National Transportation Safety Board
Office of Railroad, Pipeline and Hazardous Materials Investigations
Washington, DC 20594

PLD24FR003

INTEGRITY MANAGEMENT

Group Chair's Factual Report
November 18, 2024

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A. ACCIDENT

185 Bristol Blvd

Location:	185 Bristol Blvd., Jackson, MS
Date:	Wednesday, January 24, 2024
Time:	8:14 AM CST 2:14 PM UTC
Operator:	Atmos Energy
System Type:	Distribution System
Commodity:	Natural Gas

1146 Shalimar Drive

Location:	1146 Shalimar Dr., Jackson, MS
Date:	Saturday, January 27, 2024
Time:	4:34 AM CST 10:34 AM UTC
Operator:	Atmos Energy
System Type:	Distribution System
Commodity:	Natural Gas

B. INTEGRITY MANAGEMENT GROUP

Group Chair	Elena Bozhko National Transportation Safety Board Washington, DC
Group Member	Kaleb Gibson Mississippi Public Service Commission Jackson, MS
Group Member	Andrew Marshall Atmos Energy Corporation Dallas, TX

C. SUMMARY

For a summary of the accident, refer to the Accident Summary report within the docket.

D. FACTUAL INFORMATION

This report documents the preliminary facts, conditions, and circumstances relating to the accident which pertain to integrity management of the affected pipeline system.

1.0 Integrity Management Overview

Integrity management is a process that can be used to identify, assess, and manage pipeline risks. Risk can be defined as a measure of the probability and severity of adverse events. Risks are evaluated by answering the following questions:

- What can go wrong?
- How likely is this to happen?
- If it does happen, what are the consequences?

These risks are then managed by gathering additional information, taking action to reduce risks, continuing to evaluate risks as they change, and improving the process over time. Integrity management programs can be iteratively improved over time as additional information is gathered, risks are better understood, and assessment techniques are further developed. In some cases, integrity management programs are required by regulation (See Section 6.0).

Figure 1. Integrity Management Flowchart

A diagram summarizing Atmos's distribution integrity management program (DIMP), including processes to evaluate, monitor, and record threats and risks on its distribution system, is presented below. [1]

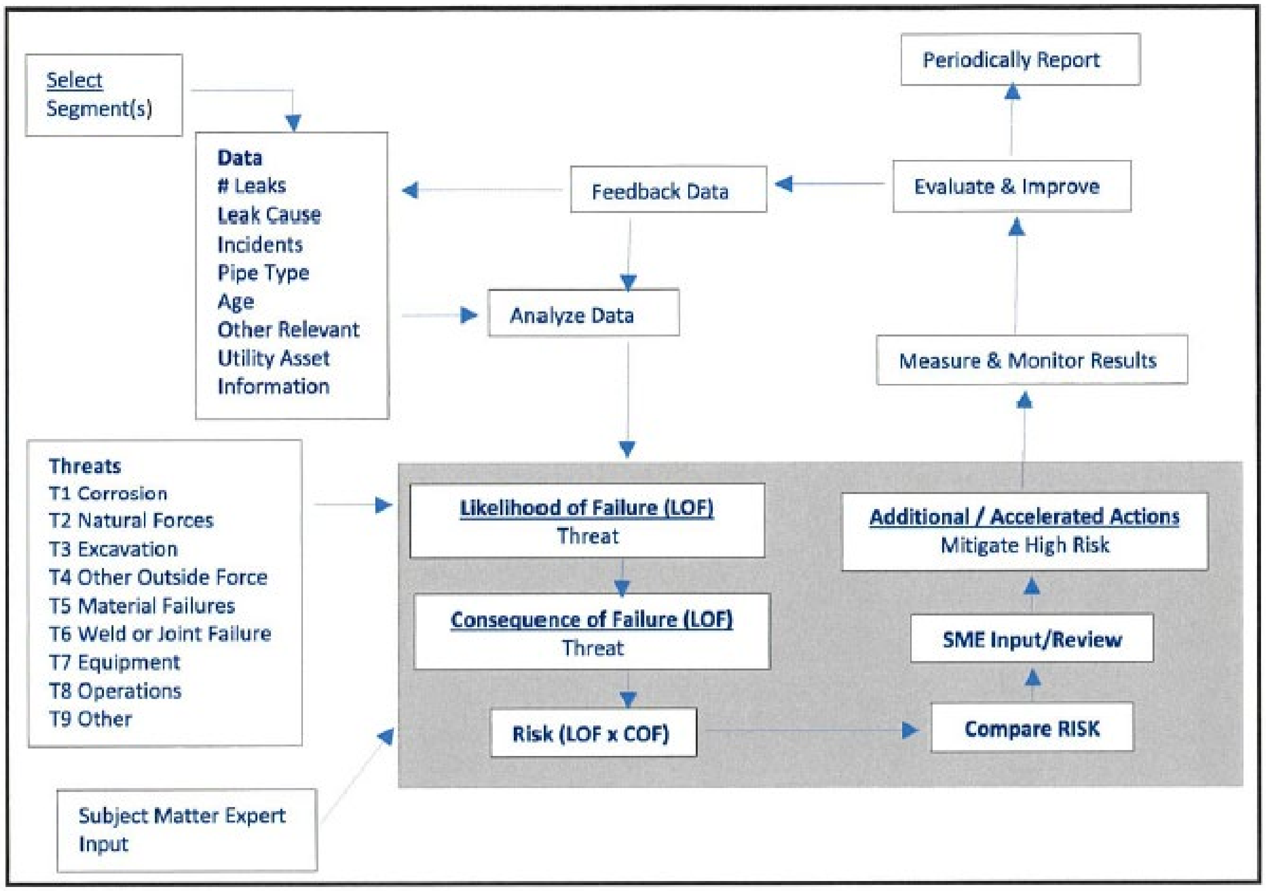


Figure 2. Atmos Energy's DIMP flow diagram

The DIMP program for Atmos followed these steps:[2]

1) Integrate information sources and data.
2) Identify risks to the integrity of distribution infrastructure.
3) Rank risks.
4) Designate measures and actions to reduce or mitigate risk as appropriate.

2.0 Integrity Management Program

NTSB investigators met with Atmos at their office in Flowood, Mississippi from May 29, 2024, to May 31, 2024, to review Atmos's integrity management program.

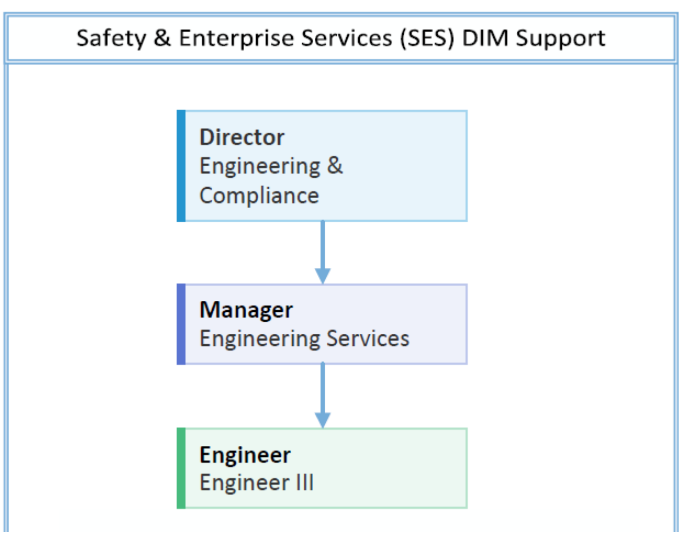
[1] Excerpt of DIM Plan - IMP flow diagram
[2] Excerpt of DIM Program Introduction PPT for NTSB Mtg (DIM Overview)

During this meeting, Atmos personnel discussed the provided information on their DIMP and answered group member questions. Atmos also provided data mapping information on factors used and their weighting as they relate to assets and threats. They told the NTSB that there was no formal documentation that describes how the relative risk model (DRAM model, discussed in more detail below) works and were not prepared to run the model in real-time as requested.[3] Atmos provided screenshots and explanation of the interface of the DRAM model. NTSB investigators were told that Atmos' service contractor, DNV GL, hosted the DRAM on their platform and that DNV performed the computational analysis within the model with the data sources, factors, and weightings developed by both Atmos and DNV. After the meeting, NTSB investigators sought additional information from Atmos and DNV GL.[4] This section documents Atmos's program as described and observed during this meeting and further explained through documentation provided by Atmos and DNV.

2.1 Organizational Structure

2.1.1 Atmos

Atmos Energy has a centralized Distribution Integrity Management Program, which uses operator knowledge in conjunction with a risk assessment tool to identify, assess, and rank risk. Information relevant to developing an understanding of risk is considered by the risk assessment tool and by Atmos Energy subject matter experts who are knowledgeable about the design, construction, operations, maintenance activities, or the system characteristics of Atmos Energy's distribution systems.



[3] On October 23, 2024, Atmos stated that attempting to navigate the model in real time as requested was not practical given the complexities involved.
[4] The NTSB issued a subpoena to DNV GL on June 11, 2024.

