Proceedings of IPC 2004
International Pipeline Conference
October 4 - 8, 2004 Calgary, Alberta, Canada

IPC04-0112

AN INDUSTRY CONSENSUS STANDARD FOR PIPELINE PERSONNEL QUALIFICATION – ASME B31Q

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ABSTRACT

The pipeline industry and its regulators have been collectively working on the qualification of pipeline personnel for more than 20 years. The U.S. Pipeline Safety Act of '02 required the U.S. Office of Pipeline Safety of the Department of Transportation to develop standards (protocols) for Operator Qualification to properly inspect pipeline companies' Operator Qualification programs. During the first half of 2003, OPS developed protocols as inspection standards for use by OPS field inspectors to audit existing OQ programs that must conform to existing regulations. The pipeline industry supported the development of the protocols.

During this process, industry and the regulators developed a longer term strategy for Operator Qualification that would resolve outstanding issues that had not yet been resolved. The strategy will be described in this presentation. Part of that strategy included the development, on an expedited basis, of an industry consensus standard for Operator Qualification. ASME agreed to sponsor and develop this standard.

This paper will discuss ASME B31Q – Pipeline Personnel Qualification, its development process, issues the team had to address and how they resolved these issues. It will describe the major elements of the standard.

The path the industry and the regulator are taking to address personnel qualification to ensure safe, reliable operation of gas and liquid pipelines will be described.

B31Q development started in August of 2003 and is expected to be completed by the end of 2004. The latest update on the standard and its implementation will be presented at the Conference.

INTRODUCTION

The hazardous liquid and natural gas pipeline industries have been required to develop and implement Operator Qualification programs since the Federal Office of Pipeline Safety (OPS) issued the "OQ rule" in 1999. This rule is performance based, i.e., it does not provide prescriptive requirements for meeting the rule.

In December of 2002, Congress passed the Pipeline Improvement Safety Act (Act). This Act added requirements to the existing operator qualification regulations. The National Transportation Safety Board (NTSB) also had open issues relative to training and requalification intervals.

The operators had developed plans to implement the rule and the regulators began developing inspection protocols to audit conformance to the rule. The initial protocols developed by OPS exposed major differences between the industry and the regulators on the specific implementation of the rule. OPS, with industry input, modified the inspection protocols for implementing the existing regulation in early 2003. They mutually agreed that there were still thirteen items that were not resolved in addition to the issues identified by Congress and the NTSB.

Industry and OPS also agreed on a longer term strategy that would include the development of a technically-based consensus standard to address industry personnel qualifications and twelve of the thirteen unresolved issues, as well as those from Congress and the NTSB. Upon the completion of the standard, OPS agreed to modify the existing rule and incorporate the standard. The pipeline industry, including hazardous liquid pipeline operators, gas transmission and gas distribution pipeline operators, service providers, labor organizations, and OPS and State regulators, began the development of the standard under the auspices of the American Society of Mechanical Engineers (ASME) and the American National Standards Institute in August of 2003.

This paper presents the background information leading to the standard and describes the standard.

OPERATOR QUALIFICATION BACKGROUND

To provide some guidance and support for the standard, industry commissioned an investigation into what other industries require for personnel qualifications. A report titled "A Comparative Analysis of Operator Qualification Requirements" (ref. 1) was issued in March of 2003. Within the report, the rail, maritime, nuclear and petrochemical industry requirements for personnel qualifications and their safety statistics were compared to existing pipeline industry requirements. In summary, all four compared industries had some personnel qualification requirements which included

training and requalification intervals ranging from one to five years or more.

TABLE 1
PIPELINE INDUSTRY
OPERATOR ERROR INCIDENTS [1]

		1996-1999	Average Number Incidents
Gas Transmission	Number of Operator Error Incidents	21	5.4 incidents/yr.
	Total Incidents	303	
	% Operator Error	6.9%	
Gas Distribution	Number of Operator Error Incidents	44	11 incidents/yr.
	Total Incidents	466	
	% Operator Error	9.4%	
Liquids	Number of Operator Error Incidents	61	16.3 incidents/yr.
	Total Incidents	686	
	% Operator Error	8.9%	

1 Source – DOT Incidence Data Forms

An additional finding was that the pipeline industry is safer than all but the nuclear industry, from an injuries or mortality perspective. Table 1 shows the number of incidents (as defined by OPS reporting requirements) that have been caused by operator error and the total number of incidents. Less than 10% of all pipeline incidents are caused by operator error.

