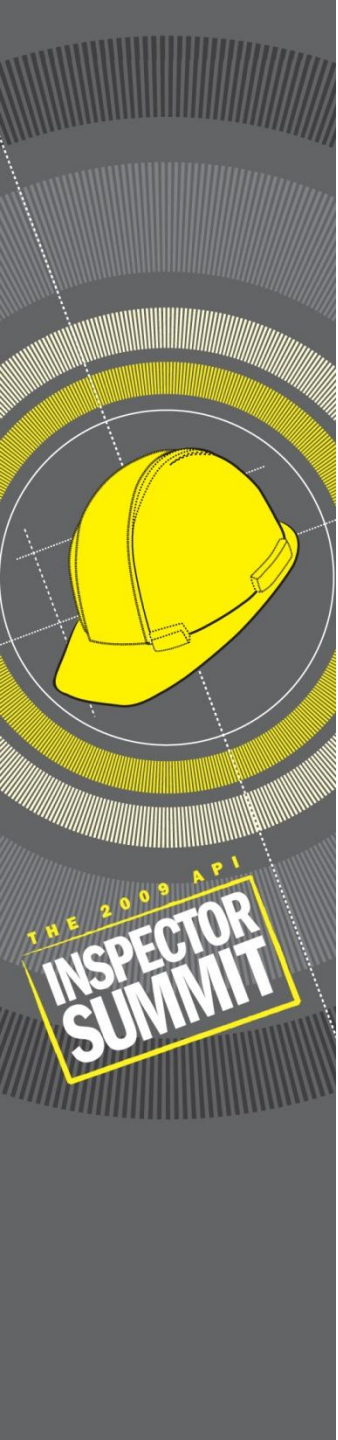


# **Role of Inspection in Capital Projects.**

**Conducting piping baseline measurements and pre-service initial inspections as early as possible on new construction offers significant life cycle cost improvement opportunities. An approach combining all this early data into a single system will be discussed.**

**Rodney Addison**



# **Rodney Addison**

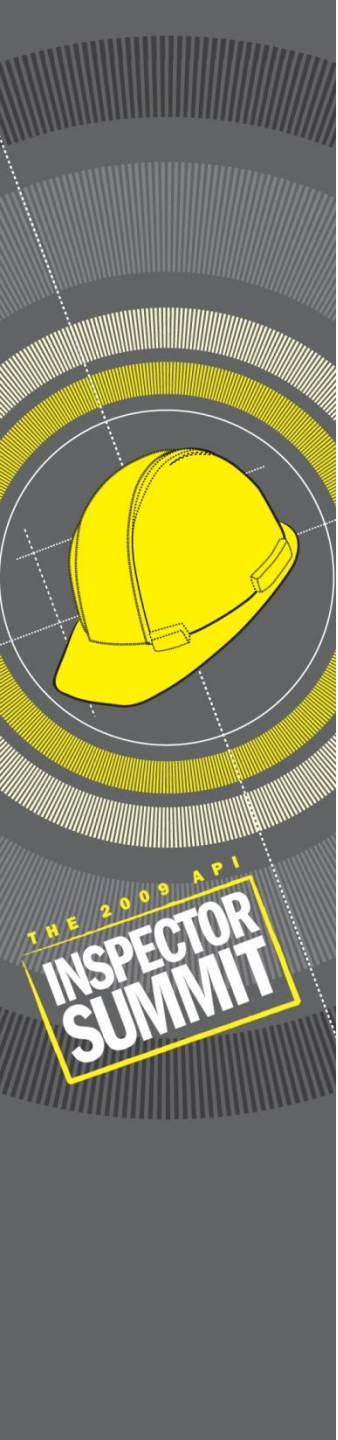
**Refining and Petro-Chemical Industry 30+ Years**

**Worked as an employee of an operating company in the Inspection Department at 3 different locations for 6 different companies.**

**Chief Inspector for >20 years.**

**Current job**

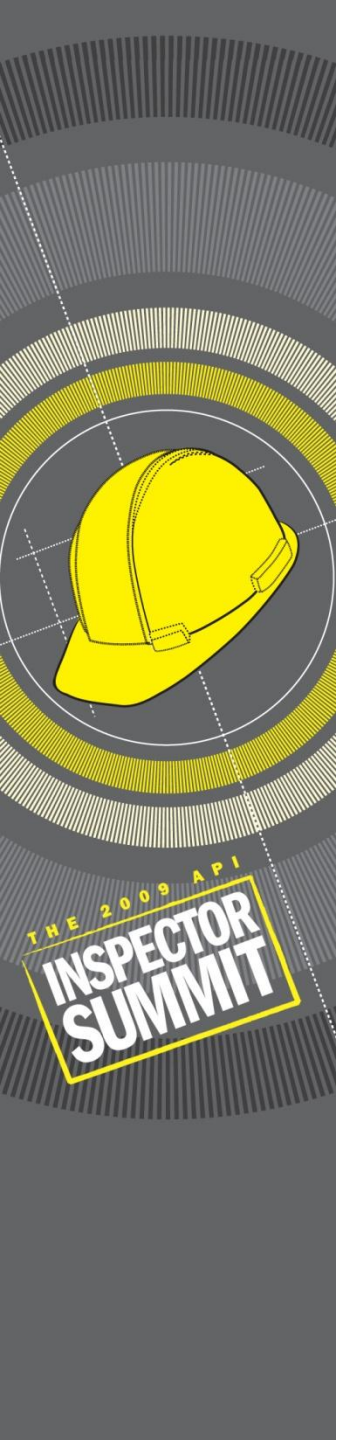
**Project Manager for SGS - ~2yrs.**



# **Target Audience**

**Operating Companies Inspection Agencies**

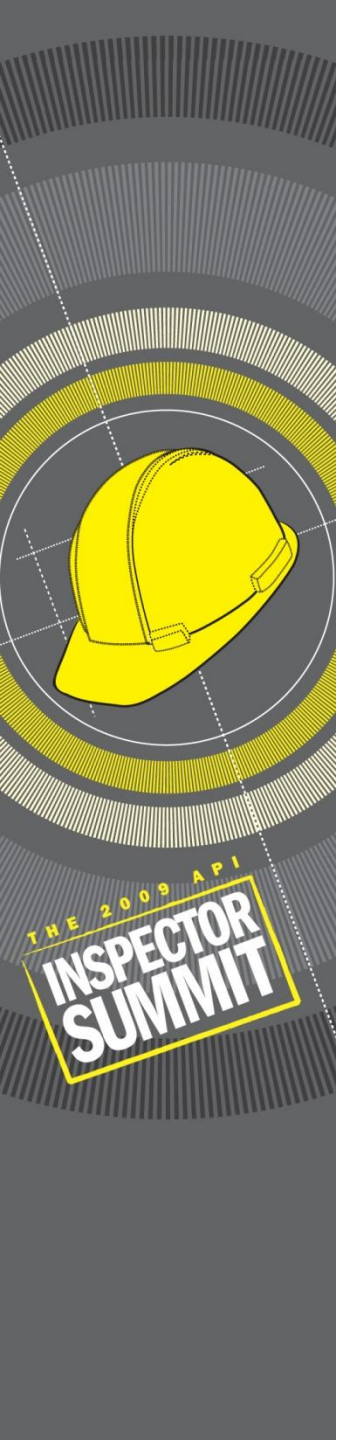
**Operating Companies Capital Project  
Managers / Directors**