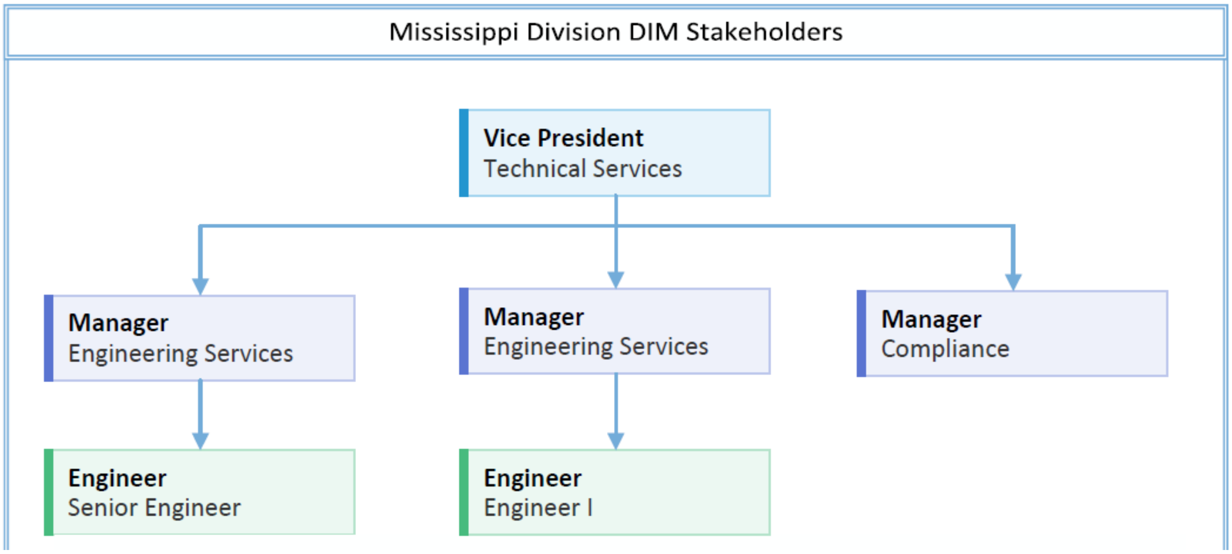


Figure 3. Organizational chart of MS DIMP - Integrity management team[5]

Jackson, MS operational region is managed by the president and eight vice-presidents (including Vice President of Technical Services) with an executive assistant.[6]

Table 1. HQ vs MS responsibilities:[7]

HQ	MS
Maintain written DIM Plan	Serve as liaison points for DIM between Divisions and SES (Safety and Enterprise Services group)
Configure, load data, and run risk model	Provide local institutional and distribution system knowledge
Identify risk model and input data, enhancements	Coordinate participation of local Subject Matter Experts (SMEs) in review/validation of risk model results
Coordinate participation of divisional team members and stakeholders	Provide insight into potential and emerging system threats
Advise on Enterprise and Division risks	Identify any additional areas exposed to risk
Administer DIM tool ecosystem	Select and execute mitigating actions

List of SMEs for MS DIMP has 20 names[8] of Atmos's personnel with varying experience, including technical services and operation employees.

[5] Atmos DIM Organization Structure
[6] Atmos MS Division Org Chart
[7] DIM Organization Detail
[8] DIM SME List and Experience

Atmos Energy's Subject Matter Experts (SMEs) help prepare and validate integrity management model results for a specific IM area.[9] SMEs use the DIM web tool (web-based application) to complete their review, supported by GIS viewer with graphics, grids and leakage information.

This division is intended to facilitate the application of geographically oriented data and SME operational input within the risk evaluation, as well as to serve as the basis for risk ranking. Atmos Energy's risk assessment tool calculates a numerical risk score, or value based on the likelihood of failure (LOF) and the consequence of failure (COF) for these areas, that supports SMEs in the evaluation and ranking process.

In 2022, Atmos migrated to a new DIMP model and generated the first risk results based on that new model in December of 2022.[10] The model included 10 year data up to February 2020. The 10 year data interval was selected to include two 5 year-leak survey cycle

2.1.2 DNV GL

DNV GL is a service contractor, that provided Atmos with the configuration of Distribution Risk Assessment Model (DRAM), deployed and hosted on DNV GL's environment (Synergi Pipeline). DNV GL also provided Atmos with on-going DRAM maintenance, management[11] and support, implemented data migration, managed external data collection and facilitated data application within the model.

2.2 Risk Identification

Risk assessments are based on the current understanding of the system, its operating environment, and potential threats. This section documents the risk identification process used by the operator in its most recent assessment.

2.2.1 System Knowledge

Atmos Energy considered gas system attributes, operating environment data, and system performance information, including leak repair records, to evaluate threats to the distribution system. Open leaks where cause was yet to be determined were applied in the model, and allocated proportionally across the leak causes, excluding excavation damage. Leaks that were eliminated via replacement and were never exposed had their cause coded as "other" at the time of replacement and were applied in the model with the same weighting as repaired leaks where the cause has been identified.

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[9] Excerpt of DIM Plan - IMP flow diagram
[10] Generation of risk results will be conducted annually.
[11] Management of the model is done at Atmos's requests

Data for the DRAM model came from the following sources:[12]

- Atmos' Geographic Information System (GIS)

GIS asset geolocation and attribute data contributes information about installation date[13], pipe size, material type, coating type, pressure class (low pressure class would be driver for overpressure risk).[14]

- Locate tickets

One call tickets volume is used for latent damage evaluation. Each ticket reported by One Call system is factored in as a risk for unreported damage for the assets. Atmos' line locate system is the system of record for locate tickets they've received.

- Sites and structures database (for 2024 evaluation)

Information is purchased from a mapping vendor and used to approximate the distance between an asset and structures, prevailing or average distance for the grid is used in calculations. The system of record for site and structures is purchased by Atmos from an external vendor.

- Atmos' Enterprise Asset Management (EAM) system

In the MS Division, Atmos' enterprise asset management (EAM) work management system is the system of record for leaks, asset involved in the leak, cause of the leak, and coating condition observed when the leak was excavated. For leaks that have not been exposed or repaired, EAM provides the location where the field crew estimated the leak to be. EAM is also the source for corrosion test point locations.

- EFRM – earth factor risk model

The model stores information on geology, soil type, climate, soil moisture and is compilation of the following risk factors: geology, expansive soils, soil hydrology, topography, climatic rating, seismic activity. The EFRM represents the earth activity data and designed to increase the risk values in the asset area of the higher risks for earth movement. The source for this model is a compiled publicly available government data.[15]

- SSURGO – soils properties database

Informs the DRAM model about corrosive properties of soils and informs threat of corrosion. The database contains government data related to geology, soil type, and soil moisture, it is the system of record for two factors used in the DIMP model (EFRM and Soil Moisture Climatology).

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[12] Data sources also include National Land Cover Database (impervious surface layer), Land Data Assimilation Systems, US Census Population Database.
[13] Installation year will drive extra risk for specific materials
[14] There are no low-pressure systems and no cast iron assets in MS.
[15] The model was first used during the 2023 DIMP run.

SMEs provide their own knowledge and experience into the DIMP process. Atmos has a capability to update information on the existing asset if new information becomes available. A newly installed infrastructure would have more detailed records created.

Table 2 below provides summary of Atmos and all US gas distribution operators' assets for 2023. Table 3 provides summary of the assets covered by the Atmos's DIMP.

Table 2. Summary of Atmos and All US Gas Distribution Operators' Assets for 2023[16]

	Atmos (all operating divisions)		**All Operators**	
Description	**Main** (miles)	**Services** (#)	**Main** (miles)	**Services** (#)
Steel	29,713	666,958	510,869	14,094,098
Ductile Iron	0	0	422	208
Copper	0	169	5	552,591
Cast/Wrought Iron	0	0	15,813	6,689
Plastic	43,595	2,538,533	838,958	55,395,785
Other	195	321,065	1,161	2,058,635
Reconditioned Cast Iron	0	0	43	0
Grand Total	**73,503** (~5.4% of US Mains)	**3,526,725** (~4.9% of US Services)	**1,367,271**	**72,108,006**

Table 3. Summary of Atmos Gas Distribution Operators' Assets in Mississippi and Atmos all operating divisions for 2023[17]

	Atmos (MS)		**Atmos (all operating divisions)**	
Description	**Main** (miles)	**Services** (#)	**Main** (miles)	**Services** (#)
Steel	3,631	96,811	29,713	666,958
Ductile Iron	0	0	0	0
Copper	0	169	0	169
Cast/Wrought Iron	0	0	0	0
Plastic	3,245	209,786	43,595	2,538,533
Other	0	0	195	321,065
Reconditioned Cast Iron	0	0	0	0

[16] From PHMSA source data web site: https://www.phmsa.dot.gov/data-and-statistics/pipeline/source-data

[17] From PHMSA source data web site: https://www.phmsa.dot.gov/data-and-statistics/pipeline/source-data

Grand Total	**6,876** (~9.4% of All Atmos's Mains)	**306,766** (~8.7% of all Atmos's Services)	73,503	3,526,725

Gas system maps representing the assets at the time of the accident in the vicinity of Bristol Blvd. and Shalimar Dr. are located below.

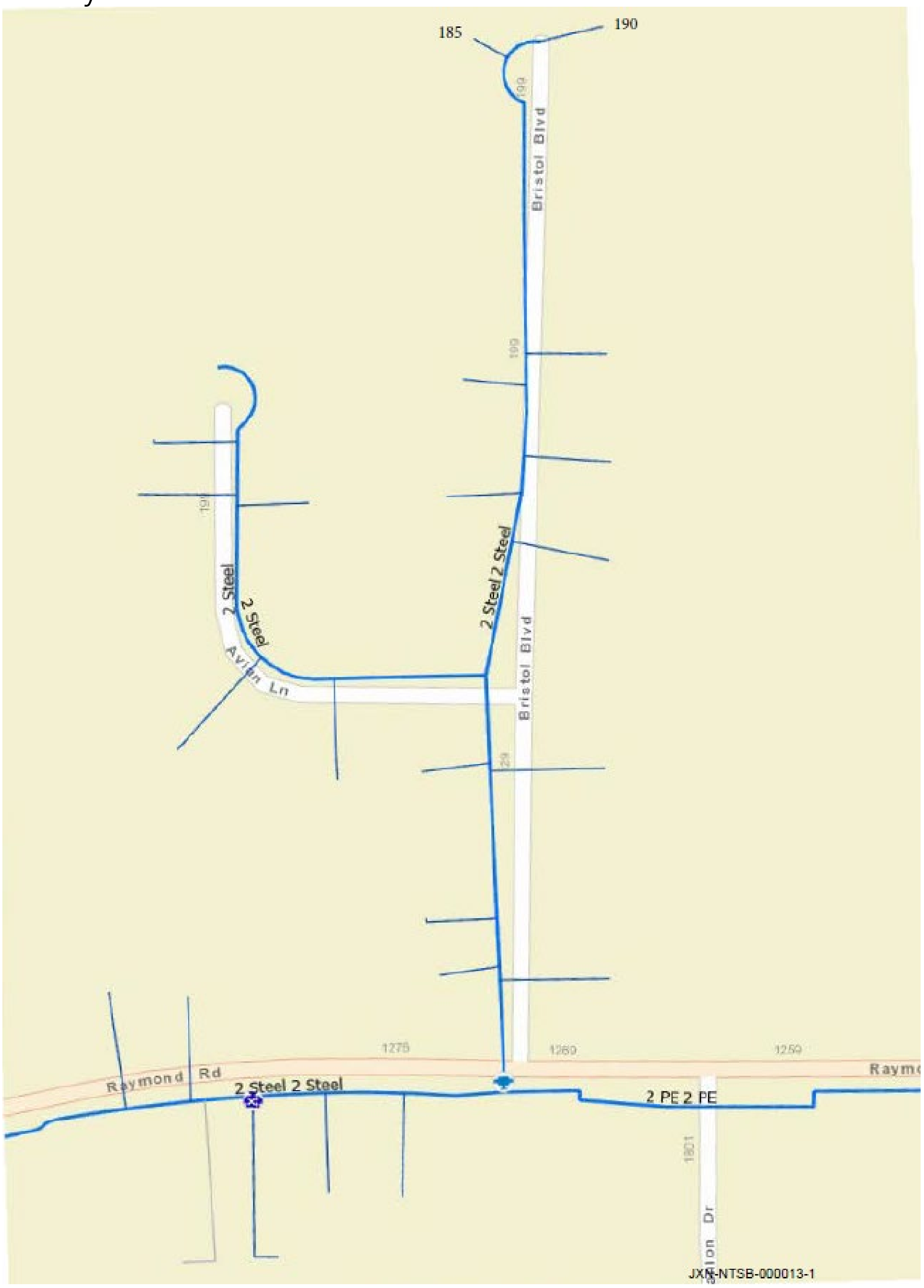

Figure 4 - Gas System at the time of the accident at Bristol Blvd.[18]

