

24. INTEGRITY MANAGEMENT SYSTEM FOR NATURAL GAS PIPELINES, REGULATION, 2012

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2006; (b) "Board" means the Petroleum and Natural Gas Regulatory Board established under sub-section (l) of section 3 of the Act; (c) "natural gas pipeline" means the pipeline as defined under the Petroleum and Natural Gas Regulatory Board (Authorizing Entities to Lay, Build, Operate or Expand Natural gas pipelines) Regulations, 2008; (d) "operator" means an entity -that operates natural gas pipeline network with the authorization of the Board; (e) "risk" means the risk as defined under the Petroleum and Natural Gas Regulatory Board (Codes of Practices for Emergency Response and Disaster Management Plan (ERDMP) Regulations, 2010; "risk analysis" means the risk analysis as defined under the Petroleum and Natural Gas Regulatory Board (Codes of Practices for Emergency Response and Disaster Management Plan (ERDMP) Regulations, 2010; 36 THE GAZETTE OF (g) "risk assessment" means the risk under the Petroleum and Nat Practices for Emergency P.pson (ERDMP) Regulations, 2010; (h) "risk management" means the Petroleum and Nat Practices for Emergency Respon (ERDMP) Regulations, 2010; (i) "spur-line" means a Natural Gas Regulatory Board and Petroleum Products 2010; (j) "Subject Matter Expert (SME)" knowledge and experience represents as per ASME B 31.4; (k) "right of use (ROU) or right of portion of land within which acquired the right through the accordance with the concerned authority having jurisdiction over the land on which pipelines; (l) "integrated surveillance system for third party encroachment using optical fiber cable, microwaves and systems and could be integrated (2) Words and expressions used and defined in the Act or in the rules or regulations shall have the meanings respectively assigned to them in the rules or regulations, as the case may be. 3. Applicability. These regulations shall apply to all the entities engaged in expanding natural gas pipelines. 4. Scope. These regulations shall cover all the pipelines, spur lines, sub-transmission This includes the associated facilities required at, existing and new natural gas transmission pipelines (SIPC) and dedicated facilities -that is terminals, intermediate pigging facilities, compressor stations, valves etc. The standards followed shall be in accordance with the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Natural gas pipeline) Regulations, 2009. 5. The basic features and requirements for developing and implementing an effective and efficient integrity management system for gas pipeline system. 6. Associated with natural gas pipelines and allocate resources for prevention, detection and mitigation activities; improve the safety of natural gas pipelines so as to protect the property, public and environment; have streamlined and effective operations to minimize the probability of Natural gas pipeline failure. System. The development and implementation of integrity Management System for the be as described in SCHEDULE-I to SCHEDULE-IV of provisions of these regulations shall be done in the schedule as described in these regulations at Schedule-7 and Schedule-8 in conjunction with Appendix-II. (2) In case of any delay in achieving the implementation schedule of integrity Management System as specified in these regulations, the entities shall be liable to face the following consequences, namely:- the entity shall be required to complete each activity within the specified time limit and if there is any deficiency in achieving in one or the activities, the entity shall submit a mitigation plan for acceptance of the Board and make good all short comings within the time agreed by the Board. If the entity fails to complete activities within the specified time limit by the Board, relevant provisions of the Act shall apply; in case the entity fails to implement the approved Integrity Management System, the Board may issue a notice to defaulting entity allowing it a reasonable time to implement the provisions of Integrity Management System. In case the entity fails to comply within the specified time, the relevant provisions of the Act and regulations shall apply.

8. Requirement under other laws. It shall be necessary to comply with all statutory rules, regulations and Acts in force as applicable and obtain requisite approvals from the relevant competent authorities for the natural gas pipeline

9. Miscellaneous. (2) (3) Through these regulations the uniform application of Integrity Management System is to be ensured for all natural gas pipelines. Entity operating and maintaining natural gas pipelines shall have the qualified manpower as per three tier structure as indicated in Appendix-IV. These regulations either on suo-motu basis or on the recommendation of concerned sub-committee of natural gas pipelines shall be reviewed by the Board. 10. In the event of the problem faced by the entity in implementing the provisions contained in these regulations, the entity may approach Board for necessary dispensation. SCHEDULES (see regulation 6) SCHEDULE-I OBJECTIVE The objective of Pipeline Integrity Management System is to maintain integrity of natural gas pipelines at all times to ensure public safety, protect environment and ensure availability of pipeline to transport gas without

interruptions and also minimize-business risks associated with accidents and losses. The availability of the Integrity Management System will allow professionals and technicians engaged in integrity tasks to have clearly established work aims and targets in the short, medium and long term, which undoubtedly will enhance their efficiency and satisfaction to attain them. 39 The Integrity Management System will enable the gas pipeline transporter to select an identified system for implementation such that the Integrity Management System will be uniform for all natural gas pipeline entities within the country. An effective Integrity Management System shall be: Ensuring the quality of natural gas pipeline integrity in all areas which have potential for adverse consequences. Promoting a more rigorous and systematic management of natural gas pipeline integrity and mitigating the risk; Increasing the general confidence of the public in the operation of natural gas pipeline. Optimizing the life of the natural gas pipeline with the inbuilt incident investigation and data collection including review by the entity.