Based on the facts presented in the report and in comparison to the four other industries, pipeline personnel qualification programs that can be effective in reducing operator error incidents and improve safety would include the following elements:

- SCADA operator training, possibly including classroom and simulator training, with requalifications every three years
- Training and/or qualification requirements for other highly safety related tasks
- Significantly lesser training and/or qualification requirements for other safety or integrity tasks, with longer requalification periods of up to five years (see ref. 2)
- Each qualified individual must demonstrate the knowledge, skills and ability to perform their tasks. How this is achieved can vary with the task.
- Existing metrics, documenting incidents by cause, should be sufficient to measure program effectiveness.
- Pipeline operators should be encouraged to pursue root cause analysis to determine if operator error is a contributing cause to incidents or near incidents.
- An industry consensus standard for personnel qualification should be developed.

In addition to the Comparative Analysis and Requalification Intervals studies (ref. 1&2), the thirteen unresolved issues between industry and OPS would have to be addressed. Table 2 lists twelve of the thirteen issues. The twelfth issue, not included in the “OQ Issues” column, discusses how to disseminate best practices. Best practices are traditionally presented and discussed at technical conferences and are not appropriately handled within a standard. The remaining twelve issues were to be addressed by the standards committee and included in the standard appropriately.

With the two studies, the twelve unresolved issues, and twenty years of working on OQ efforts as input, a committee was formed to develop a standard for pipeline personnel qualifications under the auspices of the B31 Piping Committee of ASME.

TABLE 2
B31Q STANDARD, 12 0Q ISSUES AND OPS INSPECTION PROTOCOLS

B31Q Table of Contents	OQ Issues	OPS Protocols
Introduction		
Scope	• Scope of OQ Inspection • Maintenance vs. New Construction	
Definitions/References		
Personnel Qualification Program	Criteria for Small Operators	• Contractor Qualification (1.02)* • Management of Other Entities Performing Covered Tasks (1.03) • Covered Task Performed by Non-Qualified Individual (3.02)
Determining Applicable Tasks	• Treatment of Emergency Response • Excavation • Maintenance vs. New Construction	Application and Customization of 'Off-the-Shelf Programs' (1.01)
Abnormal Operating Conditions	AOCs	Evaluation of Individual's Capability to Recognize and React to AOCs (4.02)
Evaluation	• Direct Observation NQ personnel • Evaluation of KSAs	• Evaluation Method(s) (Demonstration of Knowledge, Skill and Ability) and Relationship to covered Tasks (2.02) • Role of and Approach to 'Work Performance History Review' (4.01)
Training	Treatment of Training	Training Requirements (Initial Qualification, Remedial if Initial Failure, and Reevaluation) (1.04)
Qualification	• Requalification Intervals • Persons Contributing to An Incident	• Application and Customization of 'Off-the-Shelf Programs' (1.01) • Reevaluation Interval and Methodology for Determining the Interval (5.02) • Personal Performance Monitoring (5.01)
Documentation	Extent of Documentation	• Written Qualification Program (1.05) • Development and Documentation of Areas of Qualification for Individuals Performing Covered Tasks (3.01) • Qualification 'Trail' (i.e., covered task; individual performing; evaluation method(s); continuing performance evaluation; reevaluation internal; reevaluation records) (7.01)
Management of Change		Management of Changes (to Procedures, Tools, Standards, etc.) (8.01)
Program Evaluation	Persons Contributing to An Incident	• Program Performance and Improvement (6.01) • Field Verification (9.01 – 9.12)

*-OPS Protocol Number, see OPS Web site – www.OPS.dot.gov
Table 2 was developed by the B31Q team from the OPS list of 13 unresolved issues (San Antonio Public meeting), existing OQ protocols and the draft of B31Q.

B31Q PIPELINE PERSONNEL QUALIFICATION

The standard is performance-based in that it provides operators several methods of developing their Personnel Qualification (PQ) programs. Once the methods have been chosen, the processes are prescriptive, avoiding ambiguity for implementation. The committee took extra time to develop a "standard" list of applicable tasks with evaluation criteria, spans of control and re-evaluation intervals. An operator can bypass the sections of the standard dealing with these items and use the "standard" applicable task list to develop their PQ program. The operator reviews the task list to eliminate those tasks that do not apply to their system and the remaining tasks become their systems task list. The standard is written to apply to hazardous liquid, gas transmission, gas distribution and small operators such as master meter operators. The "standard" task list is included as a non-mandatory appendix that is expected to be most useful to: 1) small pipeline operators that do not have the staffs to develop their own programs, 2) operators that desire to engage more fully in portability of qualifications for greater cost savings, and 3) operators desiring greater simplicity and consistency within their PQ programs.

