 2009 and 2019	105	184,943	19,419
Vented	GTI 2009	3,847	184,943	711,489
Vented	Weighted - GTI 2009 and 2019	763	184,943	141,112
Current GHGI – Leak + Vented	*GTI 2009 (commercial EF)*	*9.7*	*251,484*	*2,448*
Current GHGI - Leak + Vented - CORRECTED	*GTI 2009 (commercial EF)*	*9.7*	*184,943*	*1,800*

6 Requests for Stakeholder Feedback

EPA seeks stakeholder feedback on the approaches under consideration and the questions below.

1. EPA seeks feedback on how to incorporate industrial meter venting emissions. The GTI 2019 study did not measure venting emissions, but regulator venting emissions were observed (though variable in nature). Table 6 presents weighted average EFs calculated from all study data, and which therefore has a default assumption incorporated that venting emissions were zero during all GTI 2019 study measurements. While regulator venting emissions were observed, the study does not have an indication as to the magnitude of their impact.
2. EPA seeks feedback on how to incorporate industrial meter leak emissions, including whether using solely the GTI 2019 EF, or a weighted average EF (calculated from the combined dataset) is most appropriate.
3. EPA seeks feedback on how to incorporate leak and venting emissions for commercial meters, including whether using the GTI 2019 EF or a weighted average EF (calculated from the combined dataset) is most appropriate. EPA also seeks feedback on whether commercial meter vented emissions should be supplemented with vented emissions data from industrial meters or if other data are available to address vented emissions from commercial meters. Detailed leak and vented emission are not available in the GTI 2009 study to determine the percent that each contributes. In addition, the GTI 2019 study EF (which only reflects leak emissions) is higher than the GTI 2009 EF (which includes leak and vented emissions), which could suggest that vented emissions may not be a significant contributor to commercial meter emissions.
4. In addition to the specific leak and vented emissions questions above, EPA generally seeks feedback on the most appropriate EFs to apply for commercial and industrial meters. This includes whether GTI 2019 study EFs should be applied, if weighted average EFs based on the GTI 2009 and 2019 studies are more appropriate, if regional EFs should be considered, or if another approach or data source is recommended.
5. EPA seeks feedback on whether different EFs should be applied over the time series. EPA is considering applying the same EFs, but could consider applying one EF to early years of the time series and a different EF to recent years, with linear interpolation between if there is information available indicating that the emission rate per meter has changed over the time series.

Appendix A – Time Series Emissions and Activity Data for Various Approaches for Commercial and Industrial Meters

Commercial and Industrial Meter CH_4 Emissions by Various Approaches (MT CH_4/Year)

Emissions Type (Leak / Vented)	EF Basis	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Commercial Meters																
Leak	GTI 2019	243,162	250,106	253,117	256,286	260,246	266,135	270,941	273,305	289,554	287,585	287,621	286,796	290,696	295,735	295,033
Leak and Vented	Weighted-GTI 2009 and 2019	99,249	102,083	103,312	104,606	106,222	108,626	110,587	111,552	118,184	117,381	117,395	117,059	118,650	120,707	120,421
Current GHGI Leak and Vented	GTI 2009 (commercial EF)	41,236	42,414	42,924	43,462	44,133	45,132	45,947	46,348	49,104	48,770	48,776	48,636	49,297	50,152	50,033
Industrial Meters																
Leak	GTI 2019	25,721	25,507	24,693	24,699	23,906	24,667	24,273	27,666	26,645	26,897	25,946	25,566	24,257	24,210	24,627
Leak	Weighted- GTI 2009 and 2019	22,926	22,736	22,010	22,015	21,309	21,987	21,635	24,660	23,750	23,975	23,126	22,788	21,621	21,579	21,951
Vented	GTI 2009	839,973	833,003	806,408	806,600	780,725	805,569	792,685	903,504	870,173	878,406	847,325	834,915	792,170	790,627	804,261
Vented	Weighted-GTI 2009 and 2019	166,594	165,212	159,937	159,975	154,843	159,771	157,215	179,194	172,584	174,217	168,052	165,591	157,113	156,807	159,511
Current GHGI Leak and Vented	GTI 2009 (commercial EF)	2,125	2,108	2,040	2,041	1,975	2,038	2,006	2,286	2,202	2,223	2,144	2,113	2,004	2,000	2,035