[18] System Map Bristol

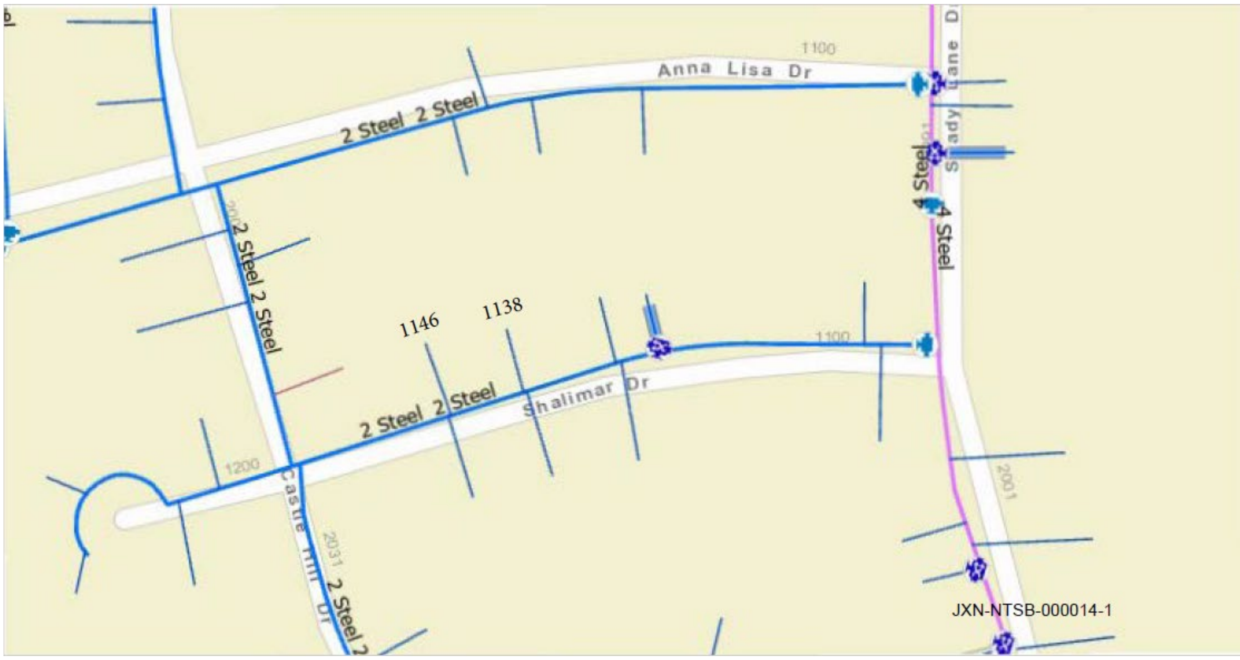

Figure 5 - Gas System at the time of the accident at Shalimar Dr.[19]

2.2.1.1 Lack of Available Data for DIMP analysis

At the time of the accident, about 72.5% of Atmos' service lines in MS had no installation records kept by Atmos.[20] The exact locations of those services are unknown, but they are represented on the Atmos's maps based on the premise locations. Those services have no record of the service line details: the exact location of the service line tap, gas line configuration, type of coating, material detail, components and connection method used are not available for those services. Since 2011, Atmos has taken up the effort to place those services onto the GIS mapping, using meter location to approximate the service line placement. The services that have no detailed record can be identified in the system by having 1900 year as their installation date.[21]

Atmos does not have detailed information on known couplings in the vicinity of the area. The coupling properties that are recorded include material, location; unknown properties include: diameter, installation date, manufacturer, model, type (stab, bolted, nut).[22]. Per Atmos's explanation "Many of the data fields requested are unknown because installation of the facilities occurred before regulations for record keeping came into effect and Atmos Energy's predecessor company did not collect

[19] System Map Shalimar
[20] Email post meeting in Jackson (GIS data)
[21] Information provided during in-person meeting with Atmos on May 29-31, 2024
[22] Additional data on Known Couplings on 1-30-24 (2 Mile Radius)

this information. Our records are supplemented with additional information during subsequent repair work."[23]

Atmos did not have records for the gas service lines involved in the incidents, stating in their response "We have completed our search and could not locate service line installation records for these locations".

PHMSA reportable incidents themselves do not feed into the model as discrete data input items. Atmos indicated that lessons learned from PHMSA reportable incidents are used to inform its risk modeling approach, including the addition of new risk model factors or the adjustment of existing.

2.2.2 Threat Identification

Leaks were classified according to Atmos Energy's Leak Management Program, as grade 1 through 3, the elements of which are described in Appendix D.2 of the Distribution Integrity Management Plan ("DIMP")[24].

The cause of a repaired leak was identified according to the threats/risks identified below, and that data is then used to inform Atmos's understanding of existing or potential threats to the distribution system.

Chapter 5 of the DIMP states: [25]"As a result of the surveying of distribution systems and the subsequent locating, grading, and repair and/or monitoring of leaks found within those systems, Atmos Energy's Leak Management Program contributes directly to the mitigation of the following threats or risks:

- Corrosion
- Excavation Damage
- Natural Force Damage
- Other Outside Force Damage
- Materials
- Joints/Welds
- Incorrect Operations
- Equipment Failure
- Other"

Atmos considers 9 threats which include the 8 threats required by PHMSA's gas distribution incident report form F7100.1-1, as described in PHMSA's instructions (materials and weld/joint are separate threats in Atmos' approach).

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[23] Atmos Energy's Responses to Data Requests (Provided May 2, 2024)
[24] Excerpt of DIM Plan - Appendix D2 Leak Management Program
[25] Excerpt of DIM Plan - Leak Management Program

Atmos' approach estimates risk by 2000 x 2000-foot grid and Atmos-defined cost center:

- Cost Centers – Atmos-defined boundary area of varying shape and size that represents the responsible areas of Atmos' operations teams, generally historically formed (e.g., Jackson is a cost center, Dallas is 3 cost centers). In MS, cost centers were formed out of operational districts.
- Grids - a square shaped area that is overlaid in GIS. Square areas are 2,000' x 2,000', that may or may not completely lay within the same Cost Center. Each grid has 18 individual asset-threat scores, representing the two types of assets (mains and services) and 9 threats.

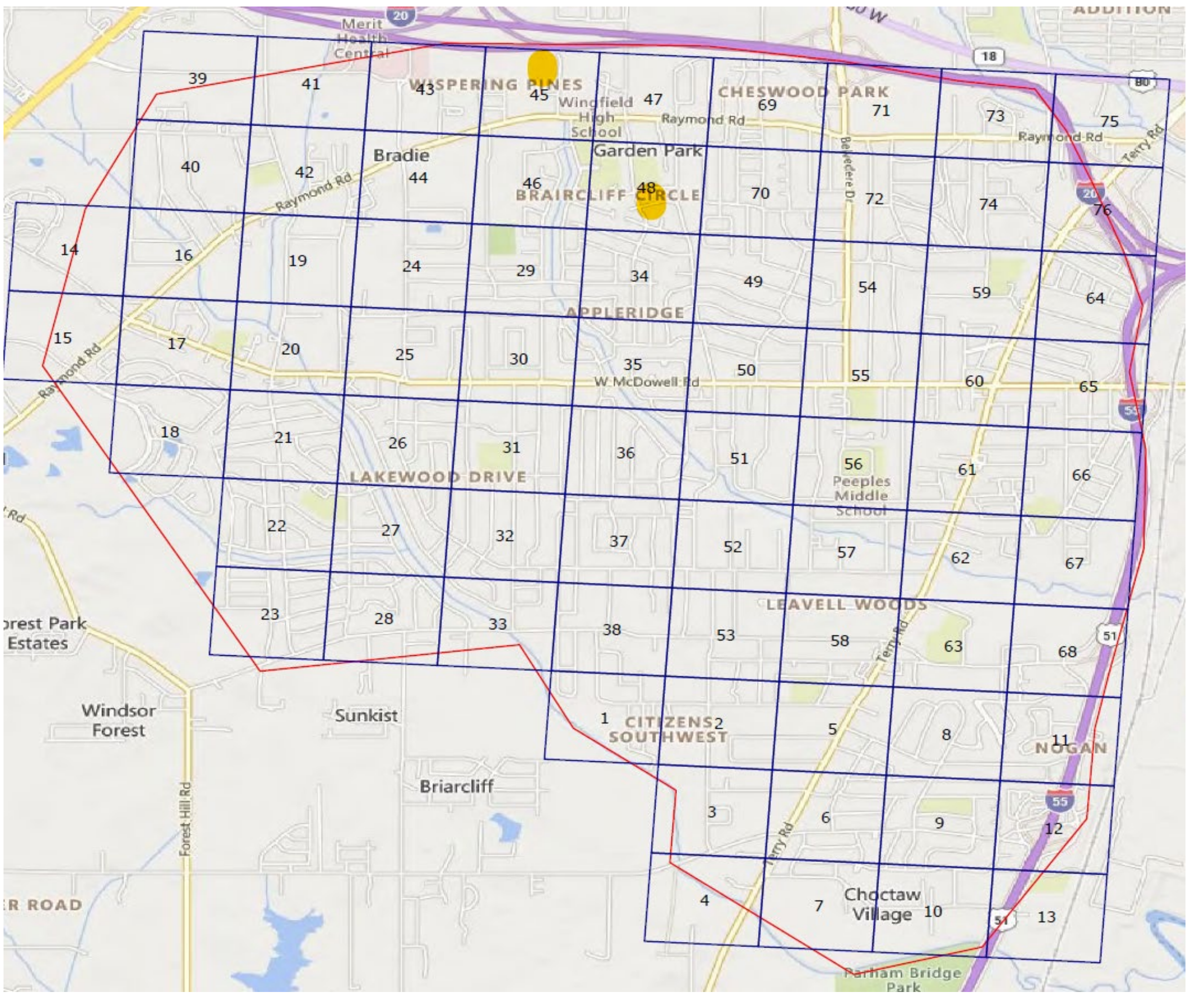

Figure 6 - Map of DIM Grids for South Jackson area, where blue tiles represent DIM Grids (with Grid IDs), red line – outline of South Jackson area. Highlighted in yellow are the incident locations.[26]