SCOPE

The standard is applicable to all pipeline systems and specifies the requirements for the qualification of individuals performing applicable tasks that might adversely impact the safety or integrity of the pipeline. Clearly, this is different from the scope of the existing rule. One area of particular interest concerning the scope is the separation of "new construction" versus maintenance. Technically, one cannot say that personnel installing new lines do not have to be qualified and people replacing short sections of line have to be qualified. The scope as written obviates that argument and new construction personnel performing tasks that could adversely affect safety or integrity of the pipeline must be qualified as well. In reality, that is what occurs on pipelines. Welders, nondestructive testing inspectors, etc. are all qualified under API 1104 or ASNT TC1A or similar standards. Qualifications under these other standards will be accepted by B31Q and only augmented to include requirements to train such personnel on the abnormalities that may occur during the performance of the task, which is not a requirement found in the other standards.

PERSONNEL QUALIFICATION PROGRAM ELEMENTS

Fig. 1 describes the B31Q process. The standard requires a written program that describes operator's processes that will meet the requirements of the standard.

The major steps in the process are:

- Identification of Covered Tasks
- Abnormal Operating Conditions
- Training
- Evaluation & Qualification Requirements
- Identification of Tasks that can be handled by non-qualified personnel under appropriate supervision
- Documentation and record keeping
- Quality Assurance
- Program Evaluation
- Management of Change

DETERMINING APPLICABLE TASKS

Applicable tasks are defined as tasks identified by a process described in the standard or are identified within the non-mandatory appendix task list. This section of the standard describes two methods that may be used to derive an applicable task list.

The first is through the use of subject matter experts (SMEs). The group of SMEs first gather a comprehensive list of tasks performed in the construction, operation, maintenance or repair of the pipeline facility. Two questions determine whether the task should be on the final task list:

1. Can the task, if performed improperly, have an adverse impact on the safety or integrity of the pipeline, either immediate or long term?
2. Is the task performed by an operator's employees, contractors or individuals working under a mutual aid agreement, on facilities owned or operated by the operator, engaged in activities such as construction, operation, inspection, maintenance or integrity management of the pipeline?

If each of the answers to the questions is yes, then the task is an "applicable task" and must be included in the applicable task list for that operator.

The second method derives the applicable task list through the use of fault trees.

The fault tree process is an analysis tool by which the relationship of many subordinate events that interact to produce a final result can be identified. (Ref. 3,4)

Through the use of SMEs and a fault tree development expert, a subcommittee developed nine fault trees, one for each of the major categories of threats found in ASME B31.8S, Managing System Integrity of Gas Pipelines. These nine categories of threats include all of the 25 threats that have actually caused incidents on gas or liquid pipeline in the past twenty years and they are listed in the OPS incident reporting forms that both liquid and gas pipeline Operators must fill out when a reportable incident occurs. When a basic event is reached, the SMEs then identify all the tasks that are performed by operators to prevent that basic event from occurring. An industry report, Ref. 5, describing best practices utilized to prevent or mitigate against the threats was also used as a final check on the list of applicable tasks that were derived. Fig. 2 shows the fault tree with the list of tasks for the internal corrosion threat.

As a final check on the list, the SMEs then subject the list to the same questions used in the SME process described above.

The fault tree process was the process utilized to derive the non-mandatory appendix applicable task list. Operators may use the fault tree process themselves to derive their own list or they may choose to utilize the non-mandatory appendix list.

ABNORMAL OPERATING CONDITIONS (AOC'S)

The standard defines the list of abnormal operating conditions that apply to all pipelines. An abnormal operating condition can occur from the malfunctioning of a component or deviation from normal operating conditions that: 1) indicates a condition exceeding design limits, or 2) results in a hazard to persons, property or the environment. All other abnormalities that may occur are considered task abnormalities and are to be included as part of the qualification process for the task.

All qualified individuals must be evaluated to determine that they can recognize and properly respond to AOC's.