SCHEDULE-2 INTRODUCTION TO THE INTEGRITY MANAGEMENT SYSTEM

2.1 2.2 2.3 Every natural gas pipeline operator's primary FOCUS shall be on operation and maintenance of natural gas pipeline in such a way that it would continuously provide on-interrupted services to customers with utmost reliability and safety without any untoward incident which can adversely impact the environment. A pipeline Integrity Management System shall provide a comprehensive and structured framework for assessment of pipeline condition, likely threats, risks assessment and mitigation actions to ensure safe incident free operation of the pipeline system. Such a comprehensive integrity management system shall essentially comprise the following elements:

Integrity Management Plan (IMP): This encompasses collection and validation of data, assessment of spectrum of risks, risk ranking, assessment of integrity with respect to risks, risks mitigation, updation of data and reassessment of risk. **Performance evaluation of IMP:** This is a mechanism to monitor the effectiveness of integrity management plan adopted and for further improvement. **Communication Plan:** This covers a structured plan to regulate information and data exchange within and amongst the internal and external environment. 4) **THE MANAGEMENT OF Change:** This process to incorporate the system changes (technical, physical, procedural and organization changes) into integrity management to update the integrity management plan. **Quality Control:** This is the process to establish the requirements of quality in execution of the processes defined in the integrity management plan. have further been detailed in Schedule-6. Note: These elements

GAS PHYSICAL DESCRIPTION: Description of gas should include

1. Detailed description of the pipelines. 1.1 Compressors, valves with respect to design specifications, length, major installations details such as:

3.1.1 Trunk Pipeline 3.1.2 Spur-pipelines 3.1.3 Sectionalizing valve Stations 3.1.4 intermediate Pigging Stations 3.1.5 Tap-off Stations 3.1.6 Compressor Stations 3.1.7 Control Stations 3.1.8 Electrical System depending power generation or Cathodic Protection- System 3.1.11 Safety Equipments 3.1.12 Delivery Stations 3.2 HISTORY OF THE PIPELINE: 3.2.1 ROU width and end constraints 3.2.2 Interfaces with other operators' facilities or 3.2.3 Historical background of the natural gas pipeline and major modifications and additions carried out in the system if any: 3.2.4 List of the consumers served by the pipelines 3.2.5 Inspection Updates; 3.2.6 3.2.7 3.2.8 Incident reporting: Statement of compliance with Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications Standards for Natural Gas Pipeline) Regulations, 2009 Statutory compliances.

SCHEDULE-4 SELECTION OF APPROPRIATE INTEGRITY MANAGEMENT SYSTEM

4.1 4.2 4.3 Integrity Management System for natural gas pipelines could employ either a performance based Integrity Management System or a prescriptive type Integrity Management System. Whereas, natural gas pipeline industry has gathered a reasonably good experience of pipeline operations and as such pipeline industry is fairly mature, a performance based Integrity Management System are appreciated globally. However, where pipeline systems are in developing stage, a prescriptive Integrity Management is recommended. Whereas, the performance based Integrity Management System recognizes the experience of the entity which has been operating the pipeline but the prescriptive type Integrity Management System is more rigorous as it considers the worst case scenario of the failures in the pipeline systems and, therefore, worst case scenario for mitigation. Though subsequent schedule in these regulations apply to both prescriptive and performance based type of Integrity Management System, present regulations mainly focus on prescriptive aspects in absence of adequate historical Integrity Management System data. A prescriptive type of Integrity Management System mandates the implementation of an established process for addressing their consequences and proven methods for the risks, mitigation. It also mandates the in-house development of Integrity Management Plan and Management of Change pertaining to technical aspects.

Based on the development of the preparation of gas pipeline industry in India till date prescriptive type Integrity Management System has been considered for implementation to all natural gas pipelines in India. Further, as the natural gas pipeline industry matures and gathers sufficient records or data as per the requirements prescribed in the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications Including Safety Standards for Natural gas pipelines) Regulations, 2009, a review mechanism may be considered by the Board for recommending a Performance Based Integrity Management System for Natural gas pipeline.

4232 GI/2012—6 -p •rl IF. : 'SC'*EDUUEWS INTEGRITY ASSESSMENT Sanoe of the too:- for integrity assessment.rare Should use as rnar-iY tools necessary to entieve the IMS 'toratvøtvalgmsæ)ip-eline. tt may be noted M nai the baseline avalc_lble with ine opera!a! as a reay-reckomer: 5.1 In-Line -Inspection In-line inspection (it l) is an integrity preliminarily charac terize indications SUCtVßS. as external and internal corrosion in a pipeline. Integrity for Natural gas pipelines" line inspection. Internal inspection tools shall have cagmitjllhy-cjf -toad deformation anomalies viz. dents. (Intelligent Pigging) or any other integrilY assessment equivalent ito provisions of Petroleum and Natural and Specifications including Safety 'Sttcmntmms Regulations, 2009 may be employed 5.2 Cathodic Protection (Following cathodic protection (iii) Pipe -to Soil 'Potential Survey / Closed Transtormer Rectifier Unit / Cathodic Module - current and voltage •monitoring Coating Heal-th Surveys (Current Attenua?itm Curren! Voltage Gradient survey and Pear-son) Pipeline Survey 5.3 Various ettaoiive surveillance methods -are being assessment 'tools. Based upon âhe one or multiple ItooFs may •be followed the op•eE0tor; as under: Patrdlling of ethe- Right 'Of- use ensuring alear •vÉlibility of *ight (Of ,WoyfRlgât Of Qhe, -access to maintenance are.w •along the -Right This;alaohelps. to.. observe surface conditions, comsjruc.tiöm; activity performed by external agencies, other factors affecting the safety and Also, pa.trolling ground survey may be done for maimiÄnxnmræoftsalihpipeime markers, kilometer posts and other specific pipeline. This may also include: Nigtđâtñæ patrolling by Line walkers or alternative security swñæ:illjtmce: system where the pipeline location is security point of view Rlgn\$ tracking through satellite imaging methods fowcritiëapstne•tches of natural gas pipeline system AerialÆut-vey- of Right of Use at critical and in-accessible stretches ag. hilly regions and Ghat sections etc. IK- critcal,stretches : The use various: types of detection systems which may be cnass. coyn*ry-pipelines based on the system requirements. The such 'iecljon system are given below:- 2. 3

