December 15, 2023

Bill Caram
Executive Director, Pipeline Safety Trust
1812 Cornwall Avenue, Suite 200
Bellingham, WA 98225

Richard Kuprewicz
President, Accufacts Inc.
8151 164th Ave NE
Redmond, WA 98052

Bill and Rick:

The American Gas Association (AGA)[1] and the America Public Gas Association (APGA)[2] are writing to express our disappointment in the recent report, developed by Accufacts, titled "Report: Safety of Hydrogen Transportation by Gas Pipelines." The report contains many inaccurate statements, misinformation, and ignores research, past experience, and current projects on hydrogen blended natural gas transported by pipelines. We have highlighted below just a few of the inaccurate statements and have provided links to published information to enlighten you and your constituents on the safety of hydrogen transportation. AGA and APGA respectfully request that Accufacts revise its report to correct the inaccurate information and that the Pipeline Safety Trust publishes AGA and APGA's letter to provide those reading the Accufacts report with a more complete, comprehensive, and factual review of this important topic.

Since the report primarily focuses on hydrogen blending into the natural gas distribution system, and the infrastructure internal to buildings, AGA and APGA's comments focus primarily on these segments of the natural gas network. However, we have also pointed out inaccuracies related to natural gas transmission pipelines.

---

[1] AGA AND APGA represents more than 200 energy companies that provide natural gas service to 180 million Americans. Founded in 1918, AGA AND APGA educates the public about the importance of natural gas, supports natural gas utilities in their efforts to make their operations safer, more efficient and more environmentally friendly, and serves as a resource for local, state and federal policymakers when it comes to regulating the natural gas industry.

[2] APGA is the trade association representing more than 730 communities across the U.S. that own and operate their retail natural gas distribution entities. These include not-for-profit gas distribution systems owned by municipalities and other local government entities, all accountable to the citizens they serve.

AGA: 400 North Capitol Street NW - 4th Floor, Washington, DC 20001 P 202-824-7214 E csames@AGA.org www.AGA.org
APGA: 201 Massachusetts Ave NE - Suite C-4, Washington, DC 20002 P 202-905-2904 E ekurilla@APGA.org www.APGA.org

Statement 1:
Hydrogen blending into gas distribution systems "Should not be permitted at any level because of hydrogen's ability to explode especially in buildings, and the weaker downstream gas pipeline systems within public buildings not intended for hydrogen.[3]"

Response 1: This statement is not based on facts.
Until the 1960s, most of the natural gas used in North America was manufactured from coal or oil. "Town gas" or "coal gas" was a mixture of hydrogen, carbon monoxide and methane, with small amounts of carbon dioxide and nitrogen. Depending on the gasification process, hydrogen concentrations ranged from 10 percent to 50 percent.[4] Town gas was used in portions of the United States well into the 1980s, utilizing some of the same distribution pipelines, service lines, and internal pipelines still in use today.

Additionally, town gas is one of the main fuels still used today in Hong Kong. Hong Kong has nearly 2.3 million residential and commercial gas customers and nearly 88% of these customers use town gas that is transported through a network that is over 3,600 kilometers in length[5]. The hydrogen content of the town gas used in Hong Kong is between 46.3% and 51.8%.[6]

Hawai'i Gas has approximately 1,100 miles of pipeline network serving approximately 70,000 residential and commercial customers. This pipeline network utilizes synthetic natural gas (SNG), renewable natural gas (RNG), liquid natural gas (LNG), and up to 15% hydrogen.[7] The pipeline network has utilized this blend of gas for years with no reported distribution, internal piping, or appliance issues due to the blend of gas.

HyDeploy, a groundbreaking green energy trail that is backed by Ofgem's Network Innovation Competition, has generated significant evidence to demonstrate that natural gas blended with hydrogen can be used safely[8].

- Phase 1[9] trial took place at Keele University on a private gas network, where their campus site received blended gas between November 2019 and March 2021. During the 18-month trial, 100 homes and 30 university buildings received a blended hydrogen content of up to 20% by volume. Laboratory testing was conducted on a range of gas appliances and extensive research was conducted on the effects of hydrogen blends on a

---

[3] Page 1, Table 1
[4] University of Calgary, Energy Education Link; NaturalGas.org: History of Natural Gas Link; ChemEurope.com, Coal Gas Link
[5] Hong Kong: The Facts, Power and Gas Supplies Link
[6] Hong Kong Gas Business: Gas Production Link
[7] Hawai'i Gas: Decarbonization and Energy Innovation Link
[8] HyDeploy Link
[9] HyDeploy Phase 1 Link

variety of materials found in the gas network, and in any appliances in homes or businesses. The results of the testing confirmed that "blended hydrogen up to 20% by volume does not interact negatively with existing materials used within infrastructure like network pipes or in homes or businesses such as boilers, hobs, cookers, or meters." The trial was permitted by the UK Health & Safety Executive (HSE) who were satisfied that the blend of hydrogen gas was as safe as the gas currently in use.