# **Presentation Objectives**

**Provide owner/user inspection agencies with**

- 1. Justification for involvement in capital projects.**
- 2. Provide examples of techniques for effective involvement in Capital Projects**
- 3. Justification for Vendor Surveillance.**
- 4. Advantages & Technical Basis for performing pre-service baseline inspections.**



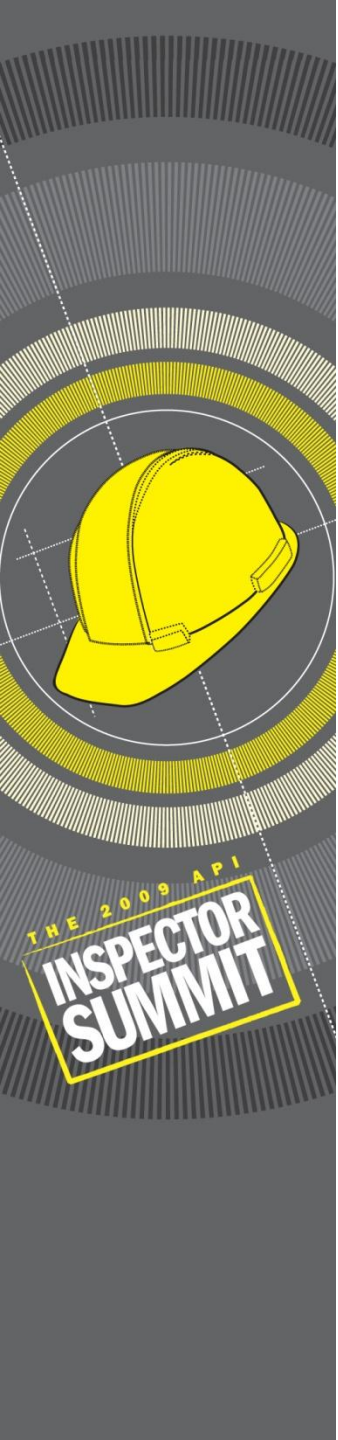
## **Justification for Involvement**

### **a. Mechanical Integrity Manual**

Does your MI Manual address new construction?

If not change it.

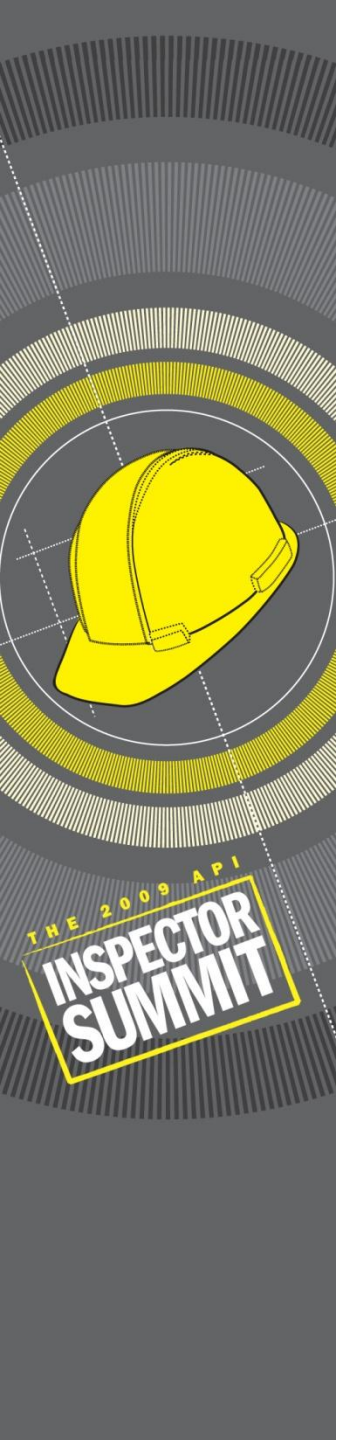
**b. Does your Capital Project Group have a Quality Assurance Manual?**



**Justification for Involvement**  
**1910.119 Appendix C Compliance Guidelines**  
**Paragraph 9**

**“The use of appropriate gaskets, packing, bolts, valves, lubricants and **welding rods** need to be verified in the **field.**”**

**“ it may be appropriate to conduct audits of the equipment supplier's facilities to better assure proper purchases of required equipment which is suitable for its intended service.”**

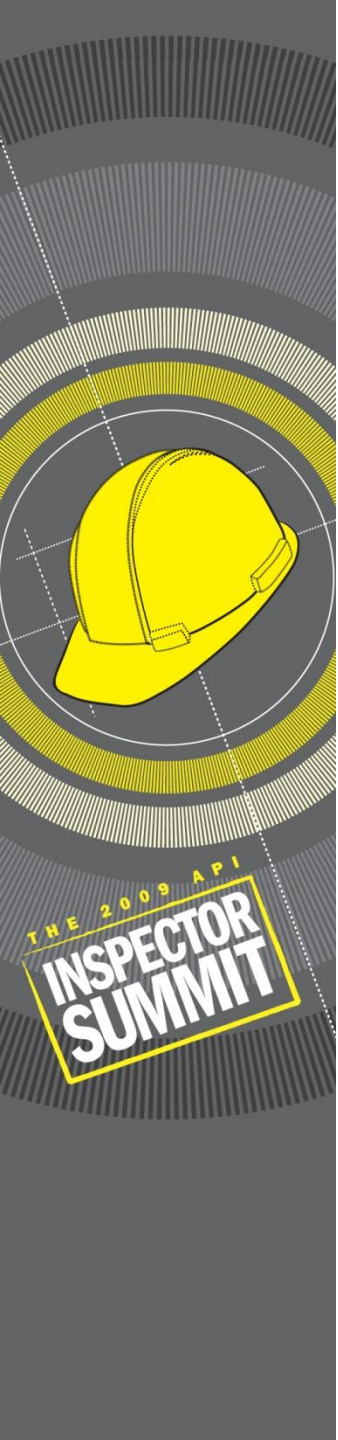


## Justification for Involvement OSHA NEP Audit Protocol.

### E. Piping

**Q 9. “Considering the five production piping circuits randomly selected, can the employer demonstrate that the piping was **installed** according to design specification?”**