TRAINING

This section of the standard establishes training requirements for personnel qualifications to assure individuals are trained properly on the knowledge and skills required to perform applicable tasks. It describes what must be included in a training program, if one is utilized to evaluate and qualify personnel for applicable tasks. Training should be performed when:

- The individual has not previously performed the task
- Is seeking qualification outside of their knowledge and skills
- When qualifications have to be restored after a suspension
- When the individual has failed to qualify the first time
- When the required knowledge or skills have changed
- When new equipment or procedures will be used to perform an applicable task.

A non-mandatory appendix provides guidance on how to establish an effective training program.

EVALUATION & QUALIFICATION

The evaluation section of the standard establishes the minimum requirements that assure individuals are evaluated for the knowledge, skills and abilities required to perform the applicable tasks. Processes for establishing evaluation material content and methods for evaluation are given. Written, oral and performance types of evaluations are covered.

The qualification section establishes the minimum requirements for initial and subsequent qualifications and requirements for suspension or revocation of qualifications.

Qualification requirements specified in other codes such as welding will govern the qualification except for the requirements in B31Q that are not covered by that standard, such as training for abnormal operating conditions.

Each Operator's program shall establish subsequent qualification intervals for each applicable task by one of several methods: 1) SME consensus process, 2) Difficulty, Importance and Frequency Analysis (DIF), 3) use of the existing non-mandatory appendix, or 4) another method that provides a rational and verifiable basis for the intervals.

The DIF analysis method uses SMEs to rate the difficulty, importance and frequency with which the tasks are performed. A decision tree is then used to determine the re-evaluation intervals for each task. The applicable task list in the non-mandatory appendix includes re-evaluation intervals that were derived by the DIF method.

This section of the standard also describes the processes to be used to determine under what circumstances non-qualified personnel, under supervision, can perform applicable tasks. Determination of spans of control for supervision is also discussed.

PORTABILITY

The B31Q development team quickly recognized that portability of qualifications, especially for contractors, was a significant issue that the standard needed to address.

A standard can only provide the framework for portability; the remaining issues are commercial drivers and issues that only the industry can address outside the confines of the standard. The primary driver for gaining nationwide portability is a single applicable task list that contains evaluation criteria sufficient for organizations to develop and implement qualification programs where most, if not all of the applicable tasks are "universally" accepted. The team took extra time to develop the applicable task list as a non-mandatory appendix so that it could serve precisely that function and permit the industry to gain portability. The committee can only hope that the industry takes the initiative to build the commercial infrastructure to fully implement portability across the entire industry.

DOCUMENTATION, PROGRAM EVALUATION, MANAGEMENT OF CHANGE

Documentation requirements, unique to personnel qualification, are prescribed. They include documentation of individual qualifications, by task, by unique identifier (e.g. Social Security Number), as well as the evaluator of those qualifications. Program evaluation is required, but the evaluation measures are chosen by each operator. Some suggested measures include:

- Number of incidents/accidents within a specific timeframe
- Number of individuals found to have contributed to an incident/accident
- Number of reasonable cause investigations.

The standard requires that quality assurance audits of the program be performed.

The standard also requires formal management of change procedures to identify and consider the impact of system or process changes too the existing Personnel Qualification program. Communication of the program and changes to the program are also described in the standard.

SUMMMARY

ASME B31Q is a comprehensive, technically based Personnel Qualification standard.

The committee considered and addressed the 12 open issues between industry and OPS in the standard as well as the concerns of Congress and the NTSB. Ten regulatory representatives, of the 32 overall formal representatives, were part of the team that developed the standard. Due to this unprecedented participation by the regulatory community, it is believed that the standard will be acceptable for incorporation into an amended OQ regulation in the near future.

The benefits to be derived from the adoption of this standard by industry and the regulators are anticipated to be:

- By meeting the stakeholders' requirements and expectations, an amended regulation that industry can readily adopt, can be promulgated and successfully implemented.
- Future changes to the regulation should be minimized or eliminated
- Broad industry portability can be achieved
- Industry and OPS will have reached a major goal in the joint strategy they had agreed to implement in mid '03.
- Overall safety of pipelines can continue to improve through this rigorous, focused approach to personnel qualifications.