4. Fibre Optics System: itiiis detection system works on seismic vibration principle wtlich employed for any kind of terrain and soil and is ft)f pipelines crossings, This system is primarily used for buried usefl,i pipelines. Ground' Semac SYg\$emt This, detection system, also works on seisrrh(vibrfïomplimcipjeamd•may also. be used for any kind of terrain and J hil Growmdsensorsyste.rn• may: be used for buried pipelines as well as abov groundpipelines. Raciurt7baæöv dæectiom, system: This system works on the principle of microz wave-refittiom,t It applicable for pipeline terrain where large However, this may be useful for any kind of soil arrd•pneâerabyuged\$f0F above ground. pipelines. This system works on the princ jp'e vio]nimm: off lb-otumdnm• amd- is useful in installation along the pipeiirM2 The o#rerf this: system could be for pipeline 0lridor securiQ• pi\$inea ima areo where 'here are attacks hw public along the righi of way shall be madw (Jas leaks by providing a Eisi Df of the possible consequences of naturall Do's and, Don'ts. Safety awareness among the administration and 44 THE GAZETTE OF INDIA : EXTRAORDINARY [PART Ili—SF.C. 41 public may be created as per the disaster management plan in accordance with the provisions of Petroleum and Natural Gas Regulatory Board (Codes of Practices for Emergency Response and Disaster Management Plan), Regulations, 2010. 5.4 HYDROTESTING Hydro testing is appropriate for integrity assessment when addressing certain threats at the pre-commissioning stage itself at test pressure specified in the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Natural gas pipelines) Regulations, 2009. 5.5 DIRECT ASSESSMENT AND EV ALUATION Direct assessment methods that include visual Non-Destructive Testing (NDT) examination to reinforce and validate findings from in-line inspection and other incidental findings, like during incidental pipeline exposure, pipeline damages and other maintenance activities may also be employed as an Integrity Assessment tools. External Corrosion Direct Assessment (ECDA), Internal Corrosion Direct Assessment (ICDA) and Stress Corrosion Cracking Direct Assessment (SCCDA) are the available tools for direct assessment and evaluation. 5.5.1 External Corrosion Direct Assæsmnt (ECDA) can be used for determining integrity for the externa' corrosion threat on pipeline segments. The ECDA .orocess has the following four components: (b) (c) Pre

assessment- incorporating various data gathering, database integration and analysis Identification - using either tools or calculations to flag possible corrosion sites, or calls, based on the evaluation or extrapolation of the database Examinations and evaluations - excavation and direct assessment to confirm corrosion at the identified sites and remediation as provided in Schedule 6 of these regulations. • Post-assessment - to determine if dig call decision are taken on on line segment. However, Call decisions are driven by various tools, technologies, or engineering evaluations, but are highly dependent on the level of experience and expertise utilized. • Corrosion Direct Assessment if the pipe is exposed, the operator is advised to conduct examinations for threats other than that for external corrosion alone (like mechanical and coating damages).

5.5.2 Internal Corrosion Direct Assessment (ICDA) can be used for determining integrity for the internal corrosion threat on pipeline segments. The ICDA process has the following four components. (a) Pre-assessment (b) Identifications (c) Examinations and evaluations (d) Post-assessment

5.5.3 Stress Corrosion Cracking Direct Assessment (SCCDA) can be used for determining integrity for the stress corrosion threat on pipeline segments. The SCCDA process has the following four components. a) Pre-assessment b) Identification c) Examinations and evaluations d) Post-assessment

Thickness assessment and periodic review against baseline values

5.6 For all sections of the pipelines above ground, all pipeline skirts and pressure vessels, a periodic thickness assessment and comparison with baseline values may be done and employed as Integrity Assessment tool. The operator of a pipeline system shall develop a chart of most suited integrity assessment tool or method and assessment interval for each threat/risk and further develop appropriate specifications and quality control plan for such assessment. After establishing effectiveness of assessment, the interval of assessment may be further modified subject to any other code requirement such as Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for natural gas pipelines) Regulations, 2009. A suggested chart is placed at APPENDIX -III Pipeline equipment Health Monitoring

5.7 Pipeline equipment such as main line sectionalizing valves, other valves, pig launching and receiving facilities etc. may be checked periodically for their operation.

5.8 Review of existing pipeline Class Locations: If class location changes are perceived due to demographic changes along the existing pipelines, population density / may be carried out to ascertain the changes in class location. THE GAZETTE OF INDIA: EXTRAORDINARY the changes in class location of a pipeline from lower to higher class; the provisions mentioned in Technical Standards and Specifications including Standards /ASME B31.8 shall be considered. The one of multiple following mitigation measures- may also be considered till same is mitigated as per Technical Standards and Specifications including • Safety Standards /ASME B 31.8 requirements - Section to be declared as vulnerable and frequency of patrolling to be increased as per new class location.

b): Intelligent pigging/ Direct Assessment frequencies to be increased. c) CP monitoring. frequencies- to be increased including provision of continuous data logging at the location. d)- monitoring probes to be installed to monitor the corrosion rate. e) Provision of carbon fiber wrapping/ composite sleeves/ concrete slabs.

SCHEDULE-6 INTEGRITY MANAGEMENT SYSTEM FOR THE GAS All operators of existing and new natural gas transmission and distribution pipelines shall develop an integrity management programme comprising the necessary plans, implementation schedule and assessment of its effectiveness in order to ensure safe and reliable operation of the pipelines. It is recognized that the comprehensive pipeline integrity management programme is based on extensive data collection, assimilation and analysis. Further, an integrity management programme can be devised on specified methods, procedures and time intervals for assessment and analysis or on the basis of performance of the programme with regard to efficacy of integrity plan, its results and mitigation efforts. For operators implementing an integrity management programme in the absence of base line and performance data, it may become imperative to adopt a prescriptive integrity management programme initially.