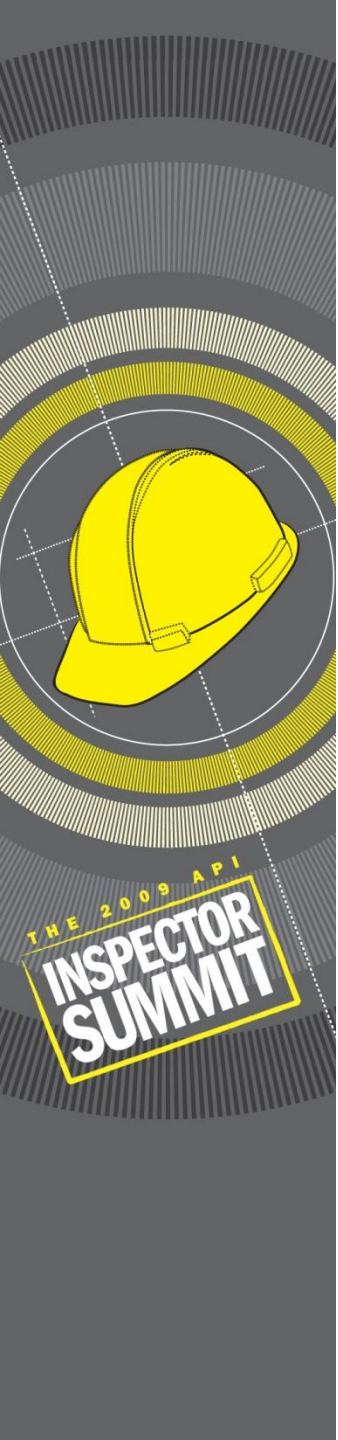
**“If no, possible violations include:”**



## Justification for Involvement OSHA NEP Audit Protocol

“If no, possible violations include:”

- a. “the employer did not conduct appropriate check and inspection to ensure piping was **installed** according to design specifications;”
- b. “the employer did not ensure that piping construction and equipment was in accordance with its design specifications **before startup**;”
- c. “the employer did not follow **RAGAGEP** when it failed to conduct **PMI testing**”



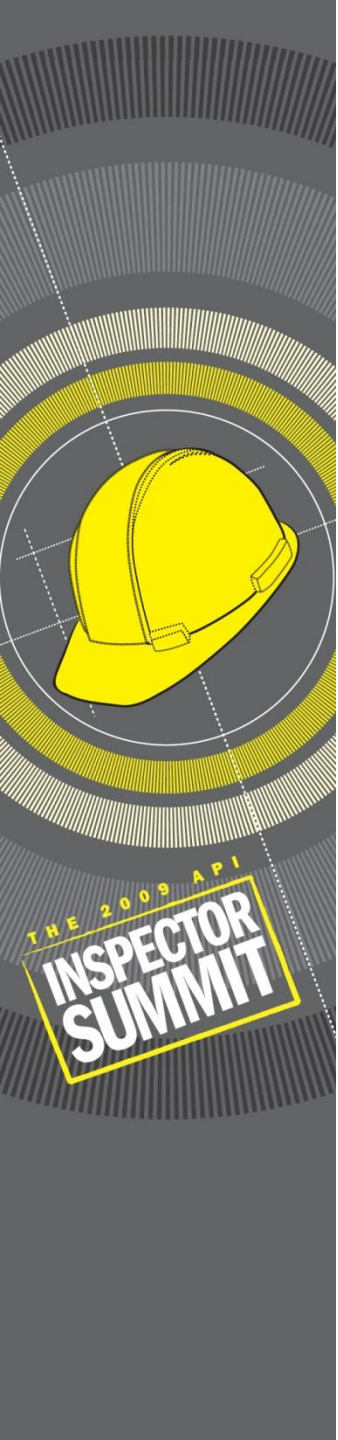
## **End of Presentation Objective One**

Justification for involvement in capital projects.

**Any questions or comments.**

Start of Presentation Objective Two

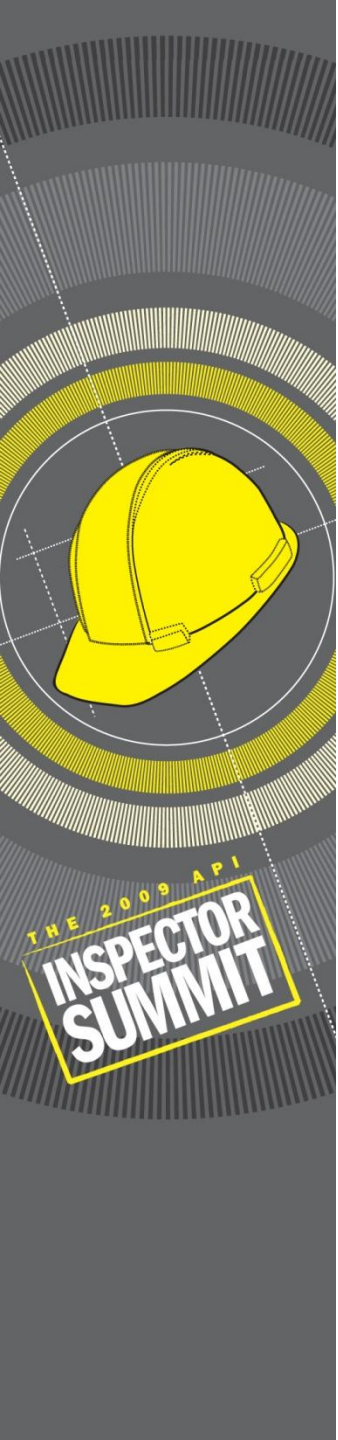
**Provide examples of techniques for  
effective involvement in Capital Projects**



## Objective 2

Provide Examples of Effective Techniques.

**Examples of Techniques Used to Effectively Involve Your Owner / User Inspection Agency During Capital Expansion Projects.**



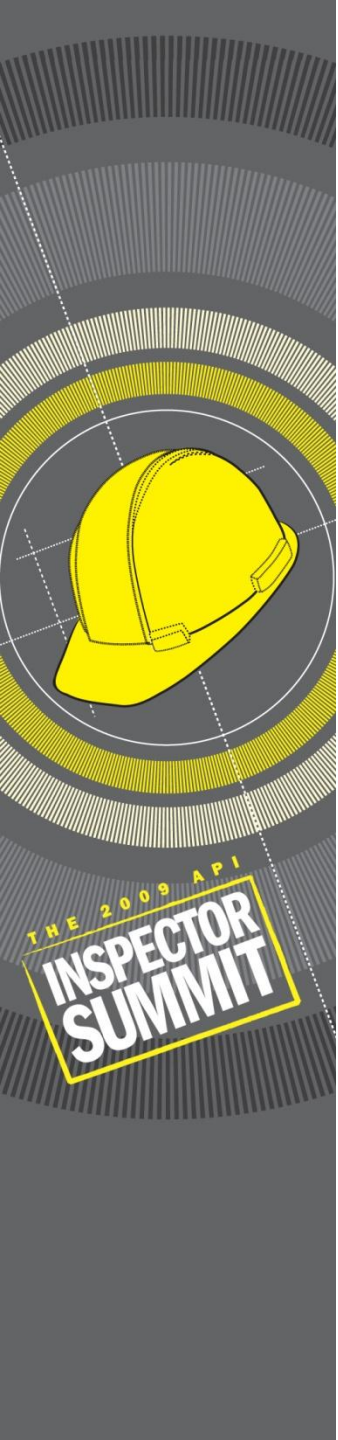


**Objective 2**  
**Examples of Essential Techniques**

- A. Review purposed Engineering Specifications to be used during procurement and construction.**
- B. Review QC Manual(s) of Construction Contractors**
- C. Establish a Project QA/QC Org Chart.**
- D. Establish a System Turn-Over Protocol.**

