Adequacy
Adequacy is achieved when completeness of processes, procedures, roles, and responsibilities and associated organization meet specific requirements from either regulations or adopted industry standards.

ALARP
As Low As Reasonably Practicable.

Anode
The location in a corrosion cell where oxidation occurs. The anode is used to protect the cathode.

Anomaly
An unexamined deviation from the norm in pipe material, coatings, or welds, which may or may not be a defect.

Appurtenance
A component that is attached to the pipeline (e.g., valve, tee, casing, instrument connection).

Audit
Systematic, independent, and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which the audit criteria are fulfilled [1].

Cathode
The location in a corrosion cell where reduction occurs. The pipeline is desired to be the cathode.

Characteristic
Any physical descriptor of a pipeline (e.g., grade, wall thickness, manufacturing process) or an anomaly (e.g., type, size, shape).

Class Location
A Class Location is a geographical area classified according to the number of dwellings that are considered when designing

**FIG. G.1 HIERARCHY OF TERMINOLOGY FOR INTEGRITY ASSESSMENT**
(Source: American Society of Mechanical Engineers - ASME B31.8S-2014 Fig. 13-1)
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and pressure testing pipelines to be located in the area. The class location-assessment area is comprised of a moving area of 200-m perpendicular to either side of the pipeline centerline with a length of 1600 m used for counting the number of dwellings with the purpose of designating a class ranging from one to four.

Reference: CSA-Z662-11

**Combustible**

Combustible liquids have the ability to burn at temperatures that are usually above normal working temperatures. Under the Workplace Hazardous Materials Information System (WHMIS), Combustible liquids have a flashpoint at or above 37.8°C (100°F) and below 93.3°C (200°F).

Reference: www.ccohs.ca/oshanswers/chemicals/flammable/flam.html

**Compliance**

It is a state of being in accordance with an established official requirement such as a pipeline act, law, regulation, adopted industry and/or company own standards. Compliance action or activity meets the requirements of legislation, rules and regulations and adopted consensus standards.

**Compliance, Non-**

Non-compliance is a failure to adhere to legislation, rules and regulations, and adopted consensus standards. Non-compliance can be classified as high, medium, and low risk.

A high-risk non-compliance is one where the nature of the non-compliance makes it more likely than other non-compliances to result in a major loss, such as life-altering injury or fatality, immediate loss of containment of a system, or other similar losses. Where non-compliance is considered high risk, corrective and/or preventive actions should be immediately undertaken.

**Conformance**

Conformance is being in accordance with a requirement, standard, code, or procedure defined by the company, but not required in the act, law, regulation nor adopted consensus standard by any corresponding jurisdiction.

**Conformance, Non-**

Non-conformance is a failure to comply with a requirement, standard, code, or established procedure defined by the company, but not required in the act, law, regulation nor adopted by any legal entity.

**Consequence**

Any unplanned effect on the environment, people, or pipeline operation.

**Corrective Action Plan**

A documented plan outlining activities and actions taken to eliminate and address the causes of an existing non-conformance or non-compliant findings identified in a compliance verification method to rectify or prevent recurrence. The Corrective Action Plan describes the methods and actions, which will be used to correct the non-compliance.

**D**

**Defect**

A physically examined anomaly with dimensions or characteristics that exceed acceptable limits. The word “defect” implies substandard. Substandard refers to a system that does not comply with its original fabrication standard. Hence, “defect” does not mean “failure”: it means it is not acceptable to a standard.

**Dem: Digital Elevation Model**

DEM represents the 3D format-surface of the terrain. For consequence assessments, DEM assists in understanding terrain topography, geomorphology, and physical geography for developing models that can be used for areas such as farming, agriculture, forestry, engineering, and pipeline fluid dispersion and consequence assessments.

**Detect**

To sense or obtain a measurable indication from a feature.