- Phase 2[10] of the project took place at Winlaton Trial and ran from August 2021 until June 2022. The trial supplied 668 houses, a school, several small businesses, and a church with a 20% hydrogen blend. This project also had the approval of HSE and provided more evidence to support the safety of blending hydrogen into a gas network.

In Australia, Hydrogen Park South Australia (HyP SA) is delivering a renewable hydrogen blend to customers on the existing gas network[11]. The first phase began in May 2021 and delivers a 5% renewable hydrogen gas blend to more than 700 gas customers. The project is expected to be expanded in early 2023 to include approximately an additional 3,000 household, business, and school gas connections.

In addition to the examples provided above, there are many more examples of companies currently using natural gas that has a higher hydrogen content. Hydrogen Forward provides an interactive map of hydrogen projects, including those associated with natural gas companies, on their website: https://www.hydrogenfwd.org/united-states-of-hydrogen/

Finally, AGA and the Canadian Gas Association produced an Information Summary Report on the "*Blending of Hydrogen into Natural Gas Delivery Systems at less than or equal to 5% (≤5%)*". Earlier this year, the Canadian Gas Association produced a follow-on report, "*Enabling Higher-Hydrogen Blending in Natural Gas Distribution Systems - Distributing Hydrogen at >5% into Natural Gas Energy Distribution Systems*". [12] The report provides information on the different considerations and the potential impacts of hydrogen use in the natural gas system at between 5% and 20% concentrations. A few take-aways from the report:

- A natural gas distribution system that is 'leak tight' will remain 'leak tight' with hydrogen
- Review of known information could not identify operating or safety concerns of high-hydrogen blends in plastic distribution pipelines
- 'Selective leaking' of only hydrogen from hydrogen blended systems is not a phenomenon found within natural gas distribution systems

---

[10] HyDeploy Phase 2 Link
[11] Hydrogen Park South Australia Link
[12] Enabling Higher-Hydrogen Blending in Natural Gas Distribution Systems Link

- There are no known chemical incompatibility issues of note between hydrogen and the odorizing compounds commonly used in natural gas. Hydrogen should therefore have no deleterious interaction with odorants
- Industry's metering technologies can support up to 10% hydrogen blends, and confidence is building for measuring 20% blends with existing metering technology

Statement 2:
Gas Transmission Systems: "As most gas transmission pipelines feed into distribution systems, hydrogen blending should not be allowed in such existing gas transmission pipelines feeding distribution systems."[13]

Response 2:
As indicated in AGA and APGA's response to Statement 1, natural gas containing higher amounts of hydrogen is already being safely used in various natural gas distribution systems around the world. Therefore, stating that hydrogen blending should not be allowed into existing gas transmission pipelines because they feed a distribution system is simply not logical.

Statement 3:
"Hydrogen has some unique properties that in chemical engineering terms make hydrogen more "reactive" as compared to other hazardous hydrocarbons moved in transportation pipelines, such as methane as natural gas. These hydrogen properties make movement by transportation pipeline, whether via gas transmission or gas distribution, substantially more dangerous than conventional natural gas pipeline operation."[14]

Response 3:
AGA and APGA agree that hydrogen has unique properties but fully disagrees that these unique properties make movement by transportation pipeline "substantially more dangerous".

- Flammability: The report states "The significantly greater range of flammability for hydrogen over methane clearly indicates that hydrogen releases have a much wider range of concentrations favoring combustion as compared to natural gas. The HyDeploy study, mentioned previously, found that the dispersion characteristics and relative leak rate of natural gas containing up to 20% hydrogen are comparable with natural gas. As discussed in Section 4.4.1 of the HyDeploy Study, a 10% hydrogen blend will result in

[13] Page 1, Table 1
[14] Section IV, page 4

only a 3% increase in the extent of the hazardous area, which means there is relatively little difference between natural gas and a blend of natural gas containing a 10% hydrogen blend. Another study, "*Hydrogen in the Gas Distribution Networks*," conducted by GPA Engineering for the Government of South Australia[15] included modelling to simulate leaks from a pressure vessel. The modelling used a range of gas compositions with 10% hydrogen. The modeling shows that the same results as they HyDeploy study – a 10% hydrogen blend will result in only a 3% increase in the extent of the hazardous area, which means that the risk profile is not noticeably different for 10% hydrogen in a natural gas blend.