## **Example 2A. Review purposed Engineering Specifications**

- 1. Determine what's missing**
- 2. Drive for a Site Specific Specification Manual. Provides location for**
  - a. Supplemental Specification (missing)**
  - b. Location specific specifications.**
  - c. Exemptions to Specification.**
  - d. Approved Manufactures List (PVFs)**
  - e. Approved Fabricators List (PV, Exch, Pipe Fabricators).**

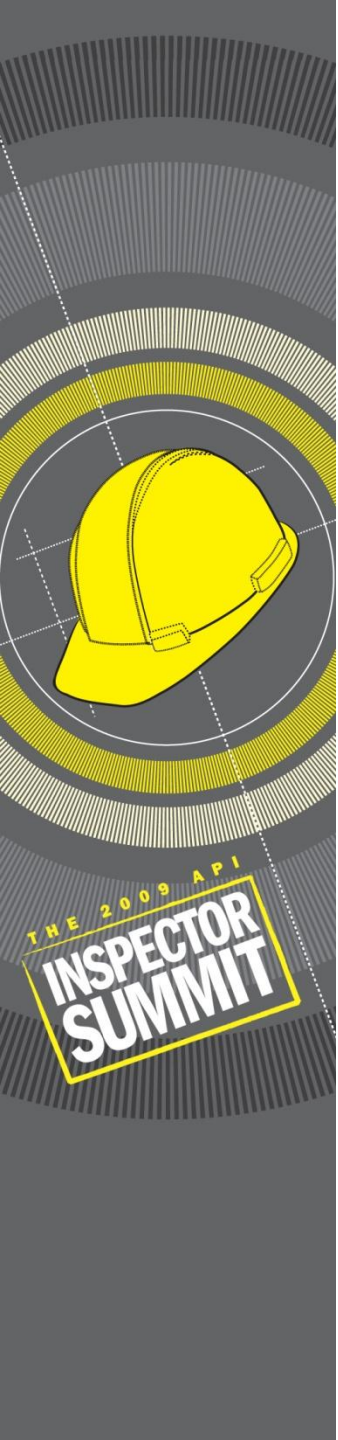


## **Example 2B. Review QC Manual(s) of Construction Contractors**

Push for a site specific project QC Manual.

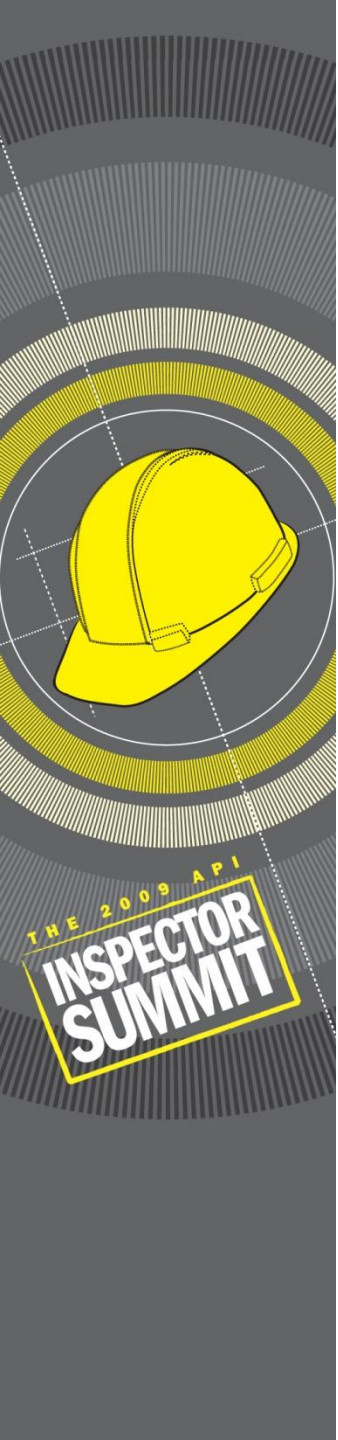
Three Essential items to include in Manual

- 1. Turn over package requirements (discussed later)**
- 2. Establish your self as a review and approval for all NCRs (Non Conformance Reports) generated by project QC.**
- 3. Pre-hydro check list (discussed later)**



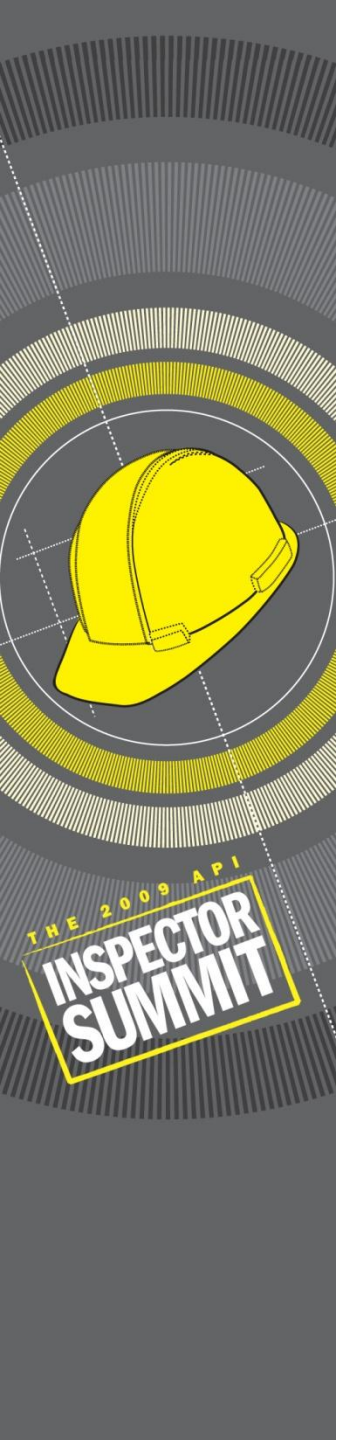
## Example 2C. Establish a Project QA/QC Org Chart.

1. Owner QA report to the operating company Project Manager or Director, have a dotted line up the chain of command (use it)
2. Establish contract QC to functionally report to you. By dotted line they administratively report the to company that signs their check



## Example 2D. Establish a System Turn-Over Protocol.

1. Establish your signature (QA) as a requirement for turnover packages.
2. Establish required documentation in the turnover package.
3. Your final leverage point for all open NCR's.  
(is your signature required for the PSSR)
4. The following activities should be complete before you sign off:
  - a) Initial base line UT, b) AutoCAD Insp Iso's & drawings. C) CM data base complete and linked.