64 All natural gas pipelines and associated facilities installed as a part of pipeline shall be covered in pipeline integrity management plan. The cycle of basic processes of integrity management Plan is illustrated in Figure I and further detailed hereunder:

11 47 No Review of Integrity Management System as per Schedule 9 No 6.1.1 Initial data gathering • Threat Identification Whether all threats evaluated Yes • Consequences and Impact Analysis Risk Assessment / Evaluation • Integrity Assessment Whether Mitigation Required Yes and Responses Data updation and Data related to design and engineering, construction, pre-commissioning and commissioning of pipeline assets, operation and maintenance shall

48 THE GAZETTE OF INDIA : EXTRAORDINARY [PART III—SEC. 41 be gathered and reviewed

along with post-construction operational and integrity assessment data gathered to identify the potential threats along the pipeline system. Operational and integrity assessment data will be continuously updated while performing various activities along the pipeline such as patrolling, aerial surveillance, Cathodic Protection (CP) monitoring, monthly maintenance of equipments etc. and records maintained either hard or soft options.

6.1.2 Threat Identification: Gas pipeline incident data analyzed and classified by Pipeline Research Committee International (PRCI) represents 22 root causes for threat to pipeline integrity. One of the causes reported by the operator is "unknown". The remaining 21 threats have been classified into three groups based on time dependency and further in to nine categories of related failure types according to their nature and growth characteristic as below:

(I) Time Dependent Threats:

- 1) External Corrosion
- 2) Internal Corrosion • Internal corrosion due to off spec. gas* also to be considered
- 3) Stress Corrosion Cracking *Refer the Petroleum and Natural Gas Regulatory Board (Access Code for Common Carrier or Contract Carrier Natural gas pipelines) Regulations, 2008.

(II) Stable Threats:

- 4) Manufacturing related defects
 - i. Defective pipe seam
 - ii. Defective pipe
- 5) Welding /fabrication related
 - i. Defective pipe girth weld
 - ii. Defective fabrication weld
 - iii. Wrinkle bend or buckle
 - iv. Stripped threads /broken pipe /coupling failure
- 6) Equipment
 - i. Gasket O-ring failure
 - ii. Control/relief equipment malfunction
 - iii. Seal pump packing failure
 - iv. Miscellaneous

(III) Time independent Threats:

- 7) Third party [mechanical damage:
 - i. Damage inflicted by first, second or third party (instantaneous [immediate failure]
 - ii. Previously damaged pipe (delayed failure mode)
 - iii. Vandalism-
- 8) Incorrect operational procedure
- 9) Weather related and outside force:
 - i. Weather related
 - ii. Lightning
 - iii. Heavy Rains or Floods
 - iv. Earth Movements

Besides the above, certain other threats may be applicable based upon the land pattern.

6.1.3 Consequence and Impact Analysis: Once the hazardous events are identified, the next step in the risk analysis is to analyse their consequences, that is. estimate the magnitude of damage to the public, property and environment of all the identified threats. These consequence may include leak, fire, explosion, gas cloud etc. Consequence estimation can be accomplished by using mathematical models e.g. consequence modelling.

Identification of High-consequence area (HCA): Locations along the pipeline system meeting the criteria for High-Consequence Areas are identified. Generally, these are high-population-density areas, difficult-to-evacuate facilities (such as hospitals or schools), and locations where people congregate (such as places of worship, office buildings, or fields). Clause no. 3.2 of ASME B 31.8 S may be referred for detailed information regarding potential impact area.

6.1.4 Risk assessment specific to pipeline system

6.1.4.1 Developing a Risk Assessment Model: Risk assessment process identifies the location-specific events or conditions, or combination of events and Conditions that could lead to loss of pipeline integrity, and 4232 GAZETTE OF INDIA: EXTRAORDINARY provides an understanding of the likelihood and Consequences of these events. The risk assessment has the following objectives:

- Prioritization of pipeline sections/segments for scheduling integrity assessment and mitigation plan
- Assessment of the benefits derived from mitigation actions
- Determination of the most effective mitigation measures for the identified threats
- Assessment of the integrity impact from modified specification
- Assessment of the use of or need for methodology
- More effective resource allocation

Pipeline sections may be prioritized for integrity assessment based on severity of composite risk due to all threats. The composite risk value for particular pipeline section is product of relative likelihood of failure and consequences combined together due to all applicable threats. Risk priority should be assigned to sections observed with high risk to the system and may simply be categorized as high, medium, low (Or L, 2, 3) or differentiate the priorities among various sections. Following approaches for risk assessment may be deemed suitable to the Operators:

- a) Utilizing the services of Subject Matter Experts (SME)
- b) Relative Assessment Model
- c) Scenario —Based Model
- d) Probabilistic Models

The risk assessment models mentioned above have following features:

- (a) They identify potential events or conditions that could compromise system integrity,
- (b) They evaluate the likelihood of failure and consequences,
- (c) They enable ranking and identification of specific threats influence on the risk;
- (d) They lead to the identification of integrity assessment and/or action;
- (e) They provide for a data feedback loop mechanism;
- (f) They provide a structure and continuous updating for risk reassessments

Risk assessment considering the likelihood and consequences through risk assessment may not consider the extent of failure that is leak or rupture. If failure cannot be identified as leak or rupture while assessing the risk through any of the models, a worst case scenario may be considered. The risk assessment is continuous and repetitive process. System wide risk assessment shall be carried out at least every year by

pipeline operators through any of the methodology mentioned above after incorporating and updating the recently captured data in risk model SUCH as :

- Increase in Operating Pressure, average temperature/dew point of gas, water content in gas beyond acceptable limits. Changes in Right of Use conditions like development of encroachments, increase in third party activities/ population density, major washouts. Pipeline Leak/rupture history. Addition of new [expansion of the existing crossings. Changes to pipeline cathodic protection levels due to external interference problems. Any other issues which may affect the integrity of pipeline. The results of previous integrity assessments. The risk assessment may be performed earlier if any new threat is perceived. The risk assessment process and method shall be reviewed and updated periodically to achieve the objective of pipeline integrity management plan consistently. The result of risk assessment shall be arranged in descending order for each section for prioritizing the section for conducting integrity assessment after selecting the appropriate integrity assessment method based on most significant threats to particular section.