[26] Map of DIM Grids for South Jackson area

The mechanical fitting failure leaks are recorded in Atmos' work management systems EAM and incorporated into Atmos' DIMP model in different ways (as natural force damage, incorrect operations, outside force damage or equipment failure), since the cause of the failure and associated leak determined at the point of repair varies (i.e., equipment failure, natural forces, etc.). The failure is applied within Atmos Energy's DIMP model according to the cause recorded.[27] The leaks are then attributed and evaluated as part of main or services asset group within Atmos' DIMP model, and fittings/couplings are not evaluated as a separate group.

2.2.2.1 New Threat – Ground Movement

In 2022, Atmos developed an additional grid-level factor - Earth Factor Risk Model (EFRM). The factor is applied to account for potential differential ground movement of each grid. The numerical value of an EFRM grid is applied in the risk calculations for assets in the grid to influence the natural forces factor.

The Earth Factor Risk Model grids overlay on the DIMP grids to influence the natural forces factor (likelihood part of the DIMP model).[28] .

The soil moisture climatology factor grid overlays on the DIMP grids and applies a factor based on the worst-case value (consequence part of the DIMP model).

2.3 Risk Assessment

At the time of the accident, Atmos used two approaches to identify and evaluate risk in the distribution system, as outlined in Figure 2. The quantitative and qualitative approaches were used for risk evaluation and to analyze risk on mains, services, regulator stations and meter sets.

DIM risk evaluation model:

(1) Distribution Risk Assessment Model (DRAM)[29]
Developed by an independent company DNV, that is providing customized software DRAM for Atmos to utilize, using their own data and modified criteria.

(2) Subject matter expert input (SME)
In-house state specific expects that Atmos indicated validate results of DRAM and identify additional risk areas based on local knowledge of the system.

[27] Atmos Energy's Responses to Data Requests (Provided May 2, 2024), question 5
[28] Earth Factor Risk Model Methodology
[29] Excerpt of DIM Program Introduction PPT for NTSB Mtg (DNV DRAM Model)

2.3.1 Distribution Risk Assessment Model (DRAM)

To estimate risk, Atmos uses DNV-developed and maintained Synergi Pipeline with the Distribution Risk Assessment Model (DRAM) algorithm. DNV provided the customized software DRAM and Atmos utilized the software by providing their own data and modified criteria. DRAM is a statistical model that was developed by DNV in conjunction with GTI in the 2011 timeframe.[30] DRAM model comes with set of factors that are intended to be modified or tailored to the operator's requests.[31]

The baseline DRAM model was modified by DNV for Atmos to include a soil moisture climatology factor, Earth Factor Risk Model factor, and factor that uses locate tickets as potential for unreported damage.[32]

The risk assessment tool calculates a numerical risk factor based on the likelihood of failure (LOF) and the consequence of failure (COF) for selected IM Regions for each threat category. When data is not available, default values are applied. Atmos Energy assesses risk for each IM Region. IM Region considerations may be assessed by the risk assessment tool or identified and evaluated by SMEs."[33]

Risk analysis in DIMP plan includes a list of 92 representative risk factors[34], 123 risk factors are used in Atmos' DRAM.[35,36]

Some risk factors are applied to the asset-threat pair at the asset level in the DRAM model, while other risk factors are applied to all assets within a grid. For example, probability of a leak within a grid are increased if assets in that grid have a history of leaking in the last 10 years. Leak rates are adjusted based on historical leak data regardless of replacement project / continued relevance. (Local SMEs can correct for information related to replacement projects during their review.)

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[30] 2023 was the first year Atmos used the DRAM model.

[31] DNV also offers Probabilistic Risk Assessment model (PRA) in Synergi Pipeline, another more modern Distribution Risk Model. Atmos clarified that PRA was not available at the time of vendor selection for distribution systems in 2018.

[32] For 2024 high relative risk determinations, a factor assessing the average distance to a structure was also added (baseline was population density).

[33] Excerpt of DIM Plan - Risk assessment methodology

[34] Excerpt of DIM Plan - Risk Analysis Factor List

[35] Atmos determined the following18 factors were not relevant because they relate to functionality that was not applicable to Atmos's functionality (marked "omitted"): Baseline Leak Rate for Incorrect Operations of All Assets, Baseline Leak Rate for Metallic Mains due to Natural Forces, Cast Iron Mains Age, Cast Iron Mains Corrosion Diameter, Metallic Depth Of Cover, Metallic Excavation Diameter, Metallic Installation Date, Metallic Services Installation Date, Plastic Depth Of Cover, Plastic Excavation Diameter, "Plastic Installation Date (ED)", Plastic Mains Diameter, Plastic Mains Installation Date (MF), Plastic Services Installation Date, Plastic Services Material Diameter, Steel Mains Corrosion Diameter, Steel Mains Material Diameter, Steel Service Installation Date

[36] Context for usage of DRAM Factors from Atmos, email

2.3.2 Likelihood Determination

Likelihood of failure was designed to represent the probability of a leak. The Likelihood of Failure (LOF) is described by in the following diagram.

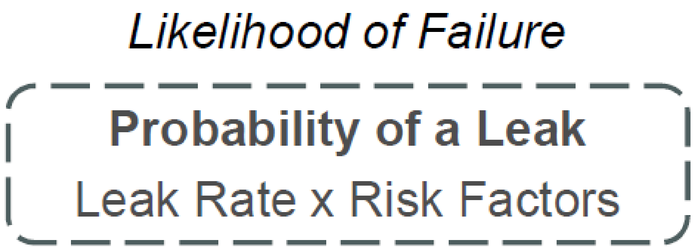

Figure 7 – DRAM's likelihood of failure calculations[37]

Leak rate in this formula is a leak rate per mile for a specific pipe type. Leaks in a grid are used to calculate a grid leak rate. In the event that a grid has no leaks, a baseline leak rate is used. The baseline leak rate is set by using the leakage by pipe type across all Atmos's territories. [38] Risk is likelihood of failure multiplied by the consequence of failure. [39]

2.3.3 Consequence Analysis

The Consequence of Failure (COF) was designed to correspond to the degree of hazard attributed to those risk factors associated with a given distribution facility. The risk assessment tool used source data records and SME factors to determine the COF. Considerations by Atmos included:

- The potential for over pressurization
- The potential for migration and ingress
- The potential for ignition
- The presence of potentially impacted persons and structures

[37] Excerpt of DIM Program Introduction PPT for NTSB Mtg (Risk Calculation)

[38] The leak rate is number of leaks per mile per 10 years. If there are open leaks, they are used to calculate the leak rate for that asset-threat group.

[39] The risk factors that are determined to be relevant to a specific asset-threat are multiplied.

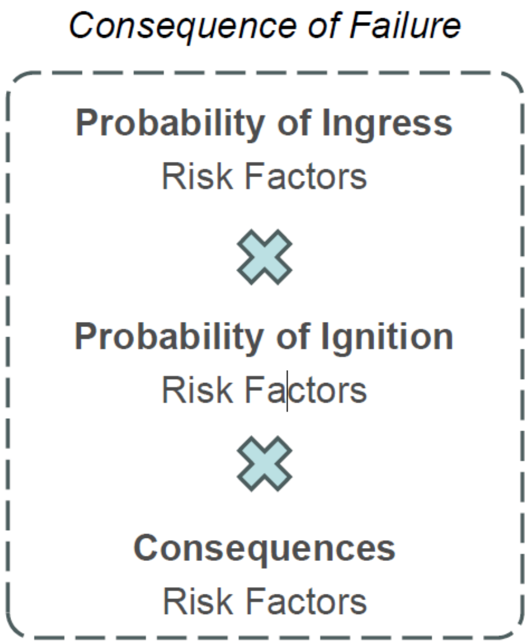

Figure 8 – DRAM's consequence of failure calculations[40]

Probability of ingress risk factor applies to all assets and varies in value based on the impervious surface coverage that the pipe of point location intersects. The weighing factors vary from 1 to 6.94.

Probability of ignition risk factor applies to all assets and based on Maximum Allowable Operating Pressure (MAOP) of the asset, with two different factors for low and medium MAOP. All assets in MS are medium MAOP.

Consequence of failure is calculated by using the following factors: gas ingress diameter (pipe diameter), gas ingress cover (ground cover: paved, unpaved), probability of ignition (defined using MAOP)[41], population density, gas ingress proximity (proximity of an occupied structure) and soil moisture climatology.[42]

2.3.4 Risk Estimation

Under the current DIM Program, the areas encompassing Bristol and Shalimar were not identified as high relative risk. The formula for risk failure calculation is provided in Figure 9. The risk of failure calculated using leak rate value that is multiplied by number of risk factors, as they relate to a specific asset/threat category in each grid.

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[40] Excerpt of DIM Program Introduction PPT for NTSB Mtg (Risk Calculation)
[41] All facilities in MS had the same "probability of ignition" factor value
[42] Distance to a structure was added in 2023 evaluation.