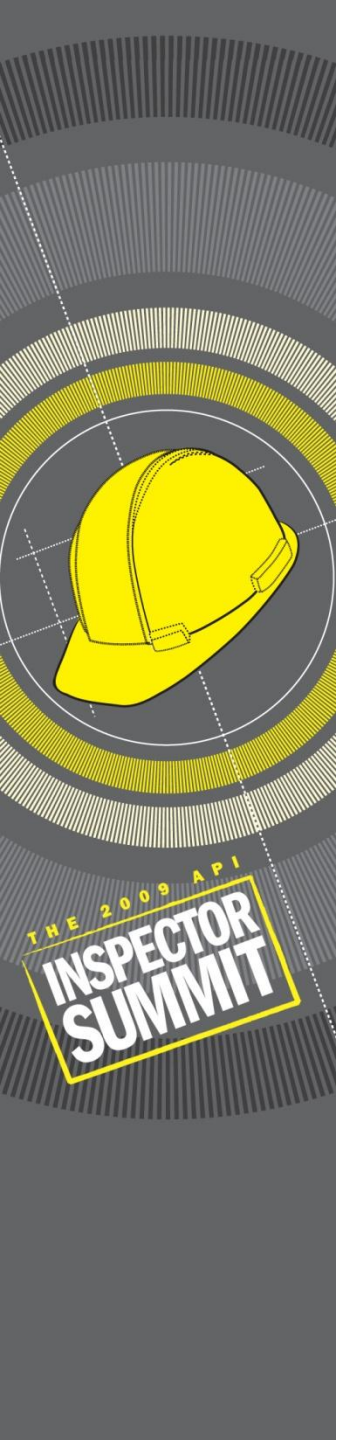
## **End of Objective 2**

Provide examples of techniques for effective involvement in Capital Projects

Questions or Comments

Start of Objective 3.

**Justification for Vendor Surveillance.**



## Objective 3 Vendor Surveillance

What data constitutes compliance with

### **1910.119(j)(6)(i)**

In the construction of new plants and equipment, the employer shall assure that equipment **as it is fabricated** is suitable for the process application for which they will be used.

Code Data Package?

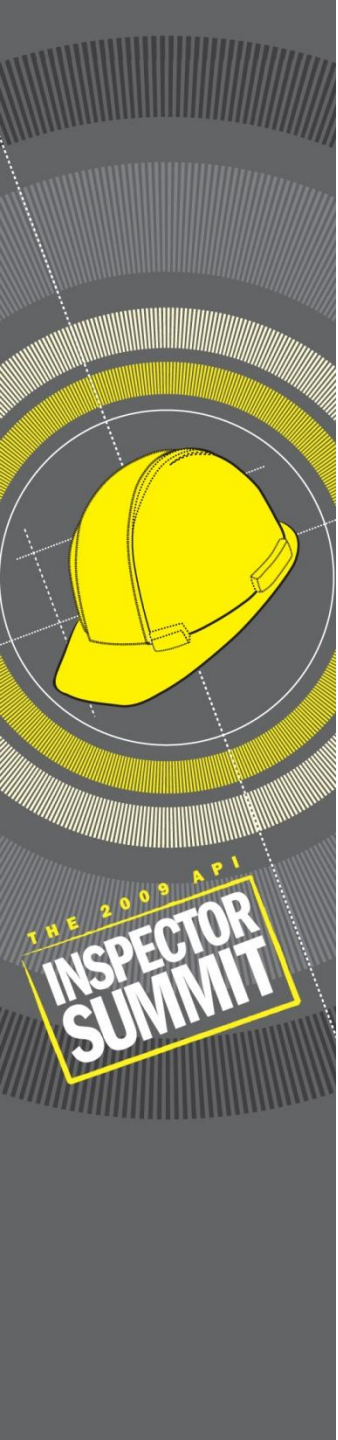


## Objective 3

### Vendor Surveillance

What is Needed to Demonstrate Compliance.

- A. Procurement specification that list essential elements of documentation. Levels of Inspection.
- B. Final documentation package that (as a minimum) includes
  1. Listing of specifications utilized.
  2. Final shop QC plan that list hold points and sign off.
  3. NCR Log and individual NCRs. Acceptance signature of QA inspector.
  4. Release Form signed by QA inspector.

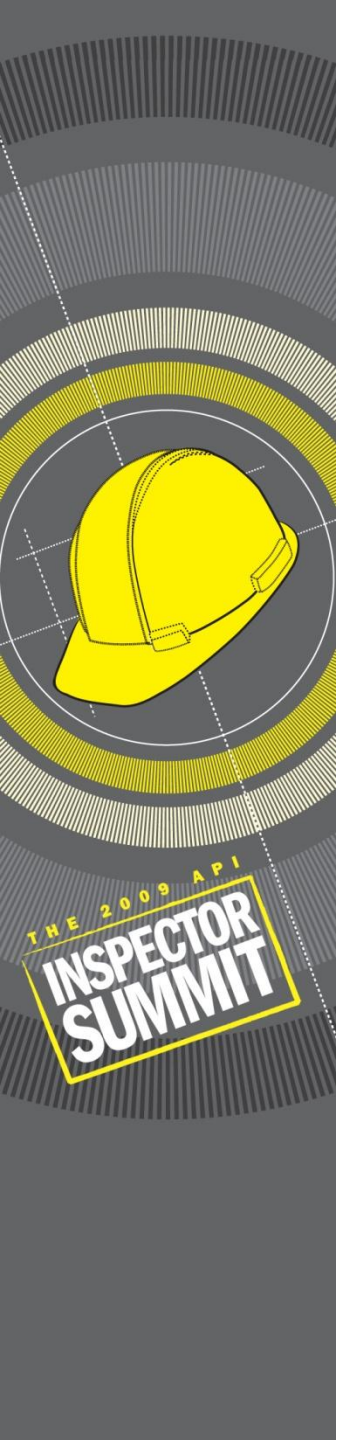


## **Objective 3**

### **Vendor Surveillance**

Other supplemental elements of a good documentation package. (Typically not included in a code data package)

5. Copy of PO to Fabricator and PO to Inspection agency
6. Log and individual SDRs and RFIs  
(Specification Deviation Request) (Request For Information)
7. On-site Inspection Reports and digital images.
8. Thickness survey at fabrication facility.



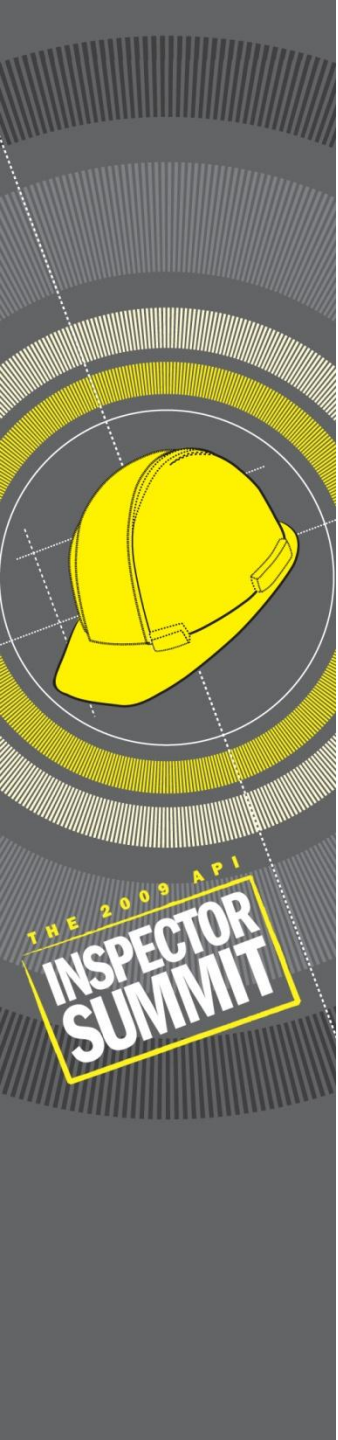
## **End of Objective 3**

Justification for Vendor Surveillance.