6.1.5 Integrity Assessment: A plan shall be developed to address the most significant threats and risks as per previous section and determine appropriate integrity assessment methods to assess the integrity of the pipeline segment. The following methods can be used for Integrity Assessment: Hydro testing before commissioning at test pressure as per T4S standard Inline inspection (ILI) External & Internal Corrosion Direct Assessment (ECDA/iCDA) • Various forms of pipeline surveillance and monitoring e.g. patrolling Integrated Surveillance System (ISS) etc. Brief description of various Integrity Assessment methods has also been provided in Schedule-5 of these regulations. THE GALEITE OF INDIA : EXTRAORDINARY Selection of appropriate integrity assessment method shall be based on most significant threats to which particular segment are susceptible. One or more integrity assessment methods can be used depending upon the threats to particular segment of pipeline. The operator of a pipeline system shall develop a chart of most suited integrity assessment method and assessment interval for each threat and risk. The operator shall further develop appropriate specifications and quality control plan for such assessment. After establishing effectiveness of assessment, the interval of assessment may be further modified subject to the requirements under the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Natural gas pipeline) Regulations, 2009 and other relevant Regulations. A suggestive chart is placed at Appendix -411.

6.1.6 Mitigation and Response (Repair and Prevention) After the completion of assessment like inline inspection and coating health surveys, the results shall be evaluated and the necessary repairs and preventive actions shall be undertaken to eliminate the threat to pipeline integrity. Immediately upon completion of integrity assessment, a comprehensive schedule of repair shall be prepared. All anomalous conditions discovered through the integrity assessment shall be evaluated and classified under the following three categories based on severity of defect. Mitigation action (repair and prevention) shall be undertaken to eliminate an unsafe condition to the integrity of a pipeline or to ensure that the condition is unlikely to pose a threat to the integrity of the pipeline until the next reassessment.

(A) Mitigation through Repair Actions: At the time of establishing schedules, responses shall be divided into three groups and repair actions shall be as follows:

- (a) Immediate repair conditions: Such indication shows that defect is at failure point. This shall include but not limited to any corroded area having - i) Metal loss equal to or more than 80% of wall thickness. ii) Predicted failure pressure less than equal to 1.1 times the maximum allowable operating pressure (MAOP) as determined by ASME B31G or equivalent. iii) Metal loss indication affecting a detected longitudinal seam, if that seam was formed by direct current or low frequency electric resistance welding or by electric flash welding.
- 53 (b) iv) Any indication of adverse impact on the pipeline expected to cause immediate or near term leaks or ruptures based on their known or perceived effects on the strength of pipeline which include dents with gouges. v) Any near term failure indication. Scheduled conditions: Such indication shows that defect is significant but not at failure point. Following indications shall be examined within one year of discovery: i) A plain dent that exceeds 6% of nominal pipeline diameter for pipeline operating at or above 30% of Specified Minimum Yield Strength (SMYS). ii) Mechanical damage with or without concurrent visible indentation of the pipe. iii) Dent with cracks. iv) Dent that affect ductile girth or seam welds if the depth is in excess of 2% of the nominal pipe diameter v) Dents of any depth that affect non ductile welds. * For more information on scheduled conditions," Repair Procedures for Steel Pipelines" paragraph 851.4 of ASME 31.8 may be referred.
- (c) Monitored conditions: Monitored conditions show that defect will not fail before next inspection. Such indications are the least severe and will not require examination and evaluation until next scheduled