**Direct Assessment (DA)**

Direct Assessment (DA) is a non-destructive assessment technique for classifying pipeline regions with common characteristics (i.e., Pre-Assessment) that may be experiencing the selected integrity threat (e.g., external corrosion, internal corrosion or stress corrosion cracking). Those regions are supplemented with field surveys (i.e., Indirect Inspection) and validated through excavation (i.e., Direct Examination) and results used for evaluating the effectiveness of the assessment and estimating the reassessment interval (i.e., Post Assessment).

**Disbonded**

Coating that is not adhered to the pipe surface.

**E**

**Effectiveness**

Effectiveness is achieved when the PIMS goals and objectives are met in a safe manner.

**Efficiency**

Efficiency is achieved when the effort (e.g., time, resources) invested is optimal accomplishing the expected results in a safe, quality, and time manner.

**Electrolyte**

A liquid medium that allows the transfer of ions in the corrosion cell.

**Emergency Response Planning Guidelines (ERPG)**

ERPGs are exposure guidelines designed to anticipate health effects from exposure to certain airborne chemical concentrations. ERPGs estimate the concentrations at which most people will begin to experience health effects if they are exposure to a hazardous airborne chemical for 1 hour.


**F**

**Feature**

Any physical object detected by an ILI system.

**Fitness-For-Service**

Fitness-for-service principle is that a structure is considered adequate for its purpose, provided the conditions to cause failure are not reached. It involves conducting a quantitative engineering evaluation to demonstrate the structural integrity of a component that may contain a flaw or damage. This evaluation is often called an 'engineering critical assessment' (ECA).

**Flammable**

Flammable liquids will ignite (catch on fire) and burn easily at normal working temperatures. Under the Workplace Hazardous
Materials Information System (WHMIS), flammable liquids have a flashpoint below 37.8°C (100°F).
Reference: www.ccohs.ca/oshanswers/chemicals/flammable/flam.html

**Flammable and Explosion Limits**

The range of fuel vapor-to-air ratio necessary for a concentration to fire or explode is called fire or explosion limits. They range between the Lower Flammability/Explosion Limit (LFL or LEL) and Upper Flammability/Explosion Limit (UFL or UEL), respectively.

**Flashpoint**

The flashpoint of a liquid is the lowest temperature at which the liquid gives off enough vapor to be ignited (start burning) at the surface of the liquid.
Reference: www.ccohs.ca/oshanswers/chemicals/flammable/flam.html

**Hazard**

Hazard means anything that can cause harm (e.g., chemicals, electricity, working from ladders, etc.), whereas risk is the chance, high or low, that somebody will be harmed by the hazard.

**Hazard (Integrity)**

Hazard is defined by Webster’s dictionary as “a source of danger” and danger is explained as the exposure or liability to harm or loss. Thus, an Integrity Hazard can be defined as any situation or event or condition (e.g., coating damage) able to initiate or grow an integrity threat (e.g., corrosion).

**Hazardous Effects**

Hazardous effects can be caused to humans, environment, and property resulting from the dispersion of a vapor cloud or fluid (e.g., spread velocity, density, or concentration) and/or its flammability, combustibility, explosion and toxicity characteristics.

**Holiday**

A small location where pipe steel is exposed through the coating.

**In-Line Inspection (ILI)**

ILI is a non-destructive inspection technique that can be used for integrity assessment of pipelines. The type of ILI survey performed is dependent upon the type of integrity threat that is being assessed. In-Line Inspection pigs are distinguished from other pigs in that they have sensors for collecting and recording information about the condition of the pipeline. In-Line Inspection is explained in detail in the chapter 8.

**Inspection Test Plan (ITP)**

Document that covers all of the steps for a paint or coating application to a pipeline.

**L**

**Lethality Probability**

Lethality probability specifies the change of having fatalities under a certain conditions (e.g., heat intensity threshold) or boundaries (e.g., open or confined space).