- Autoignition: The report states that "Hydrogen has a much lower autoignition temperature that favors ignition and resulting detonation/explosion as compared to natural gas when ignition sources are not present."[16] As the report states, autoignition is the lowest temperature at which it spontaneously ignites in a normal atmosphere without an external source of ignition. AGA and APGA do not view the 6% difference between the autoignition temperature of pure hydrogen and methane to be substantial, although we did find it interesting that the report is comparing autoignition of pure hydrogen, not blended hydrogen. When hydrogen is blended with natural gas, the autoignition temperature of the blend would be similar to methane's current autoignition temperature.
- Combustion: The report states that "The combustion characteristics of hydrogen are quicker and more efficient (i.e., faster burn velocity), producing a more rapid/efficient combustion than natural gas, often with explosive outcomes, either outside or in structures." This section also states, "Such factors contribute to hydrogen releases tending to detonate/explode with extreme energy release from pipeline fed fires generating very high temperatures."[17] The report does not substantiate the claims of "often with explosive outcomes" or "releases tending to detonate/explode with extreme energy release from pipeline fed fires" with evidence to support these statements. In addition, AGA and APGA's research was not able to identify a significant number of incidents related to hydrogen which would substantiate the claim of "often with explosive outcomes". AGA and APGA's research also did not find evidence of releases "tending to detonate/explode with extreme energy release from pipeline fed fires". Similar to AGA and APGA's comments on autoignition, the report compares combustion of pure hydrogen and not combustion of natural gas blended with hydrogen.
- Density: The density section of the report correctly points out that a pound of hydrogen has a higher energy density than a pound of methane. This would be an important point

---

[15] *Hydrogen In the Gas Distribution Networks*, GPA Engineering for the Government of South Australia in partnership with Future Fuels CRC on behalf of the COAG Energy Council

[16] Section IV, page 4

[17] Section IV, page 5

if the report discussed transporting a liquid mixture of hydrogen and methane. But mixtures of hydrogen and methane are transported in a gaseous state. The correct measurement should be cubic feet. The report fails to point out that hydrogen has less energy per cubic foot, and a cubic foot of hydrogen has only about 30% of the energy content as a cubic foot of methane, which is an important fact omitted from the Leakage argument that follows.

- Leakage: The report states "Hydrogen, being the smallest atom, makes containment challenging for pressurized pipelines, even as a H2 molecule."[18] The report's conclusion that hydrogen is more prone to leak out of a containment vessel is not supported by scientific proof. In addition, the evidence outlined in "*Enabling Higher-Hydrogen Blending in Natural Gas Distribution Systems - Distributing Hydrogen at >5% into Natural Gas Energy Distribution Systems*" [19] found that a natural gas distribution system that is 'leak tight' will remain 'leak tight' with hydrogen. Additionally, testing conducted by GTI indicates that once mixed with natural gas, hydrogen will not preferentially leak out of an opening.[20] This section of your report also states, "Hydrogen or hydrogen natural gas mixtures will likely have not only a greater propensity to leak, but such releases will more easily migrate laterally underground from pipelines and eventually accumulate if confined in structures to dangerous concentrations". Given that hydrogen is a smaller molecule, and is 14x lighter than air, it rises and disperses rapidly so the likelihood of gas build-up is less prevalent than with natural gas.
- Indirect Greenhouse Gas: On indirect greenhouse gas emissions, the study notes that hydrogen is an indirect greenhouse gas, which is factual. What the study did not point out is how hydrogen blending could reduce overall greenhouse gas emissions. One study, "*Global Environmental Impacts of the Hydrogen Economy*[21]", that was conducted by the University of Bristol's School of Chemistry, the Met Office, and the University of Edinburg's Institute for Atmospheric and Environmental Science, concluded that "Hydrogen-based energy systems appear to be an attractive proposition in providing a future replacement for the current fossil-fuel based energy systems."[22] Even considering the potential for leakage, the report states, "If a global hydrogen economy replaced the current fossil fuel-based energy system and exhibited a leakage rate of 1% then it would produce a climate impact of 0.6% of the current fossil fuel based system. If the leakage rate were 10%, then the climate impact would be 6% of the