integrity assessment interval provided that they are not expected to grow to critical level prior to the next scheduled assessment. (B) Mitigation through Preventive Actions: The pipeline operator shall develop scheduled programme for monitoring the integrity of the pipeline to prevent from time dependent and independent threats to support the integrity assessment and mitigation plan. The monitoring scheme and frequency should be decided by the pipeline operator subject to compliance of Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Natural gas pipeline) Regulations, 2009. The few schemes are as follows: (a) Patrolling of pipelines and associated facilities (b) Maintenance of Right of Use and inspection of Crossings 54 THE GAZETTE OF INDIA : EXTRAORDINARY (c) Pipeline Cleaning / Pigging (d) Inspection of cathodic protection system (e) Coating Survey (Closed Potential Logging / Direct Current Voltage Gradient I Pearson/Current Attenuation Test) 6.1.7 Update, integrate and review data: After the initial integrity assessments are completed, the results shall be maintained in soft, hard or both versions which will be used for future risk and integrity assessments in addition to operational information that is recorded on continuous basis for assessments and implementing risk mitigation plan. 6.2 Performance Evaluation Plan: Every pipeline operator shall define suitable performance indicators which can be monitored to give a picture of the integrity levels of various aspects of the operator's pipeline assets. Refer ASME B 31.8S table no 8 and 9 for finalizing performance measures and performance matrix respectively. Monitoring of these indicators on a periodic basis against pre-defined targets helps to assess the effectiveness of Integrity Management programme. Performance indicator measures should be selected carefully to ensure that they can reasonably indicate the effectiveness of programme and health of the assets. An operator can evaluate a system's integrity management programme performance within their own system and also by comparison with other systems on an industry-wide basis. Such performance evaluation should consider both threat-specific and aggregate improvements. Threat-specific evaluations may apply to a particular area of concern, while overall measures apply to all pipelines under the integrity management programme. Performance indicator measures may measure either or all of the following as applicable: (i) Process measures e.g. number of damages per excavation notification received. (ii) Operational measures e.g. number of significant In-line Inspection anomalies. (iii) Direct integrity measures e.g. number of damages per km. of pipeline length. A performance indicator may be either leading or lagging indicator. Lagging measures are reactive in that they provide an indication of past integrity management programme performance. Leading measures are proactive in that they provide an indication of how the plan may be expected to perform. 55 6.2.1 Performance Measures Performance measures serve as a tool for evaluating the success of the pipeline Integrity Management System. The performance measures have been developed as a method to gauge the extent to which the pipeline Integrity Management System goals have been met. Performance results demonstrate whether integrity management activities are appropriate or require improvements. The results may be evaluated annually by the pipeline operators, at which time the appropriateness of each performance measure will be assessed. Some of the goals as part of performance measures are illustrated below for reference. The operator may set their own goals depending on priorities and specific problems. Goals include, maintain pipeline Pipe-to-Soil Potential (PSP) within acceptable limits Execution of In-line Inspection pigging leakage and ruptures Development, Training and Awareness programmes No Right of Use encroachments PSP Level As applicable Number of training and awareness programmes conducted in a year Number of encroachments In addition to the above performance measures, the pipeline Integrity System Monitoring Report includes the following: Patrolling Inspected vs. Planned. Key Integrity issues such as encroachments, restoration, constructional deficiencies, mitigation plan and any operational issues, The number of Integrity Management System required activities completed. The number of defects found requiring repair or mitigation. The number of leaks reported. For performance measures relating to damage events, the following points are documented in the Operator's Damage Prevention Report: The number of third party damage events and near misses. The number of pipeline hits by third parties due to lack of notification. Aerial surveillance and patrolling reports. 01, INDIA : EXTRAORDINARY 6.2.2 Continuous Improvement The Integrity Management System shall be continuously evaluated and modified to accommodate changes in pipeline design and operation changes in both the physical and regulatory environment in which the system operates and new operating data or other integrity related information. Continuous evaluation is required to make sure that the programme takes appropriate advantage of improved technology and that the programme remains integrated with the operator's business practices and

effectively supports the operator's integrity goals. Integrity Management System shall be evaluated and reviewed as per the frequency described in Schedule-9 of these regulations. Issues that would typically be reviewed may include, but are not limited to:

- Based on Performance measures. Testing and inspection successes and failures. New threat identification. Root cause analysis of pipeline breakdowns and accidents. Process enhancement / changes (Management of Change). Recommended changes for the Integrity Management System. Additional training requirements necessary to support integrity Management System. Public awareness programme. Inspection tool performance (whenever applicable). Inspection tool vendor performance. Alternative repair methods. Staffing for inspections. testing and repairs. Past and present assessment results. Data integration and risk assessment information. Additional preventive and mitigating actions. Training needs of O&M personnel. Additional items as necessary to aid in the success of the IMP programme. results of the internal reviews, integrity assessment and mitigation programme shall be improved and documented

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6.3 Communication Plan:

This provides a framework for developing and implementing a written internal and external communication programme for operators of natural gas transmission lines and distribution pipelines. All pipeline operators shall develop and implement a communication plan to disseminate the integrity management efforts undertaken by pipeline operator and also to receive internal and external information or input. This programme must address intended audiences, message content, communication, frequencies and methods and programme evaluation. The information received through external/internal communication should be considered for risk assessment, integrity assessment and mitigation. The communication plan typically comprises, establishment of external and internal communication system as follows:

6.3.1 External Communication:

This should cover the communication plan with external agencies, which are not directly related with operator's business, for propagating information regarding presence of pipeline location, damage preventing actions, company contact information for reporting leakage and informing before carrying out any excavation etc. The various means such as web site, warning boards, pamphlet distribution, street plays etc. can be utilized by operators for this purpose. The following external agencies may be targeted:

- (I) Land owner and tenants along the Right of Use.
- (II) General Public near pipeline route.
- (III) Public officials and statutory bodies other than emergency responders.
- (IV) Local and regional emergency responders.

6.3.2 Internal Communications:

This should cover the dissemination of the information to employees and persons involved in operation and maintenance of pipeline system regarding integrity management programme to understand and comply with the programme objectives and requirements. Such a plan is also expected to fully cover the flow of information and controls in response to emergencies.

6.4 Management of Change:

Pipeline systems and the surrounding environment in which pipelines operate are often dynamic and need changes depending upon operational or any other requirement. Prior to implementation of any changes to pipeline system, a systematic process shall be adopted to ensure that prospective changes VA 32 58 THE GAZETTE OF INDIA : EXTRAORDINARY PART (such as design, operation, or maintenance) are evaluated for their potential risk impacts to pipeline integrity including impact on environment. All natural gas pipeline operators shall define a management of change plan in integrity management programme to at least address the following:

- (i) Reason for Changes
- (ii) Authority to approve changes
- (iii) Analysis of implications (threat and risk analysis)
- (iv) Documentation
- (v) Communication of changes to affected parties

After implementation of changes, they shall be incorporated, as appropriate, into future risk assessment to ensure that the risk assessment process addresses the systems as currently configured, operated, and maintained. The results of the Integrity Management Plan's mitigation, activities should be used as feedback for systems and facilities design and operation. Changes to the pipelines could affect the priorities of the pipeline Integrity Management Plan and the risk mitigation measures employed. Any change in design basis, process or operational issue that can affect the risk rating has to be routed through Management of Change.