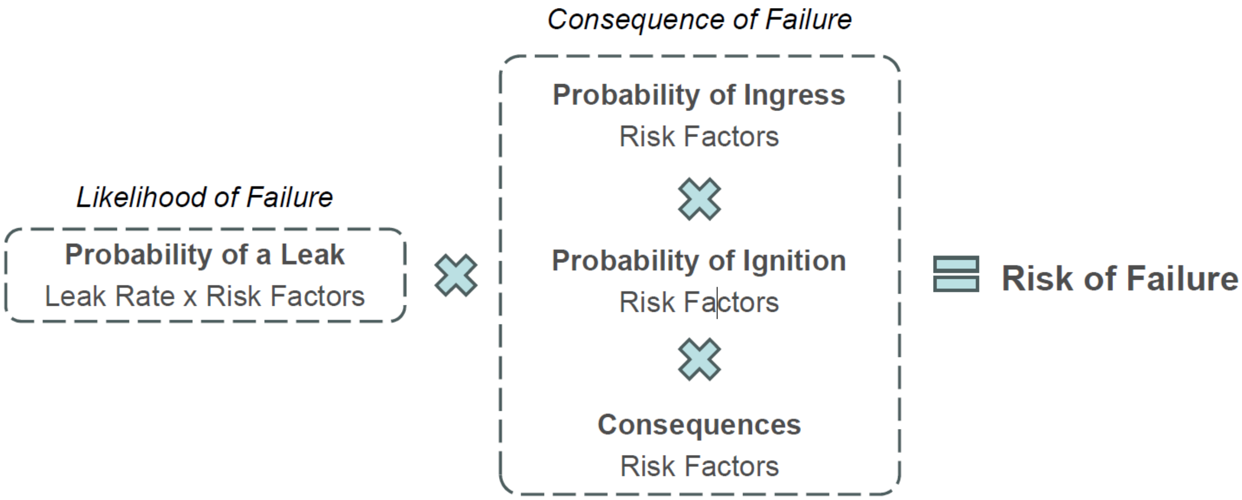

Figure 9 – DRAM's risk of failure calculations[43]

The 2023 risk ranking was the latest information available on the date of the accident, January 24, 2024. For the 2023 risk ranking, the previous 10 years of data was pulled to support the DIMP risk evaluation in February 2022. SMEs reviewed this data and provided input between April and June 2022. Through this process, SMEs had the opportunity to use their local knowledge to weigh-in on data fields and provide additional data to be used. The risk model was run in July 2022 by Atmos' service contractor, DNV, with oversight by Atmos. From August to September 2022, the modeling results were post-processed by Atmos. Atmos SMEs reviewed post-processed results beginning in October and finalized the 2023 high relative risk results and accelerated actions list in December 2022.

Atmos indicated that interactive threats are included in the DRAM model and provided a notional corrosion example showing how corrosion that interact with other threats to increase risk.

Soil moisture climatology (rainfall) is another risk factor, and it is applied broadly to grids based on the average soil moisture. This factor ranges from 0.95 (for average soil moisture less than or equal to 1.689) to 1.4 (for average soil moisture of greater than 9.077).

Leaks, that are open at the time data is pulled for the model, are modeled in DRAM. The likelihood of failure is not increased to account for the fact that there is one or more existing leaks within a specific grid. Atmos discussed their view that leak clusters would be addressed quickly, if there were an extraordinary number of leaks in a given area. Atmos indicated these types of safety issues would surface, if needed, during regular operations meetings.

[43] Excerpt of DIM Program Introduction PPT for NTSB Mtg (Risk Calculation)

The NTSB asked if Atmos has used other data, such as leak survey data to validate the effectiveness of the model. Atmos indicated that field crews have reported incremental increases in leaks found in relative high-risk grids. Atmos also indicated that they have observed a decrease in the number of Grade 1 leaks in 2022 (see 3.4.3).

Within each grouping risk score can be compared (for example: Mains Equipment Failure between the grids can be compared to other mains equipment failure grids, but not to any of the service Equipment Failure). The risk scores are threat specific and allow comparison between the same threats, the risk scores do not allow comparison between different threats.

2.3.5 Calculated relative risk results

Under the current DIM Program, the areas encompassing Bristol and Shalimar were not identified as High Relative Risk Grids.

Table below provides threat risk scores for the grid that includes 185 Bristol Blvd location.[44]

Table 4. Threat risk scores for the grid that includes 185 Bristol Blvd location

Grid_2k	Asset Type	Threat	Cost Center	Threat Risk Score	Mean +2Sigma Score/Value[45]	Risk Designation	Threat Risk Rank[46]
MS2k_13_12_23_19_4_4	Mains	Corrosion	Jackson	0.00003786	0.20897428	Not HRR	16371
MS2k_13_12_23_19_4_4	Mains	Equipment Failure	Jackson	0.00017377	0.03121855	Not HRR	25033
MS2k_13_12_23_19_4_4	Mains	Excavation Damage	Jackson	0.00000496	0.03022611	Not HRR	48022
MS2k_13_12_23_19_4_4	Mains	Incorrect Operations	Jackson	0.00004851	0.00219957	Not HRR	30100
MS2k_13_12_23_19_4_4	Mains	Joint Weld Failure	Jackson	0.00015024	0.00787857	Not HRR	25621
MS2k_13_12_23_19_4_4	Mains	Material Failure	Jackson	0.00015182	0.08565649	Not HRR	37674

[44] Main and Service Grid2k Results - 185 Bristol and 1146 Shalimar Grids

[45] Mean+2Sigma Score/Value – is a threshold for a given asset and threat combination to be considered "Relative High Risk". A "Threat Risk Score" value must be larger than "Mean+2Sigma Score/Value" for a grid to be designated HRR. The Mean +2Sigma Score/Value is specific to each asset/threat combination.

[46] It is a ranking order out of 66,945 grids for mains and 67,922 grids for services. The services figure is slightly larger than mains because the extents of a service may have traversed into an adjacent grid that didn't have mains.

MS2k_13_12_23_19_4_4	Mains	Natural Forces	Jackson	0.00021890	0.00818177	Not HRR	26016
MS2k_13_12_23_19_4_4	Mains	Other	Jackson	0.00009198	0.00713104	Not HRR	29393
MS2k_13_12_23_19_4_4	Mains	Other Outside Forces	Jackson	0.00009198	0.00263543	Not HRR	29287
MS2k_13_12_23_19_4_4	Services	Corrosion	Jackson	0.00001577	0.00515269	Not HRR	11461
MS2k_13_12_23_19_4_4	Services	Equipment Failure	Jackson	0.00006751	0.18270634	Not HRR	18710
MS2k_13_12_23_19_4_4	Services	Excavation Damage	Jackson	0.00004687	0.38107266	Not HRR	23332
MS2k_13_12_23_19_4_4	Services	Incorrect Operations	Jackson	0.00002948	0.00656955	Not HRR	13266
MS2k_13_12_23_19_4_4	Services	Joint Weld Failure	Jackson	0.00007406	0.02128664	Not HRR	10850
MS2k_13_12_23_19_4_4	Services	Material Failure	Jackson	0.00011311	0.02669701	Not HRR	15608
MS2k_13_12_23_19_4_4	Services	Natural Forces	Jackson	0.00122963	0.03394987	Not HRR	2411
MS2k_13_12_23_19_4_4	Services	Other	Jackson	0.00005590	0.01236856	Not HRR	12436
MS2k_13_12_23_19_4_4	Services	Other Outside Forces	Jackson	0.00005590	0.01244481	Not HRR	13629

Table below provides threat risk scores for the grid that includes 1146 Shalimar Dr location.

Table 5. Threat risk scores for the grid that includes 1146 Shalimar Dr location.

Grid_2k	Asset Type	Threat	Cost Center	Threat Risk Score	Mean+2Sigma Score/Value	Risk Designation	Threat Risk Rank
MS2k_13_12_23_25_5_5	Mains	Corrosion	Jackson	0.00028646	0.20897428	Not HRR	8771
MS2k_13_12_23_25_5_5	Mains	Equipment Failure	Jackson	0.00108808	0.03121855	Not HRR	10194
MS2k_13_12_23_25_5_5	Mains	Excavation Damage	Jackson	0.00002931	0.03022611	Not HRR	35262
MS2k_13_12_23_25_5_5	Mains	Incorrect Operations	Jackson	0.00189129	0.00219957	Not HRR	1320
MS2k_13_12_23_25_5_5	Mains	Joint Weld Failure	Jackson	0.00100928	0.00787857	Not HRR	7822
MS2k_13_12_23_25_5_5	Mains	Material Failure	Jackson	0.00114053	0.08565649	Not HRR	19949
MS2k_13_12_23_25_5_5	Mains	Natural Forces	Jackson	0.00128341	0.00818177	Not HRR	9301
MS2k_13_12_23_25_5_5	Mains	Other	Jackson	0.00061750	0.00713104	Not HRR	10823

MS2k_13_12_23_25_5_5	Mains	Other Outside Forces	Jackson	0.00061752	0.00263543	Not HRR	10507
MS2k_13_12_23_25_5_5	Services	Corrosion	Jackson	0.00003485	0.00515269	Not HRR	7764
MS2k_13_12_23_25_5_5	Services	Equipment Failure	Jackson	0.00014277	0.18270634	Not HRR	15374
MS2k_13_12_23_25_5_5	Services	Excavation Damage	Jackson	0.00006438	0.38107266	Not HRR	21341
MS2k_13_12_23_25_5_5	Services	Incorrect Operations	Jackson	0.00006325	0.00656955	Not HRR	6289
MS2k_13_12_23_25_5_5	Services	Joint Weld Failure	Jackson	0.00016164	0.02128664	Not HRR	4545
MS2k_13_12_23_25_5_5	Services	Material Failure	Jackson	0.00019132	0.02669701	Not HRR	11000
MS2k_13_12_23_25_5_5	Services	Natural Forces	Jackson	0.00017091	0.03394987	Not HRR	8416
MS2k_13_12_23_25_5_5	Services	Other	Jackson	0.00011492	0.01236856	Not HRR	6163
MS2k_13_12_23_25_5_5	Services	Other Outside Forces	Jackson	0.00011492	0.01244481	Not HRR	7245

2.4 Risk Management

Pipeline risks are managed by Atmos through completing targeted assessments and surveys, reducing risks through repairs, replacements, or other risk reduction actions, continual evaluation, and improvement.