---

[18] Section IV, page 6
[19] Enabling Higher-Hydrogen Blending in Natural Gas Distribution Systems Link
[20] W. J. Jasionowski and H. D. Huangt, "Gas Distribution Equipment in Hydrogen Service — Phase II," J. Energy, vol. 5, no. 5, pp. 298–301, 1981.
[21] Global Environmental Impacts of the Hydrogen Economy Link
[22] Global Environmental Impacts of the Hydrogen Economy Link

current system."[23] It should be noted that the publication referenced in the Accufacts report also acknowledges how hydrogen blending can reduce overall greenhouse gas emissions – "In fact, the worst-case green hydrogen benefits are roughly the same as the best-case blue hydrogen benefits across all timescales (such as a ~ 65 % decrease in the warming impact from fossil fuel CO2 emissions over a 10-year period and an 85 % decrease over a 100-year period)"[24]

Statement 4:
"The internal piping in buildings is the weakest link that should prevent hydrogen blending in gas distribution systems." "Adding a new substance like hydrogen, with its greater ability to leak and explode, to the wide range of internal piping used in structures intended for methane, will have serious public safety consequences."[25]

Response 4:
This statement is not based on facts, it is based on assumptions. Below is a short recap of the facts presented earlier:

- Hawai'i Gas has safely provided fuel that is up to 15% hydrogen to approximately 70,000 residential and commercial customers for decades.
- The HyDeploy project at Keele University safety provided blended gas to 100 homes and 30 university buildings between November 2019 and March 2021. That blended gas contained a hydrogen content of up to 20% by volume. During the 18-month trial, extensive research was conducted on the effects of hydrogen blends on a variety of materials found in the gas network, and in any appliances in homes or businesses. The results of the testing confirmed that "blended hydrogen up to 20% by volume does not interact negatively with existing materials used within infrastructure like network pipes or in homes or businesses such as boilers, hobs, cookers, or meters."
- The HyDeploy project at Winlaton Trial safely supplied 668 houses, a school, several small businesses, and a church with a 20% hydrogen blend from August 2021 until June 2022.
- The Hydrogen Park South Australia project is safely supplying a renewable hydrogen blend (5%) to more than 700 gas customers on the existing gas network. The project is expected to be expanded in early 2023 to include approximately 3,000 more household, business, and school gas connections.

[23] Global Environmental Impacts of the Hydrogen Economy Link
[24] Ilissa B. Ocko and Steven P. Hamburg, "Climate consequences of hydrogen emissions", pages 9359-9360, 2022
[25] Section V, page 9

Finally, given that the pressures downstream of the meter set assembly are relatively low, the potential risk of hydrogen embrittlement and/or increased damage to sealant materials for downstream components is expected to be low, and cannot be described as "the weakest link".

Statement 5:
Footnote 22: "As a cost reduction effort, some in the gas pipeline industry have been trying to get area classification regulations that apply only to gas transmission pipelines removed from federal minimum pipeline safety regulations. Such removal would significantly increase the risks associated with hydrogen transportation by transmission pipeline. Class location requirement basically prescribe thicker pipe or lower MAOP to be imposed, increasing pressure related safety margins within a certain time period, as building density and other factors increase around a gas transmission pipeline."

Response 5:
This is another instance, among many in the report, of a fully unsubstantiated claim. Who exactly is trying to remove transmission pipelines from federal safety regulations? A statement like this should not be made without providing a specific factual for the claim.

Statement 6:
"Most existing gas transportation pipeline systems are not suited for hydrogen, even as blends.[26]" "Few existing gas transmission systems may be suitable for conversion to hydrogen"[27]

Response 6:
These are overly broad and unsubstantiated statements. Assessment is needed on an individual pipeline basis to determine suitability for the transport of hydrogen blends. ASME B31.12 provides guidance on steel pipeline service conversions from natural gas to hydrogen service.

Statement 7:
"As efforts to reduce the impacts of climate change drive some fossil fuel gas pipelines into underutilization or obsolescence, there is great temptation to try to convert this existing pipeline infrastructure to extend its lifecycle."[28]

---

[26] Section VI B, page 10
[27] Section VI C1
[28] Section VI B, page 11

Response 7:
This statement is based on the author's assumptions. There are many motivating factors and reasons driving the significant research being conducted across the globe regarding the feasibility of blending hydrogen into the natural gas pipeline system. Just a few of these factors include the significant potential to reduce greenhouse gas emissions; limiting the number of electric power stations and electric transmission lines that will need to be built and recognizing the disruption that this massive buildout would cause to communities; utilizing the excess hydrogen coming from other renewable sources; and supplementing limited energy supplies in countries that are not as fortunate to have the abundant supply of methane that we have in the United States.

Statement 8:
"There are existing gas transmission and distribution pipelines that should not be considered for hydrogen service, even limited blended service."[29]

Response 8:
This is another very broad and unsubstantiated statement. Assessment is needed on an individual pipeline basis to determine suitability of blending hydrogen into a natural gas transmission or distribution system.