6.5 Quality Control

All the entities shall prepare and maintain documented procedure and records as per the requirement of this standard which can also be made part of existing quality programme (e.g. ISO-9001-2001) maintained by the entities. The following activities shall be made part of quality control programme:

- (i) Identifying and maintaining the documents required for Integrity management plan, procedures and records. This includes both controlled and uncontrolled documents. Defining roles and responsibilities for implementation of programme, documentation etc.
- (ii) Reviewing of Integrity Management Plan and implementation of recommendation at predefined interval.
- (iii) Training and awareness of persons implementing the Integrity

management plan. Periodic internal Audit of integrity management plan and quality Documentation of corrective actions taken or required to be taken to improve the integrity management plan or quality plan.

11—eug 4] Internal Audits of the Pipeline Integrity Management System shall be performed on a regular basis. The purpose of the audits is to ensure compliance with the policies and procedures as outlined In these regulations. Recommendations and corrective actions taken shall be documented and incorporated into the Pipeline Integrity Management System. Internal aualTs are conducted by the audit group nominated by Head of the Operations Team of the entity at least ohce in a year. Internal audits aim to ensure that the Integrity Management System's framework is being followed. The following essential items wilt be focused for any internal and external audit of the entire Integrity Management System: Ensuje that the Baseline Plan is being updated and followed and that the baseline inspections are carried out. Verify qualifications of O&M personnel and contractors based on education qualification (Appendix-IV), formal training received through in-house or external programme, demonstrated practical skills, and experience records in the relevant areas. Refer ASME 331 Q for guidance. Ensure adequate documentation is davailable to support decisions made. Determine if annual perormonce measures have been achieved. A written integrity management policy and programme for all element S Written Integrity Management System procedures and task descriptions are up to date and readily available. Activities are performed in accordance with the Integrity Management System. A responsible individual has been dssigned for each task. All required activities are documented. All action items or non-conformances are closed in a timely manner. The risk criteria used have been reviewed and documented. Prevention, mitigation and repair criteria have been established. met and documented. 4232 GV2012—9 THE GAZETTE OF INDIA :

•EXTRAORDINARY SCHEDULE 7 APPROVAL OF INTEGRITY MANA EMENT YSTEM IMS :

[PART [11—sæ. 41 A Natural gas pipeline Integrity Management System is a management plan in the form of a document that explains to operator's employees, customers, regulatory authorities. etc., as to how the operator and its assets are mahaged. by stating: (ii) (iv) who is responsible for each aspect of the asset and its management; what policies and processes are in place to achieve targets ana goals: how they are implemented; how performance is measured and; how the whole system is regularly reviewed and audited. For the first time the approval of the IMS document shall be done by the Board of the entity. While during review to be done every three years, the approval shall be done by CEO / Full time Director of the company and all levels of management shall comply with its confents. Necessary awareness shall also be created within and outside the company regarding benefits to the society for up keeping of the pipeline system for all times to come. Preparation of the document shall be done in following three stages and six MANAGEMENT APPROVAL: e Step#1: Prepared by In-house team or Consultant • Step#2: Checked by In-house team Head or Consultant head Step#3: Provisionally approved by Head of Operation team of the entity • Step#4: Conformity of IMS document with the Regulation by Third Party Inspection Agency (TPIA) 7.2 ACCEPTANCE BY PETROLEUM & NATURAL GAS REGULATORY BOARD (PNGRB) Step#5: Acceptance by the Board 7.3 APPROVAL FOR IMPLEMENTATION Step": Approval of Integrity Management System document for implementation by the Board for the first time and approval of subsequent periodic review by CEO or Full time Director of the entity, Note: A certificate regarding the approval of Integrity Management System document duly approved as specified at clause no. 7.1 above shall be submitted to the Board that the Pipeline Integrity Management system is in line with the requirements of the various regulations issued by the Board from time to time and has been approved by the CEO or full time Director of the company. 61 SCHEDULE-8 IMPLEMENTATION SCHEDULE of Integrity Management System: Sr. No. 2 3 4 5 6 7 Actlvltles Compliance with Petroleum and Natural Gas Regulatory Board (Technical Standards and specifications Safety Standards for Natural gas pipelines) Re ulations. 2009 Preparation of Integrity Management System document and approval by Head of Operation team of the entit Conformity of Integrity Management System document with regulation by Third Party Inspection Agency. Submission of Integrity Management System document to Petroleum and Natural Gas Regulatory Board Approval for implementation by the Start of Implementation Time Schedule YES/ NO confirmation within month from date of notification of these regulations year from date of notification of these regulations 3 months from the approval by Head of Operation team of the entit I month from the conformity of Management System by Ins ection A enc Within 3 months from the acceptance of Management System document Petroleum Natural by and Gas Submission of Re ulator Board Immediately approval at Sr. No. 5 above Shall be submitted Compliance and Natural Statement to Petroleum Gas