The risk mitigation strategies employed by Atmos Energy are identified in Sections 6-8 of the DIMP, and include:

- identifying and implementing measures to address risk through programs and policies that include, among others, leak management, damage prevention, operator qualifications, public awareness, continuing surveillance, training, distribution facilities replacement, odorization, and implementing additional and accelerated actions, including those listed in Appendix C.2 of the DIMP; [47,48]
- annual performance measurement and effectiveness evaluations of the DIMP; and
- periodic evaluation and improvement of the DIMP.

[47] Excerpt of DIM Plan - Table of contents
[48] Excerpt of DIM Plan - Potential Additional and Accelerated Actions

There were no risk mitigation actions specifically identified for the areas of Bristol Blvd and Shalimar Dr.

2.4.1 Integrity Assessments

The Atmos assets in the vicinity of the January failures were assessed through inspections and patrols required by the Operations and Maintenance Manual. The two incident locations were not located within designated business districts.

- **Leak surveys**

Generally, discovered leaks remain the same grade throughout the duration of the calendar year.[49]

Table 6. Number of repaired leaks that were regraded.[50]

	2020	2021	2022	2023
Number of leaks repaired, annually	1962	3050	1880	2380
Number of leaks, annually, that were upgraded from grade 2 to grade 1	1	0	0	0
Number of leaks, annually, that were upgraded from grade 3 to grade 1	1	0	0	0
Number of leaks, annually, that were upgraded from grade 3 to grade 2	3	3	1	0
Total number of regraded leaks	5	3	1	0

- **Patrolling**

Atmos Energy accomplishes its patrols in the regular course of operating and maintaining its distribution system through a combination of leak surveys, meter reads, service orders, repairs and replacements, atmospheric corrosion surveys, and similar activities where technicians are present. No separate records for patrolling activities are created.

3.0 Related Engineering Studies

3.1 Post-Incident Engineering studies

NTSB has conducted material testing of the failed gas service assets from the incident locations. For a summary of the testing, refer to the *Materials Laboratory Factual Report* within the docket.

[49] There were no downgraded leaks in the three years reviewed.
[50] Number of Repaired Leaks in MS that were re-graded

3.2 Yazoo Clay

Please refer to *Operations Group Factual Report* for Soil references.

Atmos Energy (and its predecessors) use native soil to backfill the excavation trenches for their gas facilities, when needed. It was not in their practice to backfill the trench with sand/other materials brought to the site.

3.3 Indications of issues with structures in the vicinity of the accident

From 1/4/2019 to 3/25/2024, there were three one call tickets called in indicating foundation repair work on Bristol Blvd: [51]

Table 7. One Call tickets indicating foundation repair for homes on Bristol Blvd

Ticket number	Ticket date	Address	Work Type
20021909430421	2/19/2020	165 Bristol Blvd	Foundation
21012810030641	1/28/2021	135 Bristol Blvd	Foundation
23082414281383	8/24/2023	165 Bristol Blvd	Foundation

There were no foundation repair tickets recorded by One Call Center for Shalimar Dr since 2019.

3.4 Repaired leak information

After the incident, Atmos conducted leak surveys of the area and as of 1/24/2024, the 5 mile radius area, with a center at Capitol Building in Jackson, MS, had 289 open below-ground leaks, including:[52,53]

Grade 1: 0
Grade 2: 82
Grade 3: 207

Of the 289 open leaks, 120 (42.5%) were located in South Jackson:[54]

Grade 1: 0
Grade 2: 21
Grade 3: 99

[51] Bristol & Shalimar_Jackson Hinds Co 811 Calls 2019 to Present
[52] Map of Known Leaks on 1-24-2024 in 5 Mile Radius
[53] The leaks were preexisting and not found after the incident.
[54] List of Open Grade 2 and 3 belowground leaks

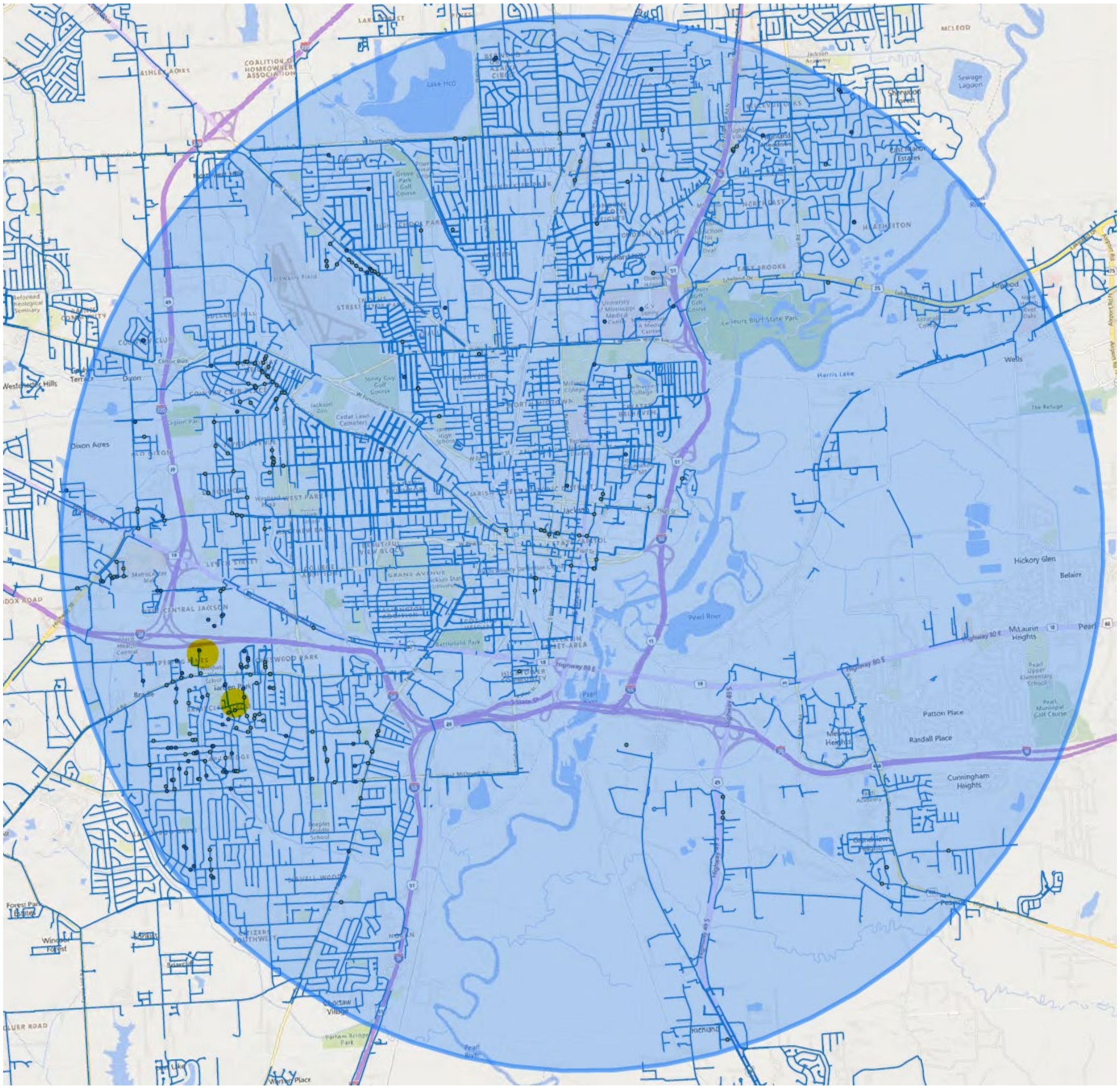

Figure 10 – Map of open belowground leaks, identified with small circles, in Jackson as of 01/24/2024 (highlighted in yellow are the accident locations in South Jackson area)[55]

[55] Map of Known Leaks on 1-24-2024 in 5 Mile Radius

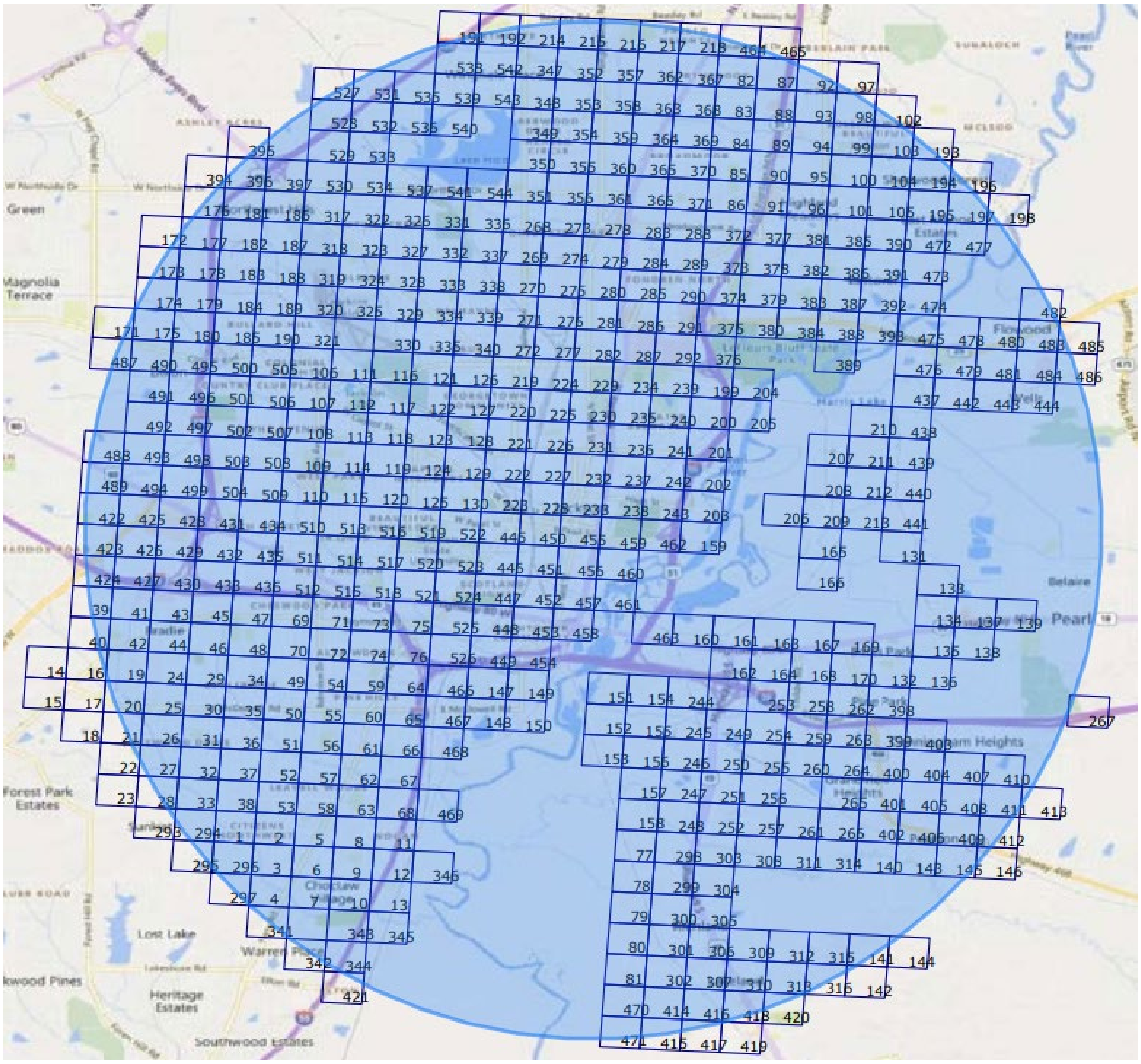

Figure 11 – Map of DIM grids in Jackson, MS[56]