**LIDAR: Light Detection and Ranging Technology**

LiDaR is a remote sensing method used to capture topographic (with near-infrared laser) and/or bathymetric (with water-penetrating green light) information of the surface of the earth. This information can be used for producing Digital Elevation Models (DEM). LiDAR instruments mainly consist of a laser, a scanner, and a specialized GPS receiver.
Reference: oceanservice.noaa.gov/facts/lidar.html

**Likelihood**

The probability that an event occurs.

**M**

**MAOP**

Maximum Allowable Operating Pressure defined as per US 49 CFR DOT. Canada standard, CSA Z662, and regulation, NEB OPR, defines MOP (Maximum Operating pressure) to similarly United States regulation.

**Mitigation**

The act of removing a threat or reducing the likelihood of a threat causing a consequence on the pipeline.

**Monitoring**

The act of ensuring that known threats do not increase likelihood of.

**N**

**Near misses**

An event could have the potential to incur a loss under certain circumstances.

**P**

**People Concentration**

People concentration refers to locations with concentrations equal or higher than 20 persons that may be used infrequently such as weekly, monthly, or seasonal.


Performance Criteria and Symbols

The integrity performance criteria provides the acceptability of the integrity performance measure based on a pre-defined expectation, benchmark or standard (e.g., <80% deep corrosion), which can be graded in multiple levels from acceptance to rejection (e.g., <50%, 50% to 70%, >70%). The results of the comparison can also be expressed as a three-color code (e.g., green, yellow, red), binary response (e.g., Yes/No), percentage and qualitative measure (e.g., low, medium, high).

Performance Cycle

The performance cycle describes the objectives and interrelationship of the performance elements of integrity management driven by continuous improvement. The performance cycle is divided in four (4) stages: input or integrity feed, process or integrity progress/fraction, output or system response to integrity actions, and outcome or integrity end-results towards goals.

Performance Indicator

An integrity performance indicator represents an integrity focus, objective, or outcome to be measured and compared against stakeholders’ goals, targets, or expectations. A condition indicator would reflect the level of degradation of the pipeline related to an integrity threat (e.g., corrosion), group of threats (e.g., time-dependent) or overall pipeline condition; whereas, the integrity management indicator would reflect the level of adequacy, implementation or effectiveness of a given activity (e.g., corrosion inhibition), process or program (e.g., corrosion inhibition).

Performance Measure

An integrity performance measure quantifies one (or the key) factor or component (e.g., maximum depth of corrosion anomalies) of an integrity performance indicator within a time period (e.g., monthly, quarterly or annually). A collection of selected measures (e.g., corrosion identification and mitigation) can be used to build up a performance indicator (e.g., corrosion performance). Hence, integrity performance indicators are comprised of one or more integrity performance measures.

Pipeline

Pipeline includes all components through which oil and gas industry fluids are conveyed including pipe, isolating valves and other appurtenances, but excluding pumping, compression, and metering stations. This definition makes the pipeline starting and ending at the station fence excluding components within the stations or facilities. Simply, pipeline definition would include pipe and accessories from fence to fence.

Pipeline Integrity

Pipeline Integrity is the status of a pipeline defined by its structural reliability and availability to transport a fluid under safe conditions.

Pipeline Integrity Management Program (IMP)

IMP can be defined as an engineering-sound process to manage the integrity a pipeline through the identification, susceptibility, assessment, prevention, mitigation and monitoring of risks to protect people and environment providing a reliable service to shippers and customers. PIMS is supported at the core by an engineering-sound Integrity Management Program (IMP).

Pipeline Lifecycle

It is a series of changes in the life of a pipeline, covering the design, construction, operation, maintenance, discontinuation/deactivation, and abandonment.

Pipeline Systems

Pipeline System includes all components of a pipeline and facilities required to move oil, gas and products including measurement, non-formation storage (e.g., tank farms), transportation and distribution. Furthermore, industry standards typically define Pipeline Systems within their applicability flowcharts having in common the exclusion of production, underground formations, bulk plant, steam generation, tanker and barge loading/unloading, gas processing and refinery facilities.