Any Questions or Comments?

Start of Objective 4

**Advantages and Technical Basis for  
Conducting Pre-Service Base Line  
Inspections**





## **Objective 4**

# **Advantages and Technical Basis for Conducting Pre-Service Base Line Inspections**

### **1. Advantages:**

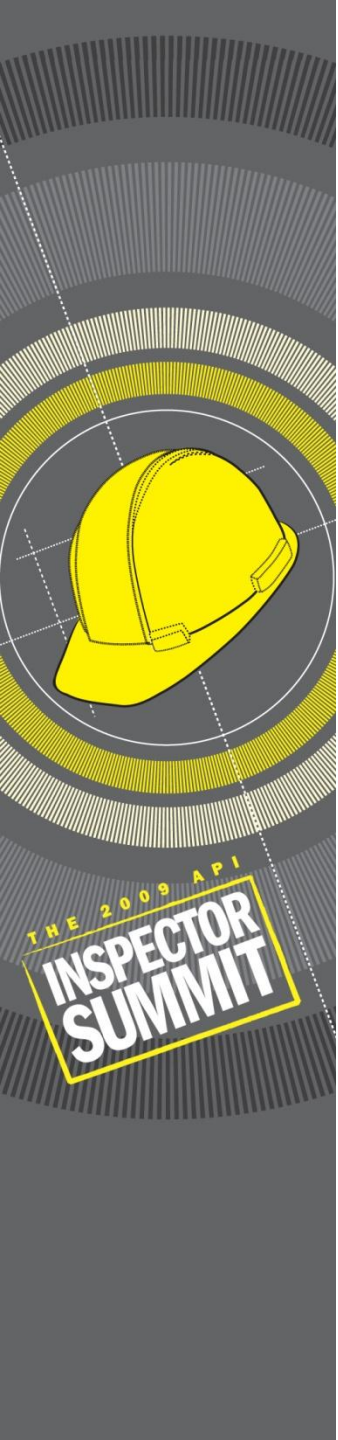
- a. Capital vs Operating Expense**
- b. Hidden Administrative Cost of Post Construction Execution.**
- c. OSHA Compliance**

# **Objective 4**

## **Advantages and Technical Basis for Conducting Pre-Service Base Line Inspections**

### 1. Advantages

#### a. Capital vs Operating Expense





## Objective 4

# Advantages and Technical Basis for Conducting Pre-Service Base Line Inspections

### 1. Advantages:

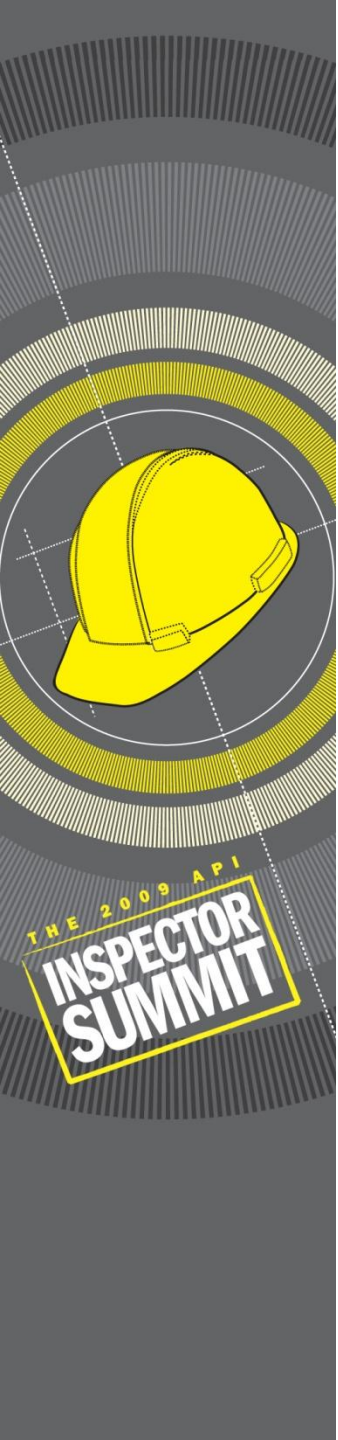
#### B. No Hidden Administrative Cost of Post Construction Execution.

1. Develop bid package which includes work practices. IF you are requesting a hard dollar bid we need -as a minimum- CML placement procedure, P& IDs, piping specifications, line list, equipment fabrication drawings and construction isometrics.
2. Coordinate Bid Walk Down
3. Bid evaluation process and contractor selection