REFERENCES

1. Comparative Analysis of Personnel Qualification Requirements of 5 Industries – GRI-03-0094
2. Reevaluation Intervals for Pipeline Personnel – B.J. Selig '03 P-PIC
3. Guidelines for Hazardous Evaluation Procedures – AICHE-CCPS – 1992
4. Reliability & Risk Analysis – ASME Press – 2002
5. Reliability Based Prevention of Mechanical Damage to Pipelines – PRCI Catalog # L51816-August 1999

FIGURE 1
PERSONNEL QUALIFICATION (PQ) PROCESS FLOW

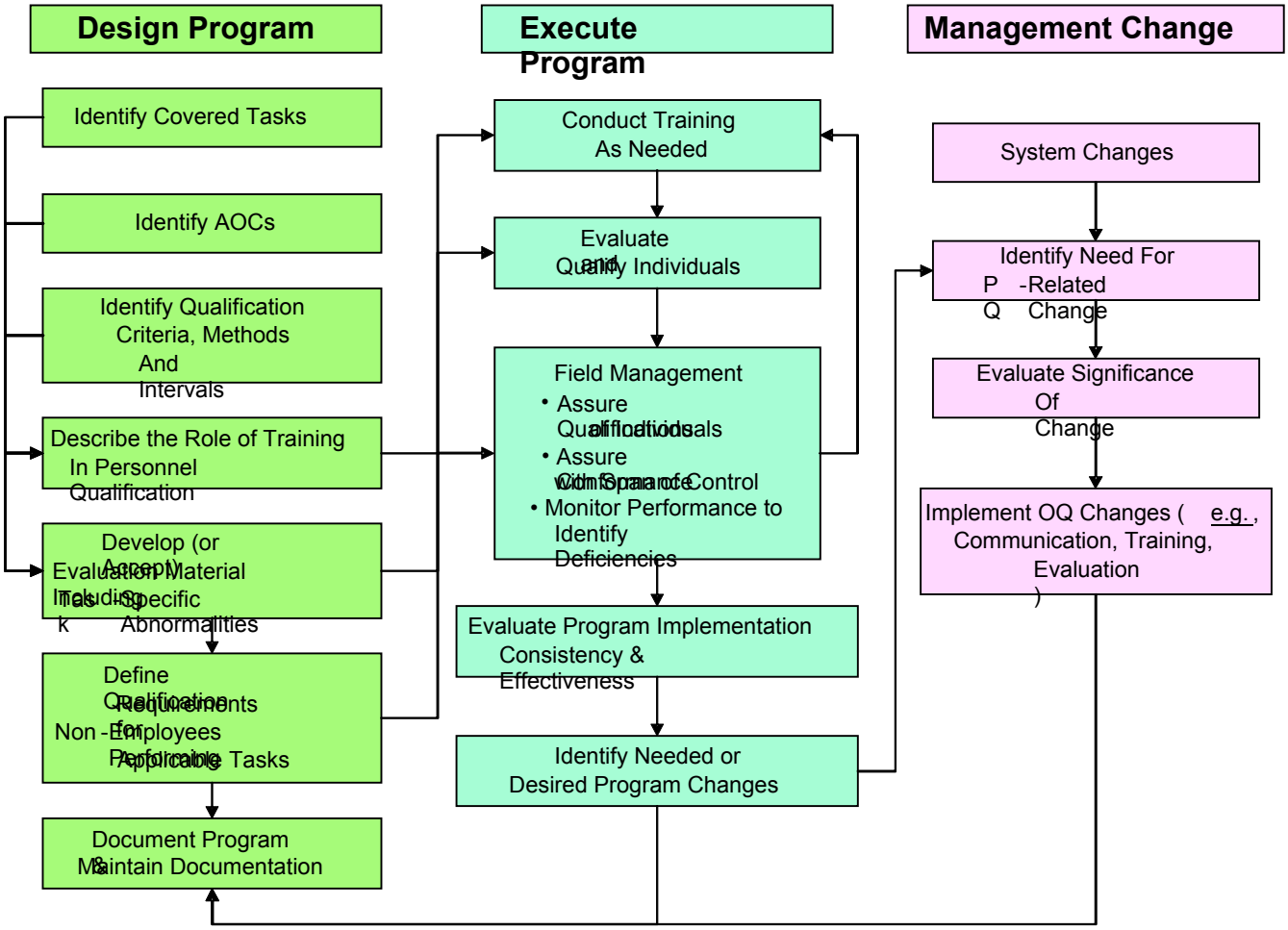
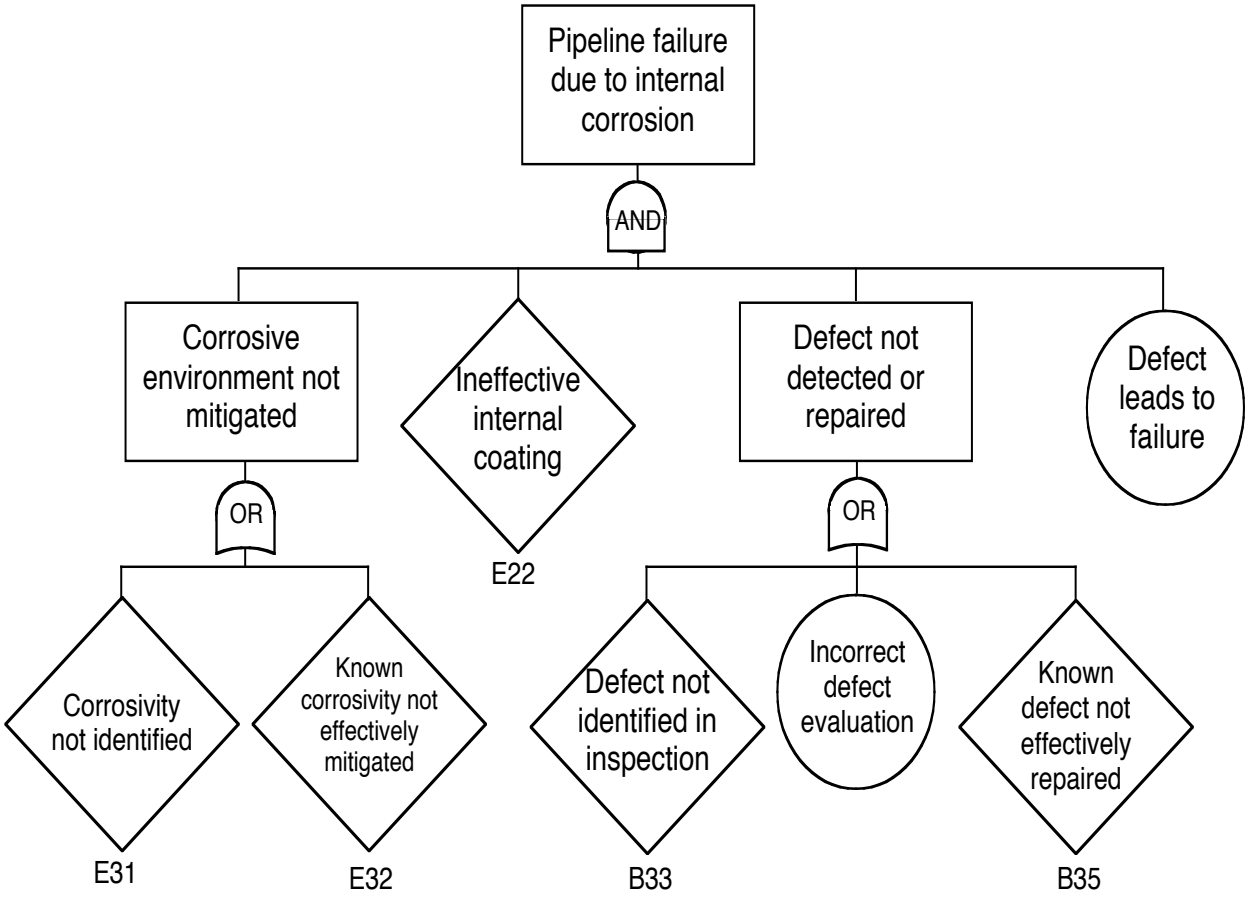


FIGURE 2
FAULT TREE FOR INTERNAL CORROSION



B33
- Select inspection method
- Apply inspection method
- Interpret inspection method

B35
- Pipeline repairs

E22
- Inspect internal pipe surface
- Repair internal coating on vessels (tanks, etc.)

E31
- Inspect internal pipe surface
- Internal corrosion direct assessment
- Monitor for internal corrosion
- Coupons installation
- Monitor probes
- Launching in-line inspection devices
- Receiving in-line inspection devices
- Analysis of in-line inspection results

E32
- Perform internal corrosion remediation
- Gas treatment
- Maintain inhibitor injections
- Installation internal corrosion
- Placement of inhibitor injection points
- Installation of inhibitor injection
- Launching & receiving cleaning pigs

Fig. 2 developed by CFER (ref.5) & Subject Matter Experts as part of the developmenrt of B31Q.