Table 8. Threat risk scores of the 25 Relative Risk Grids in MS[57,58]

Seq. No.	Grid_2k	Asset Type	Threat	Cost Center	Grid2k_Threat_Risk_Score
1	MS2k_10_3_6_6_2_1	Mains	Excavation Damage	Clarksdale	0.131628307
2	MS2k_11_13_16_25_5_5	Mains	Equipment Failure	Greenwood	0.335454181
3	MS2k_11_13_16_25_5_5	Mains	Natural Forces	Greenwood	0.035396329
4	MS2k_12_8_16_14_3_4	Mains	Equipment Failure	Yazoo City	0.000046520

[56] Map of DIM Grids in 5-mile radius
[57] DIM HRR Grid2ks CY2023 (Mississippi)
[58] DIMP assessment identified 155 HRR grids after Atmos's SME evaluation was completed in the state of MS in 2023. 68 HRR of them were in Jackson, MS. The complete list of Atmos identified HRR grids for the state of Mississippi is included in DIM HRR Grid2ks CY2023 (Mississippi)

5	MS2k_13_12_11_20_4_5	Mains	Natural Forces	Jackson	0.016156599
6	MS2k_13_12_11_25_5_5	Mains	Equipment Failure	Jackson	0.143359023
7	MS2k_13_12_17_15_3_5	Mains	Natural Forces	Jackson	0.008876116
8	MS2k_13_12_21_5_1_5	Mains	Natural Forces	Jackson	0.012086739
9	MS2k_13_12_22_1_1_1	Mains	Material Failure	Jackson	0.002241478
10	MS2k_13_13_21_18_4_3	Mains	Equipment Failure	Jackson	0.091071888
11	MS2k_13_16_10_12_3_2	Mains	Equipment Failure	Jackson	0.000742825
12	MS2k_13_16_10_17_4_2	Mains	Equipment Failure	Jackson	0.000237222
13	MS2k_13_16_10_24_5_4	Mains	Material Failure	Jackson	0.019170912
14	MS2k_13_16_19_13_3_3	Mains	Excavation Damage	Jackson	0.098354466
15	MS2k_13_16_21_13_3_3	Mains	Excavation Damage	Jackson	0.093955882
16	MS2k_13_17_6_18_4_3	Mains	Excavation Damage	Jackson	0.117973279
17	MS2k_13_17_6_2_1_2	Mains	Excavation Damage	Jackson	0.143813119
18	MS2k_13_17_7_13_3_3	Mains	Excavation Damage	Jackson	0.267978291
19	MS2k_13_17_7_18_4_3	Mains	Excavation Damage	Jackson	0.205717088
20	MS2k_13_17_7_2_1_2	Mains	Corrosion	Jackson	0.015206528
21	MS2k_19_17_4_1_1_1	Mains	Equipment Failure	Kosciusko	0.003180998
22	MS2k_2_25_6_1_1_1	Mains	Corrosion	Cleveland	0.008677454
23	MS2k_26_10_21_23_5_3	Mains	Equipment Failure	Columbus	0.013889816
24	MS2k_26_13_10_11_3_1	Mains	Equipment Failure	Tupelo	0.026663772
25	MS2k_27_2_20_13_3_3	Mains	Other	Columbus	0.007005836

3.4.1 Leak repair process

"Operations and Technical Services work collaboratively to repair leaks within the Mississippi Division. Grade 1 leaks are typically repaired by Atmos company crews. Operation Supervisors, Field Construction Coordinators, and Crew Leaders all play key roles in the Grade 1 leak repair process relative to determining how to perform the repair and then executing on it. Contract crews typically repair the majority of Grade 2 and 3 leaks in the Mississippi Division. Since these leaks are non-hazardous, they are scheduled for repair in accordance with the repair guidelines contained in Chapter 9 of Atmos Energy's O&M Manual (see JXN-NTSB-00032-00060). In general, the contract crews are assigned specific leaks to repair by Atmos personnel, and Atmos Operation Supervisors and Field Construction Coordinators monitor the work. The Construction/Project Management Group within Technical Services monitors the number, location, and repair timelines of outstanding Grade 2 and 3 leaks across the Mississippi Division and works with Operations to provide sufficient contract resources to make the needed repairs within the required timelines."[59]

[59] Atmos Energy's Responses to Data Requests (Provided May 2, 2024)

Leak repair priority: “Grade 2 Leaks should be repaired or cleared within one calendar year, but no later than 15 months from the date the leak was reported. In determining repair priority, the following criteria should be considered:

- Amount and migration of gas,
- Proximity of gas to buildings and subsurface structures,
- Extent of pavement,
- Soil type, venting, frost cap, moisture,
- System pressure; and,
- Nature of the leak.”[60]

3.4.2 Leak Reporting

Field training and mentoring occurs among employees and their supervisors related to entering leak repair data, including leak causation. A formal computer-based training on distribution integrity management, including information on leak causation, was provided to Atmos' Operations and Technical Services groups in the fall of 2023. The section that covered Natural Forces threat states “An indication that a leak or incident might occur from earth movements, earthquakes, landslides, subsidence, lightning, heavy rain, floods, washouts, floatation, mudslides, scouring, temperature, frost heave, frozen components, high winds, or similar natural causes.” There was no mention of the swelling of the soil due to rains/Yazoo clay.

The training did not provide specific examples nor quizzed employee on which leak classifications by threat to use in a scenario.

3.4.3 Leak history

Leak history from submitted PHMSA Annual Reports for Atmos Energy Mississippi is below (Hazardous leaks):

Table 9. Total repaired leaks by cause in Mississippi, hazardous and non-hazardous for both mains and services, including above and below ground

Leak Cause	2019	2020	2021	2022	2023
Corrosion failure	137	134	204	177	330
Equipment Failure	1410	886	1612	823	1117
Excavation Damage	440	415	481	527	490
Materials & welds	52	46	63	31	129
Natural forces	297	148	228	113	108
Incorrect Operations	216	150	165	60	88
Other Cause	92	101	212	68	31
Other outside forces	86	82	85	81	87

The number of repaired leaks, per cause and hazard level, and open leaks at the end of the year, presented in the tables 7-9.

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[60] Excerpt of O&M-Ch.9 Gas Leak Surveys

Table 10. Annual Repaired leaks in Mississippi, including above and below ground[61]

	2019	2020	2021	2022	2023
Hazardous leaks repaired	785	789	818	784	863
mains	148	148	172	183	169
services	637	641	646	601	694
Non-Hazardous leaks repaired	1945	1173	2232	1096	1517
mains	300	192	330	249	419
services	1645	981	1902	847	1098
Total leaks repaired	2730	1962	3050	1880	2380
Number of Known Leaks at Year-End[62]	830	1428	479	960	3178

Table 11. The number of repaired hazardous leaks by cause, for mains, in Mississippi:

Repaired hazardous leaks on mains	2019	2020	2021	2022	2023
Corrosion Failure	14	24	13	10	29
Equipment Failure	21	20	20	15	19
Excavation Damage	89	67	108	143	108
Materials & welds	1	0	3	3	1
Natural forces	11	16	17	3	5
Incorrect Operations	5	5	7	1	0
Other Cause	0	9	0	2	1
Other outside forces	7	7	4	6	6

Table 12. The number of repaired hazardous leaks per cause, for services, in Mississippi:

Repaired hazardous leaks on services	2019	2020	2021	2022	2023
Corrosion Failure	22	34	21	31	46
Equipment Failure	125	104	147	81	104
Excavation Damage	321	334	360	374	377
Materials & welds	5	5	1	4	8
Natural Forces	78	70	42	37	64
Incorrect Operations	23	19	16	11	21
Other Cause	7	14	6	7	9
Other outside forces	56	61	53	56	65

[61] Leak Repair Data for MS (2014-2023)
[62] Number of Known Leaks at Year-End in Mississippi (2014-2023), of the 3,178 known leaks, 2,258 (71%) were above-ground and 920 (29%) were below-ground

3.4.4 Leak history involving mechanical fitting failures

3.4.4.1 MS hazardous leaks due to mechanical fitting failures

Number of hazardous leaks involving a mechanical fitting failure, by year, for Mississippi, as submitted via PHMSA Annual Reports:

2021: 120
2022: 35
2023: 94

3.4.4.2 Hazardous leaks due to mechanical fitting failures in South Jackson

The number of hazardous leaks involving a mechanical fitting failure (MFF), by year, for South Jackson area, from 1/13/2014 to 1/31/2024 (not including the incident location failures) was 88.[63] All 5 hazardous leaks repaired in 2024 were discovered after 1/24/2024, the date the first incident occurred.

Of those leaks, 60 were due to equipment failure, 1 due to excavation damage and 27 due to natural forces.[64] All, but one, leaks were repaired the day they were discovered.