Pipelines, Distribution

Distribution Pipelines transport treated fluids from transmission pipelines, distribution centers, or terminals to the end-user or customer. Distribution pipelines are also known as city or town networks. Distribution pipelines cross populated and environmentally sensitive areas to reach houses, factories, or dwellings with high exposure to excavation or drilling damage. Distribution pipelines are designed for low pressures (i.e. <30% SMYS) transporting smaller volumes for shorter distances with thinner pipe walls underground.

Pipelines, Gathering

Gathering Pipelines transport untreated fluids from onshore or offshore wells to battery/treatment, processing or refining facilities for extracting natural gas, natural gas liquids (e.g., propane, butane, and ethane) or crude oil. Gathering pipelines are also known as feeders.

Pipelines, Transmission

Transmission Pipelines transport treated fluids from processing, production, or refining facilities to distribution centers or terminals. Transmission pipelines are also known as trunk lines. Facility laterals or interconnecting pipelines can be also included within the transmission pipeline category, if the fluids have been treated.

Population Density

The population density at any point along the pipeline can be calculated as the number of occupant of all buildings and facilities within an assessment area centered on that point, divided by the size of the selected assessment area.

Reference: CSA-Z662-11

In the United States, census block data can also be used as an estimate for residential population estimates, but it does not represent daytime business population distributions. Expand (Robin).

Potential Impact Radius (PIR)

The radius of a circle within which the potential failure of a pipeline could have significant impact on people or property. PIR is determined by the formula \( r = 0.69 \times (p^2 d^2) \), where ‘r’ is the radius of a circular area in feet surrounding the point of failure, ‘p’ is the minimum allowable operating pressure (MAOP) in the pipeline segment in pounds per square inch and ‘d’ is the nominal diameter of the pipeline in inches.

Note: 0.69 is the factor for natural gas. This number will vary for other gases depending upon their heat of combustion.

Reference: http://www.phmsa.dot.gov/staticfiles/PHMSA/Pipeline/TQGlossary/
**Pressure Reversal**

A pressure reversal is a phenomenon where a pipeline fails at progressively lower pressures during depressurization/unloading or subsequent tests.

**Pressure testing**

Pressure testing is a destructive testing technique to detect/eliminate (by failing) the largest defect in the pipeline at the time of the testing that can fail due to internal pressure. The test is performed at a pressure higher than the proposed pipeline operating pressure providing a pressure-dependent safety margin to the normal operation and leak-tightness at the time of the testing. Pressure testing is explained in detail in the Chapter 9.

**Prevention**

The act of stopping a threat from occurring on a pipeline during any phase of a pipeline’s life cycle.

**Probability of Detection (POD)**

The probability of a feature being detected by an ILI tool.

**Probability of Failure (PoF)**

Probability of Failure (PoF) is the probability or likelihood that an event or condition will result in failure factoring their resistance and loading characteristics. PoF is mathematically defined as the Unitarian complement of reliability or $R$ (i.e., $PoF = 1 - R$). The probability of failure is typically expressed as a dimensionless number (changes of failure); however, as the number reach very low magnitude, they can also be expressed in terms of kilometer or per year per mile (i.e., PoF/year-km, PoF/year-mile).

**Probability of Identification (POI)**

The probability that the type of anomaly or other feature can be correctly classified (e.g., as metal loss, dent).

**Probit Analysis**

Probit analysis is an approach for determining the effects of a received dose of either toxic substances or thermal radiation. The Probit functions calculate the fatality rate of personnel exposed to harmful agents over a given period. Reference: [www.hse.gov.uk/foi/internalops/hid_circc/technical_osd/spc_tech_osd_30/spctecosd30.pdf](http://www.hse.gov.uk/foi/internalops/hid_circc/technical_osd/spc_tech_osd_30/spctecosd30.pdf)

**Purge**

Process to remove hydrocarbon fluids out of the pipeline typically using nitrogen or non-toxic liquids until the pipeline is free of potential pollutants or contaminants.