Emissions Type (Leak / Vented)	EF Basis	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Commercial Meters															
Leak	GTI 2019	298,367	302,692	304,724	312,505	305,502	304,310	305,357	307,457	308,383	310,738	313,038	314,248	315,620	316,609
Leak and Vented	Weighted-GTI 2009 and 2019	121,781	123,547	124,376	127,552	124,694	124,207	124,635	125,492	125,870	126,831	127,770	128,263	128,823	129,227
Current GHGI Leak and Vented	GTI 2009 (commercial EF)	50,598	51,332	51,676	52,996	51,808	51,606	51,784	52,140	52,297	52,696	53,086	53,291	53,524	53,692
Industrial Meters															
Leak	GTI 2019	24,293	22,833	23,358	26,510	24,458	22,704	22,300	22,308	22,652	22,634	22,186	22,245	21,787	21,786
Leak	Weighted- GTI 2009 and 2019	21,653	20,352	20,820	23,630	21,801	20,237	19,877	19,884	20,190	20,175	19,775	19,828	19,419	19,419
Vented	GTI 2009	793,355	745,678	762,832	865,760	798,744	741,446	728,254	728,528	739,746	739,172	724,542	726,466	711,504	711,489
Vented	Weighted-GTI 2009 and 2019	157,348	147,892	151,295	171,709	158,417	147,053	144,437	144,491	146,716	146,602	143,700	144,082	141,115	141,112
Current GHGI Leak and Vented	GTI 2009 (commercial EF	2,007	1,887	1,930	2,191	2,021	1,876	1,843	1,843	1,872	1,870	1,833	1,838	1,800	1,800 [a]

a – Corrected value for 2018 industrial meters emissions. The current 2018 values in the 2020 GHGI were based on an incorrect national industrial meter count due to a spreadsheet error. The spreadsheet error only impacted year 2018 emissions. The 2018 value for CH_4 from industrial meters presented in the 2020 GHGI was 2,448 kt CH_4. Please see section 5 of this memo for additional information.

Activity Data: Number of Commercial and Industrial Meters

Meter Type	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Commercial	4,236,280	4,357,252	4,409,699	4,464,906	4,533,905	4,636,500	4,720,227	5,064,384	5,152,177	5,139,949	4,236,280	4,357,252	4,409,699	4,464,906	4,533,905
Industrial	218,341	216,529	209,616	209,666	202,940	209,398	206,049	205,915	205,514	209,058	218,341	216,529	209,616	209,666	202,940

Meter Type	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Commercial	5,198,028	5,273,379	5,308,785	5,444,335	5,322,332	5,301,576	5,319,817	5,356,397	5,372,522	5,413,546	5,453,627	5,474,701	5,498,603	5,515,841
Industrial	206,223	193,830	198,289	225,044	207,624	192,730	189,301	189,372	192,288	192,139	188,336	188,836	184,947	184,943 [a]

a – Corrected value for 2018 industrial meters counts. The current 2018 values in the 2020 GHGI incorporated an incorrect national industrial meter count due to a spreadsheet error. The spreadsheet error only impacted year 2018 data. The 2018 value for national number of industrial meters presented in the 2020 GHGI was 251,484. Please see section 5 of this memo for additional information.

Appendix B – Study Design Information

Meter Type	Measurement Type	Number of Sources	Location and Representativeness	EF Calculation Method
GTI 2009				
Commercial	Hi Flow Sampler measurements of leaks and vents	836 meters at 6 companies	Spread across five areas of the U.S. Randomly selected meters. The meters tested equal approximately 0.11% of the meters in operation at the 6 companies	GTI developed a weighted average EF based on number of meters tested.
Industrial	Hi Flow Sampler measurements of leaks and vents	46 meters at 5 companies	Spread across five areas of the U.S. Meters were randomly selected.	GTI developed a weighted average EF based on number of meters tested
GTI 2019				
Commercial	Hi Flow Sampler measurements of leaks	337 meters at 10 companies	Spread across six regions of the U.S. Initial site for the day was randomly selected, efficient route determined from there.	GTI developed EFs in multiple ways: population, leaker-only, regional
Industrial	Hi Flow Sampler measurements of leaks	186 meters at 10 companies	Spread across six regions of the U.S. Meters were randomly selected	GTI developed EFs in multiple ways: population, leaker-only, regional