Table 13. The number of repaired hazardous leaks due to MFF in South Jackson, MS, by cause:[65]

	2014	2015	2016	2017	2018	2019	2020	2021	2023	2024	Total
Equipment Failure	9	9	12	12	11	1		2	1	3	60
Excavation Damage	1										1
Natural Forces	5	6	7			1	1		5	2	27
Total	15	15	19	12	11	2	1	2	6	5	88

4.0 Procedures

Atmos Energy's Distribution Integrity Management Plan was first issued on August 2, 2011. The revision in effect at the time of the incidents was dated December 31, 2022. The document details DIMP procedures. Key sections are noted below:

- Section 1 - Introduction
- Section 2 – Atmos Energy DIM Plan Overview
- Section 3 – System Knowledge

[63] List of 10 Year History of MFF
[64] 10 Year MFF leak repair data (South Jackson)
[65] Number of leaks per year for 2014, 2015 and 2016 was different between List of 10 Year History of MFF and 10 Year MFF leak repair data (South Jackson), but the total for the time frame in both sets was the same at 88 leaks.

- Section 4 – Risk
- Section 5 – Threats
- Section 6 – Identify and Implement Measures to Address Risk
- Section 7 – Annual Performance Measurements and Evaluation
- Section 8 – Periodic Evaluation and Improvement
- Sections 9-14 are Appendixes

5.0 Industry Guidance and Consensus Standards

- ASME B31.8S, *Managing System Integrity of Gas Pipelines*
- *ANSI GPTC 2380.1 Guide for Transportation of Natural and other Gas by Pipeline.*

6.0 Regulatory Requirements

Federal pipeline safety regulations are found in 49 *CFR* Parts 190-199. Integrity management requirements are included in 49 CFR Part 192, Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards

- 49 CFR §192.721, Distribution systems: Patrolling, requires the frequency of patrolling mains be determined by the severity of the conditions which could cause failure or leakage, and the consequent hazards to public safety
- 49 CFR §192.723, Distribution systems: Leakage surveys, requires each operator conduct periodic leakage surveys with leak detector equipment as frequently as necessary, but at least once every 5 calendar years at intervals not exceeding 63 months.
- 49 CFR Part 192 Subpart N, Qualification of Pipeline Personnel, prescribes minimum requirements for operator qualification of individuals performing covered tasks on a pipeline facility. A covered task is an activity that:
    - - Is performed on a pipeline facility
    - - Is an operations or maintenance task
    - - Is performed as a requirement of this part, and
    - - Affects the operation or integrity of the pipeline
- Subpart P, Gas Distribution Pipeline Integrity Management

  49 CFR §192.1007, specifies the required elements of an integrity management plan:
    - knowledge; identify threats; evaluate and rank risk; identify and implement measures to
    - address risks; measure performance, monitor results, and evaluate effectiveness; periodic

- evaluation and improvement; report results.

49 CFR Part 196, Protection of Underground Pipelines from Excavation Activity

State of Mississippi regulations that apply to every public utility, as defined in MS Code of 1972, impose regulations through Title 39: Utilities, Part III: Rules and Regulations Governing Public Utility Service, Subpart Special Rules – Gas. [66]

7.0 Historical Records

7.1 Previous Atmospheric Corrosion Assessments

Atmos completed inspection of above ground facilities for each of the sites on the following dates:[67]

Table 14. Inspection history for 185 Bristol Blvd and 1146 Shalimar Dr.

MRU	Installation	Premise	Survey Date	Hs	Street	City	Customer	Atmos Corr	Need Paint	No Issue	Tech	Repair Date
07JA098A	7001565796	700417405	12/9/2023	185	BRISTOL BLVD	Jackson	Johnny Barbour			X	Tech 1	
07JA098A	7001565796	700417405	5/11/2023	185	BRISTOL BLVD	Jackson	Johnny Barbour			X	Tech 2	
07JA098A	7001565796	700417405	6/15/2020	185	BRISTOL BLVD	Jackson	Johnny Barbour			X	Tech 2	
07JA098A	7001565796	700417405	11/13/2017	185	BRISTOL BLVD	Jackson	Johnny Barbour			X	Tech 3	

MRU	Installation	Premise	Survey Date	Hs	Street	City	Customer	Atmos Corr	Need Paint	No Issue	Tech	Repair Date
08JA109H	7001487102	700417045	12/10/2023	1146	SHALIMAR DR	Jackson	Sfr3 Llc			X	Tech 4	
08JA109H	7001487102	700417045	5/15/2023	1146	SHALIMAR DR	Jackson	Sfr3 Llc			X	Tech 5	
08JA109H	7001487102	700417045	6/15/2020	1146	SHALIMAR DR	Jackson	Sfr3 Llc			X	Tech 5	
08JA109H	7001487102	700417045	11/13/2017	1146	SHALIMAR DR	Jackson	Sfr3 Llc			X	Tech 6	

7.2 Leak and Failure History[68]

According to the PHMSA data, 75 gas distribution incidents have involved Atmos assets, across its eight state operating territory, since 2010, resulting in 6 fatalities and 22 injuries.[69] These incidents were attributed to the following causes:[70]

- corrosion failure (1)
- equipment failure (4)
- excavation damage (38)
- incorrect operation (4)

[66] Rules and Regulations Issued by the Mississippi Public Service Commission
[67] Bristol and Shalimar Atmospheric Corrosion Reports
[68] PHMSA Distribution Incident Data
[69] PHMSA defines *incidents* as: incidents including any of the following conditions, but gas distribution incidents caused by a nearby fire or explosion that impacted the pipeline system are excluded: 1) Fatality or injury requiring in-patient hospitalization. and 2) $122,000 or more in total costs, measured in 2020 dollars
[70] 12 (16%) of the 75 incidents had occurred on facilities with unknown installation date.

- natural force damage (3)
- other incident cause (3)
- other outside force damage (13)
- pipe, weld, or joint failure (9).

Of the 75 incidents, 3 were reportedly caused by mechanical joint failures, 1 of them occurred in Jackson, MS:

1) On 12/29/2014, an explosion and fire occurred in North West Jackson neighborhood. The cause of the explosion was contributed to a gas leak, caused by a mechanical joint failure on a gas service line. Atmos was notified of the event by the Emergency Responders (NRC report# 1209969).
2) On 1/1/2018, an Atmos crew was working a gas leak for over 8 hrs. at an intersection, when nearby residence at 3567 Colgate Ln, Irving, TX ignited. All occupants were evacuated from the residence without injury. It was determined that the 6" plastic main had separated from one end of a mechanical, bolted fitting that was used to join the main, causing the migrated gas leak. Atmos was notified of the event by the pubic (NRC report# 1200886).
3) On 4/21/2018, Atmos Energy received a notice of the incident that had occurred at 900 n. O'Neal St in Caldwell, TX the previous day. Arrived technicians discovered indications of natural gas present under the street and in the sewer. A leak was discovered near the location where the service line tapped into the gas main. The gas leak was traced to a dresser fitting of the 900 coupling assembly. Atmos was notified of the event by the Emergency Responders (NRC report# 1104428).

Table 15. Atmos MS incident history since 2013.[71]

Report Receive Date	Report Number	Fatalities or injuries	Cause	Narrative
5/12/2022	1335844	No	Excavation damage	Atmos Energy's second-party contractor was in the process of replacing a critical valve on an 8-inch high pressure distribution line near Aberdeen, MS. An unlocatable and unmapped 2-inch nipple and a valve were damaged during excavation activities. The unintentional loss of gas exceeded the reportable threshold, and Atmos Energy reported the damage as an incident.

[71] PHMSA Distribution Incident Data

6/4/2019	1247854	No	Other outside force damage	A vehicle collided with a gas regulator station in Jackson, MS. The impact caused the distribution station to separate from its connecting piping. The resulting escaping gas ignited, causing a fire and loss of gas service to connected customers.
12/29/2014	1104428	No	Pipe, weld, or joint failure (mechanical joint failure)	Atmos was notified of a fire at a residence located at 409 W. Hill Dr. in Jackson, MS (North West Jackson). Some of the exterior walls had been displaced outward indicating a possible explosion. Due to heavy rains saturating the soil, performance of leak surveys around the premise were difficult. Ultimately a leak was found behind the left rear corner of the house alongside the side street (Magnolia Dr.). The saturated soil caused gas to migrate along the roots of a tree towards the residence. In haste to secure the scene and stop the leak, the construction crew shut off the service tap and dislodged a mechanical fitting connected to the tap. As a result, it is impossible to know for certain the specific source of the leak.
11/12/2014	1100900	No	Equipment failure	The debris damaged the rubber diaphragm of a device controlling pressure and settled in the pressure relief pilot at a regulator station in Kosciusko, MS. Rising pressures caused the failure of a service regulator at a grocery store, resulting in a fire. The grocery store was closed at the time.

8.0 Post-accident Actions

8.1 MS PSC

Following the explosions, the Mississippi Public Service Commission has:[72]

- increased construction inspections on the Atmos gas system because of the accelerated pipe replacement that is going on in the Jackson, MS area.
- participated in the Atmos Joint Assessment Meetings with PHMSA.
- continued to investigate the incidents.

There have not been any violations letters sent to Atmos.

[72] MS PSC actions taken email- Jackson, MS (PLD24FR003)

8.2 Atmos

Atmos indicated that they have taken or plan to take the following post-accident safety actions:[73]

1 changed leak management approach by
   - completing repair of 120 open below-ground leaks in South Jackson, that were open as of 1/24/2024.
   - Leak evaluation timeframe is shortened temporarily to re-evaluate all below-ground Grade 2 and Grade 3 leaks every thirty (30) days.
   - Repair of grade 2 and grade 3 leaks is temporary being completed at a shorter time interval of 6 months or sooner
   - Implemented temporary increase in leak survey frequencies for areas across Mississippi.

2 Offered additional leak survey training to leak survey technicians, compliance supervisors, third-party contractors performing leak surveys. Leak classification and Emergency Response training is offered to operations employees.

3 Implemented changes to DIMP
   - Updated Earth Factor with current year data.

4 Additional natural gas safety training sessions provided to first responders in Jackson, MS area.

5 Plan to initiate a dynamic soil stability alert system for all of MS. The system considers significant changes in soil moisture and alarms Atmos to perform an additional leak survey of the reported area. [74]

Submitted by:

Elena Bozhko
Integrity Management Group Chair

[73] Continuous Improvement Safety Initiatives reported by Atmos
[74] Action 5 is a planned action; this action was not yet implemented