## **Objective 4**

# **Advantages and Technical Basis for Conducting Pre-Service Base Line Inspections**

4. Develop AFE, Write the PO.
5. Coordinate the project kick-off
6. Daily supervision headaches.

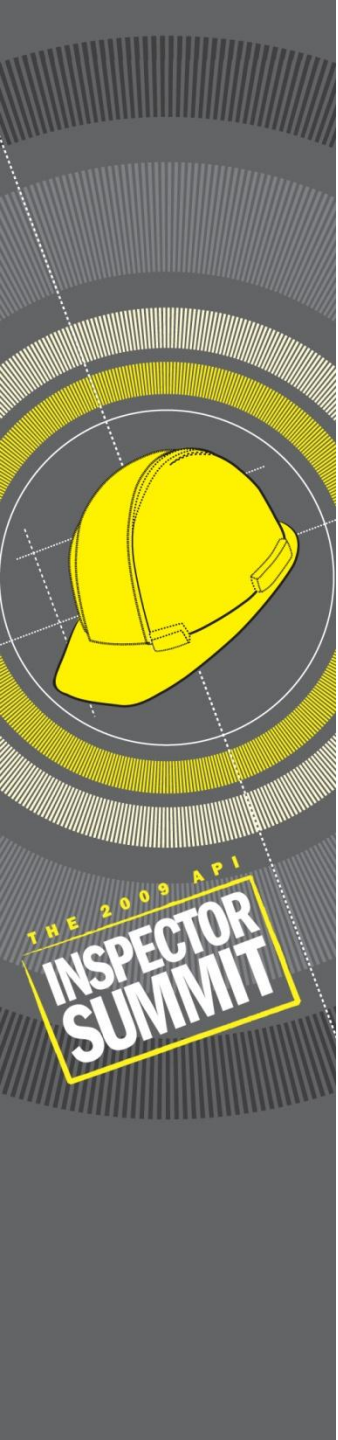


# Objective 4

## Advantages and Technical Basis for Conducting Pre-Service Base Line Inspections

### 1. Advantages

#### C. **OSHA Compliance**



## Objective 4

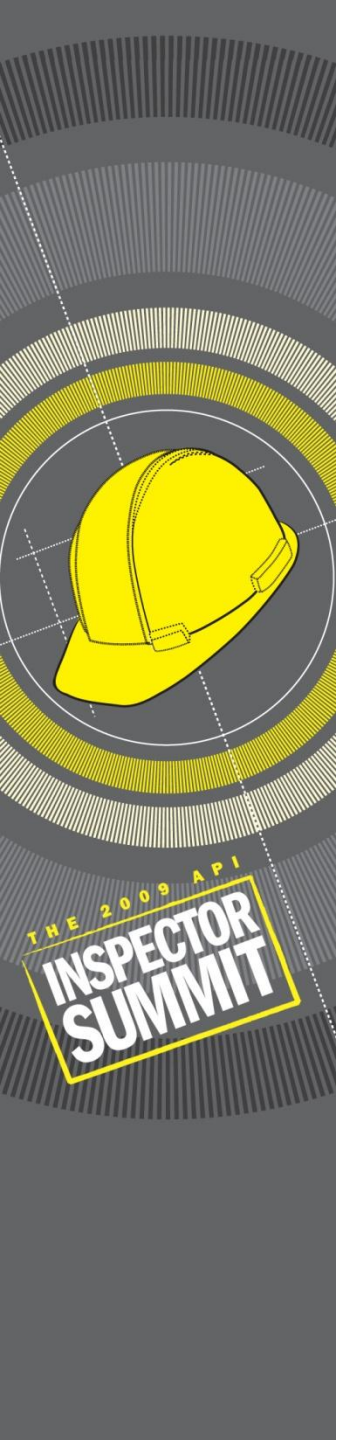
# Advantages and Technical Basis for Conducting Pre-Service Base Line Inspections

### API 510 Pressure Vessel Code

5.3.c.

“If the probable corrosion rate can not be determined by a or b above, on-stream determinations shall be made after 1000 hours of service by using suitable corrosion monitoring devices or actual nondestructive thickness measurements of the vessel or system.”

1000 hrs = 41 days.



## Objective 4

# Advantages and Technical Basis for Conducting Pre-Service Base Line Inspections

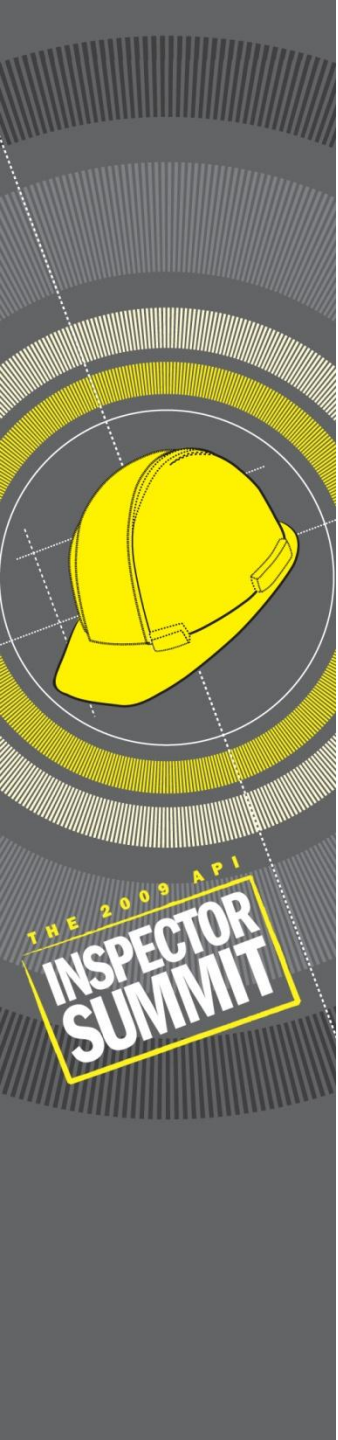
### API 574 Inspection Practices for Piping Systems

12.1.c. " All inspection records should contain as a minimum:

- a. The original date of installation
- b. The specifications and strength levels of the materials used.

c. The original thickness"

WHY Original Thickness



## **Objective 4**

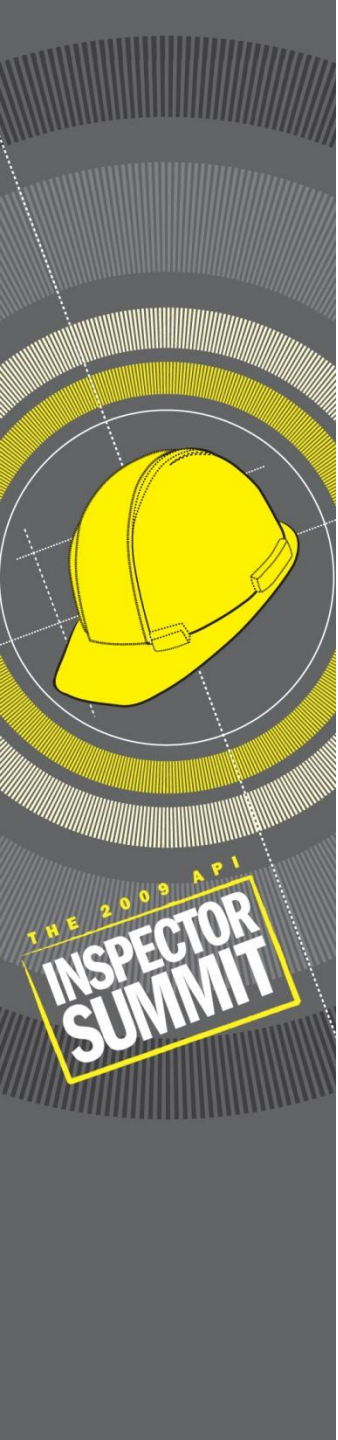
### **Advantages and Technical Basis for Conducting Pre-Service Base Line Inspections**

Piping Corrosion Rate Calc using the assumed nominal thickness. (mill under tolerance)

Example 6" Sch 40 pipe = .280" nominal thk  
.280" - 12.5% (mill under tolerance) = .245"

First Inspection 12 months after initial service date the measured thickness is .245"

Does initial corrosion rate = 35 MPY or 0 MPY  
(3X)