**R**

**Receptors**


**Reliability**

Reliability is defined as the probability that a component of pipeline system will perform its required function without failure during a specified time interval (usually taken as one year). Reliability is expressed as 1 minus PoF, where the PoF is the probability that a segment, section, component part, or equipment associated to a pipeline system fails its required function under given operating conditions for a specific time period.

**Risk**

Risk is a measure of human injury, environment damage, or economic loss in terms of both the incident likelihood and the magnitude of the loss or injury (Centre for Chemical Process Safety, 2000). In pipeline integrity, is a measure of the safety of the structural integrity of a pipeline system, which considers the probability of failure associated to its consequence of an undesirable event (i.e., leak or rupture).

**Risk, Individual**

Individual risk is the probability that an individual at a specific pipeline location will be a casualty as a function of distance from a pipeline because of pipeline rupture assuming that the individual is present 100% of the time.

**Risk, Societal**

Societal risk is a measure of the risk where the consequence considered is a function of the expected number of fatalities (N) or injured persons occurring due to a pipeline failure, and the probability incident causing number of fatalities (i.e., # of Fatalities/km-year).

**Risk-based design**

Risk-based design is a process that enables the pipeline design to minimize risk in a cost-effective manner and to demonstrate safe and reliable pipeline operations.

**Risk Management**

The systematic application of management policies, procedures, and practices to the tasks of analyzing, assessing, and controlling risk in order to protect employees, the general public, and the environment as well as company assets while avoiding business interruptions [2].

**S**

**Service Provider**

Any organization or individual providing services (e.g. in-line inspection, cathodic protection, depth of cover, above ground surveys, laboratory analysis) to operators.

**Shielding**

Prevention of cathodic protection current from reaching the pipe.

**Sizing Accuracy**

The accuracy with which an anomaly dimension or characteristic is reported.

**Societal risk**

Societal risk measures the overall risk where consequences considered is a function of the expected of fatalities occurring due to a pipeline failure. Societal risk is defined as the relationship between frequency of number of fatalities (F) and the number of fatalities (N) suffering from a specified level of harm in a given population from the consequence of hazardous fluids being released from a pipeline.

**T**

**Test, Leak**

This test is used to determine that a pipeline segment does not show evidence of leakage.
Test, Spike
This test is used to verify the integrity of a pipeline containing “time dependent” defects.

Test, Strength
This test establishes the operating pressure limit of a pipeline segment.

Threats, Integrity
An Integrity Threat is defined as an abnormal state affecting a pipeline that may have the capacity to cause a failure. Abnormal states or threats (e.g., Stress Corrosion Cracking) are typically created, made active, or grown by one or more hazards (e.g., tape coating damage, stress levels, pipe manufacturing thermal treatment).

Toxic and Toxicity
Toxic means able to cause harmful health effects to receptors. Toxicity is the ability of a substance to cause harmful health effects. Under the Canadian Controlled Products Regulations and the U.S. OSHA HAZCOM Standard, there are specific technical criteria for identifying a material as toxic for the purpose of each regulation.
Reference: http://www.ccohs.ca/oshanswers/chemicals/glossary/msds_gloss_n.html#_1_67
Reference: en.m.wikipedia.org/wiki/Digital_elevation_model

Vapor Cloud
A vapor cloud can be formed from the discharged pipeline fluid by
a. Being a fluid in gaseous state (i.e., gas);
b. Vaporizing fluid (i.e., liquid or liquefied gas) while escapes from the pipeline, and/or;
c. Evaporating from the spills (i.e., liquids) shorter distances with thinner pipe walls underground.

REFERENCES