Regulatory Board Note: Steps for Implementation Schedule-7 within Petroleum Natural Gas Regulatory Board and Gas to be followed as described in THE GAZETTE OF INDIA : EXTRAORDINARY SCHEPVI-9 REVIEW OF THE INTEGRITY MANAGEMENT SYSTEM 9.1 Periodicity of review of Integrity Management System of PART III—Sc. 4] 9.2 Entities shall review their existing Integrity Management System every 3 years based on: (i) Revised Baseline data (i') Critical Inputs from various departments Review of and Audit There shall be a system for ensuring compliance to the provisions of these regulations by conducting following audits during operation phase: (a) Internal Audit as per the checklist for natural gas pipelines provided by Petroleum and Natural Gas Regulatory Board shall be carried out by the management of operator every year. (b) External Audit (EA) by third party, approved by the Board, as per the methodology specified by the Petroleum and Natural Gas Regulatory Board every 3 years. SCHEPUL-1Q Adequacy of Manpower positioned at different stage of project Entity will have to address the requirement of manpower for different stages of project. namely: Design, construction, commissioning, operation and maintenance. The entity which is preparing Integrity Management System should address the manpower requirement for its present and future operations. The qualification of SUCH manpower shall conform to Appendix-IV. 63 APPENDIX-I REFERENCES Reference documents of Standard Operation and Maintenance procedures related to Pipeline Integrity may be developed for use of O&M personnel. Some of them are mentioned below for reference: Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Natural gas pipelines) Regulations. 2009: Petroleum and Natural Gas Regulatory Board (Codes of practices for Emergency Response and Disaster Management Plan) Regulations. 2010; ASME 831.8-Gas Transmission and Distribution Piping Systems; ASME 831.8S - Managing System Integrity of Gas Pipelines; ASME 831 Q-Pipeline Personnel Qualification ASME B31G - Manual for Determining Remaining Strength of Corroded Pipelines. Gas Research Institute - 00/0189 - A model for sizing high consequence areas associated with natural gas pipelines AP"NDIX-II CRITICAL ACTIVITIES IMPLEMENTATION SCHEDULE 1 3 4 5 6 7 CRITICAL ACTIVITY Cathodic Protection CP Inspection in Surveillance Coating Surveillance Hydro-testing GIS Mapping Implementation Leak Detection System Implementation TIME SCHEDULE As per Petroleum and Natural Gas Regulatory Board Standards (Technical and Specifications including Standards for natural gas pipelines) Regulations, 2009 THE GAZETTE OF INDIA : EXTRAORDINARY APPENDIX-III [PART III—SEC. 41 SUGGESTIVE CHART FOR SELECTION OF INTEGRITY ASSESSMENT METHOD' WITH RESPECT TO SPECIFIC THREAT Threat Group Threat (A)Time-Dependent (B)Stable a) Manufacturing related defects b) Welding / Fabrication related c) Equipment External Corrosion Internal Corrosion Stress Corrosion Cracking Defective Pipe Seam Defective Pipe Defective Pipe Girth Weld Defective fabrication Wrinkle bend or buckle Stripped threads/broken tie Gasket / O-ring Failure Control / Relief equipment malfunction Seal pump packing failure C)Time-Independent Integrity Assessment Method* Inline inspection, External Corrosion Direct Assessment Inline inspection, Internal Corrosion Direct Assessment Inline inspection, Direct Assessment Hydro-test (Post Construction), Inline inspection Caliper Pigging / Electronic Gauging Pigging (EGP) Visual Examination / Gas Leakage Survey Visual Examination / Gas Leakage Survey Visual Examination / Gas Leakage Survey Visual Examination / Gas Leakage Survey Public Education (See Communication Plan & preventive actions), Patrolling, ROW Maintenance, External Protection Above + Leakage Survey, Rehabilitation All above Compliance Audits Assessment interval Max. 10 year* * Max. 10 year* * Max. 10 year* * Before commissioning or as and when required Monthly [quarterly a)Third Party / Mechanical Damage b)Incorrect Operations Damage inflicted by first, second, or third parties (instantaneous / Immediate failure) Previously damaged pipe (delayed' failure mode) Vandalism Incorrect Operational procedure c) Weather Related and Outside Forces Weather related Lightning Heavy rains or floods Earth Movements Creek Area Effects Muddy/Marshy area effects River Bed Movements Leakage survey, Surveillance Sur e diversers Anti-buoyancy inspection, Surveillance Strain monitoring, Leakage survey . Surveillance, Pipe to Soil Potential surveys near creek, Leakage survey, Anti-Buoyancy Inspection, Integrated Surveillance System Surveillance, Pipe to Soil Potential surveys, Leakage survey, Cathodic Protection monitoring, Integrated Surveillance System Surveillance, Pipe to Soil Potential surveys, Leakage survey, Cathodic Protection monitoring, Buoyancy Inspection, Integrated Surveillance System and As required and As required and As required and As required when when when when • Some of the Important Integrity Assessment Methods have been briefed In Schedule- 5 of these regulations " Inline Inspection frequency to be as per Petroleum and Natural Gas

Regulatory Board (Technical Standards and Specifications Including Safety Standards for natural gas pipelines) Regulations, 2009 APPENDIX-IY Minimum Qualification and Experience for Field Personnel In Protect Phase well as OLM Stage Discipline Mechanical Metallurgical Tier-I Degree In Mechanical Engineering Degree In Metallurgical Engineering Tier-II Supervisor Level Diploma In Mechanical Engineering + at least year of Experience Diploma In Metallurgical Engineering + at least 1 year of Experience in Pipeline corrosion control Tier-III Operator Level ITI with at least 1 year experience in the relevant field of operation ITI with at least 1 year experience in the relevant field of operation THE GAZETTE OF INDIA : EXTRAORDINARY Instrumentation & Control Electronics & Communication Electrical Fire & Safety Civil Degree In / Electronics Engineering Degree In Electronics or Communication Engineering Degree In Electrical Engineering Equivalent Degree Engineering Degree In Civil Engineering Diploma In / Electronics + at least 1 year of Experience Diploma In Electronics or Communication Engineering + at least 1 year of Experience in SCADA Diploma In Electrical Engineering+ at least 1 year of Experience Diploma In F&S Engineering/ at least 1 year of Experience Diploma In Civil Engineering+ at least 1 year of Experience [PART III—SEC. 4) ITI with at least 1 year experience in the relevant field of operation ITI with at least 1 year experience in the relevant field of operation ITI with at least 1 year experience in the relevant field of operation Fireman course passed and proficient in operation of fire water pumps and fire tenders with heavy vehicles driving license / at least 1 year experience in the relevant field of operation ITI with at least 1 year experience in the relevant field of operation Note: Each Natural gas pipeline shall have SME (Subject Matter Expert) having qualification in any of the discipline of relevant RATAN P. WAI*AL, secy. by the Ministry, Government of India Bess, Ring Road. Mayapuri. New Delhi-11006-1 and Published by Controller of Publications, Delhi-110054