Statement 9:
"It is worth noting that DIMP's focus is on pipeline safety, usually the reduction of grade 1 leaks designed as hazardous, and not on methane leak reduction, which is historically not illegal.[30]"

Response 9:
The report is correct that DIMP's focus is on pipeline safety. It is completely incorrect to state that the focus of DIMP is on reducing grade 1 leaks. A correct statement would be that DIMP is focused on pipeline safety through the identification of risks to the system and the mitigation of those risks.

DIMP requires operators to:

- Understand their system
- Identify existing and potential threats

[29] Section VI B, page 11
[30] Section VI B, page 12

- Evaluate and rank risks
- Identify and implement measures to address risks
- Measure the performance of the integrity management program, monitor the results and evaluate the program's effectiveness
- Report performance results to PHMSA and the operator's state regulator.

Leaks are just one of many factors that operators consider to determine the potential risks that are occurring on the system and identify the appropriate steps to mitigate those risks. Other factors that operators take into consideration are the age of the pipeline, how the pipeline was constructed, the pipeline's material, the environment that the pipeline is in (wet, dry, clay, sand, extreme heat/cold, urban/suburban/rural, under concrete/pavement), how the system has been maintained, the diameter of the pipe, the pressure of the system, the location of the pipeline in relation to people and other areas of importance, if the system is a one-way feed, and many, many other factors.

Operators must also take into account the existing and potential threats to the system such as the threat of excavation damage (the leading cause of most distribution incidents), other outside forces (the second leading cause of distribution incidents, many due to vehicles hitting above ground natural gas distribution structures when the vehicle operator was impaired, having a medical issue, operating the vehicle at a high speed, or evading police), natural forces (earth movement, flooding, earthquakes), material/weld/equipment failure, corrosion, incorrect operation, and other risks. It should be noted that excavation damage and other outside force make up more than 60% of the distribution incidents when you analyze PHMSA's 3-, 5-, and 10-year significant incident statistics.

It is also completely incorrect to say that operators are not focused on methane leak reduction. It was the industry that worked closely with EPA to develop EPA's Natural Gas STAR Program which is voluntary program fully focused on implementing methane reduction technologies and practices. That program has been in place for nearly 30 years and includes many voluntary participants from the industry[31]. And the distribution industry, working with their state commissions, has for decades actively replaced pipelines that are prone to leakage. PHMSA's statistics show that a significant amount of pipeline replacement that has taken place over the years. The industry has also invested significant resources to advance pipeline leak detection, something that would not have occurred if the industry was not focused on leak reduction.

[31] Natural Gas Star Partners

Additional comments:

- Footnote 16 pertaining to definitions does not apply to the statement "The majority of transmission pipelines operate at much higher pressures…that place them in the rupture consequence regime if certain anomalies in the pipeline grow to defects."
- Under section IV, Leakage, the report states, "…think of hydrogen or hydrogen natural gas blends as being more "slippery" than natural gas. While hydrogen is a smaller molecule based on the Oxford and Merriam-Webster dictionaries, small does not mean "slippery".

Research and Testing:

It should be noted that significant research and testing on blending hydrogen into natural gas pipelines, and the effects of this blending, have been done by GTI Energy, the European Gas Research Group (GERG), NYSEARCH, the Department of Energy (DOE) HyBlend initiative[32], the DOE National Laboratories Consortium H-Mat[33], and various universities around the world. GTI Energy has created a Hydrogen Technology Center[34] which contains a significant amount or information and as previously mentioned, Hydrogen Forward provides an interactive map of hydrogen projects, including those associated with natural gas companies, on its website.

[32] HyBlend Link
[33] H-Mat Link
[34] GTI Energy Hydrogen Technology Center Link

Conclusion:
As stated previously, the report contains many inaccurate statements, misinformation, and ignores existing research, past projects, and current projects on hydrogen blended natural gas transported by pipelines. AGA and APGA respectfully request that Accufacts revises its report to correct its inaccurate information and that the Pipeline Safety Trust publishes AGA and APGA's letter to provide those reading the Accufacts report with a more complete, comprehensive, and factual review of this important topic.

Thank you for your time and consideration.

Sincerely,

Christina Sames
Senior Vice President for Safety, Operations & Security

Erin Kurilla
Vice President, Operations and Pipeline Safety

AGA: 400 North Capitol Street NW - 4th Floor, Washington, DC 20001 P 202-824-7214 E csames@AGA.org www.AGA.org
APGA: 201 Massachusetts Ave NE - Suite C-4, Washington, DC 20002 P 202-905-2904 E ekurilla@APGA.org www.APGA.org