# ASME Section II Part A

## SA-530 Specification for General Requirements for Specialized Carbon Steel and Alloy Steel Pipe (Includes A-106)

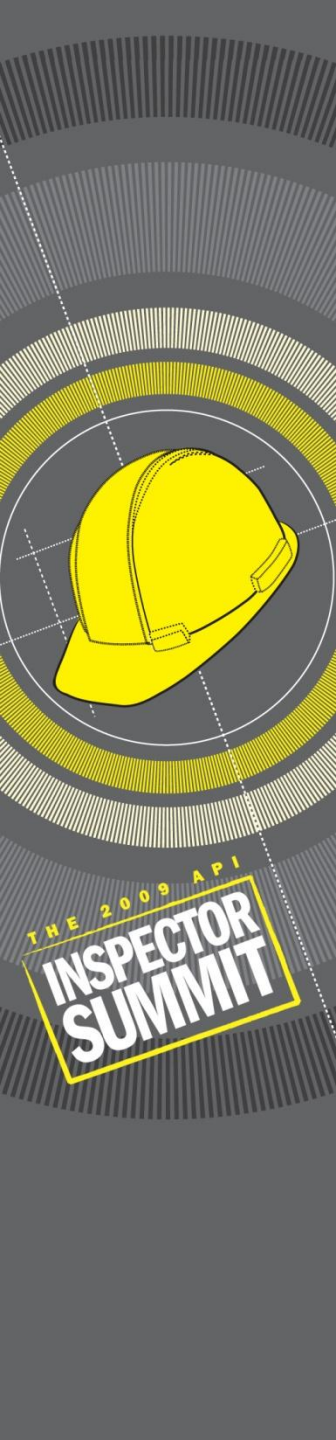
TABLE 1 (Page 1010 Edition 2004)

### PERMISSIBLE VARIATIONS IN WALL THICKNESS

<u>NPS Designator</u>	<b>Tolerance, % from Nominal</b>	
	<b>Over</b>	<b>Under</b>
1/8 to 2 1/2, incl., all t /D ratios	20.0	12.5
3 to 18 incl., t /D up to 5% incl. (example)	22.5	12.5
3 to 18 incl., t /D > 5%	15.0	12.5
20 and larger, welded, all t /D ratios	17.5	12.5
20 and larger, seamless, t /D up to 5% incl.	22.5	12.5
20 and larger, seamless, t /D > 5%	15.0	12.5

t = Nominal wall thickness.

D = Ordered outside diameter.



## Objective 4

### Advantages and Technical Basis for Conducting Pre-Service Base Line Inspections

Example 6" Sch 40 pipe = .280" nominal

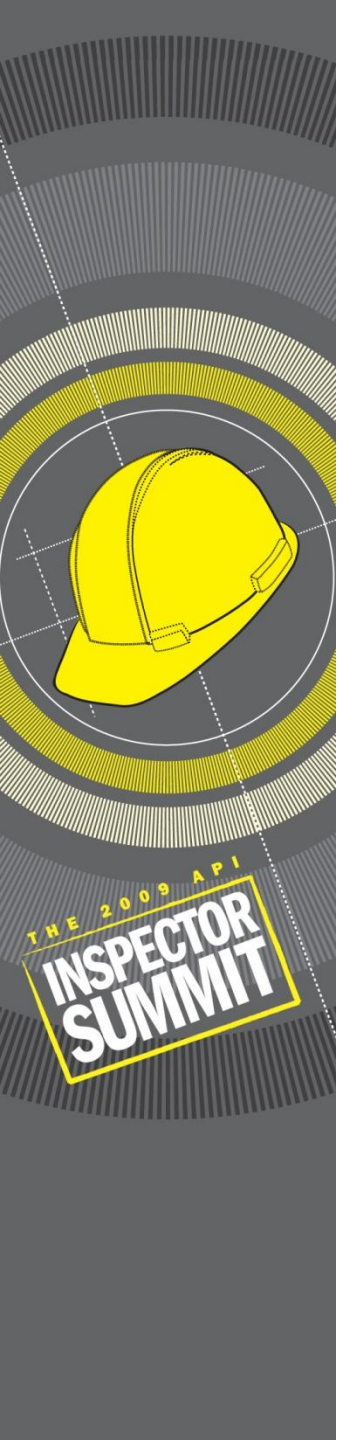
.280" - 12.5% under tolerance = .245"

.280 + 22.5% over tolerance = .343"

.343" - .245" =  $\Delta$  .098"

After 12 Mo UT = .245".

Is the corrosion rate 35 MPY (using nominal),  
or 0 MPY using (-12.5%) or 98 MPY (using  
+22.5%)????



## Objective 4

# Advantages and Technical Basis for Conducting Pre-Service Base Line Inspections

ASME-SA 20

Under tolerance for plate = .010"

Over tolerance varies by thickness range.

1/4" - 1" = .03"

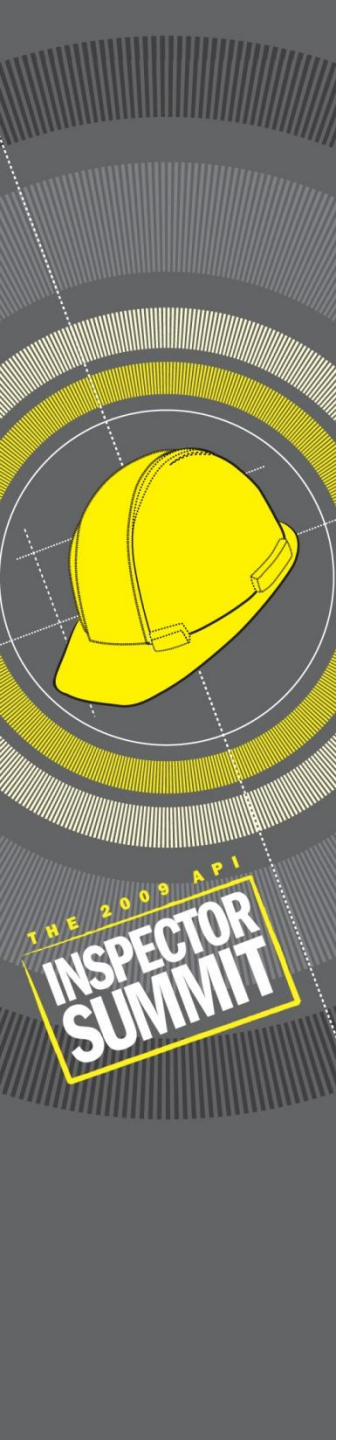
1" - 2" = .06"

2" - 3" = .09"

3" - 4" = .11"

ect

12" - 15" = .29"



## **Objective 4 Advantages and Technical Basis for Conducting Pre-Service Base Line Inspections**

**Example 1.5" thk vessel with 1/8" CA**

**Specified original thickness as  $1.5 + .060" = 1.56"$**

**Assume t-min as  $1.5" - .125" = 1.38"$**

**After 1 yr of service you record a thk of 1.49"**

**Assume Nom T(1.5"), Calc Corrosion Rate Calc = 10 MPY.**

**Using MOT, Calc Corrosion Rate = 70 MPY**

**At 10 MPY ½ remaining life calc (using ca Min t) = 5.5 yrs**

**At 70 MPY ½ remaining life calc (using ca Min t) = 1.5 yrs**

**MOT = Mill Over Tolerance**





## **Objective 4**

# **Advantages and Technical Basis for Conducting Pre-Service Base Line Inspections**

## **Dilemma**

Using post service measurements, you don't know if the established corrosion rate is accurate. (Mill tolerances or corrosion)

Inaccurate inspection schedules.

## **Solution**

Measure and use pre-service thickness.

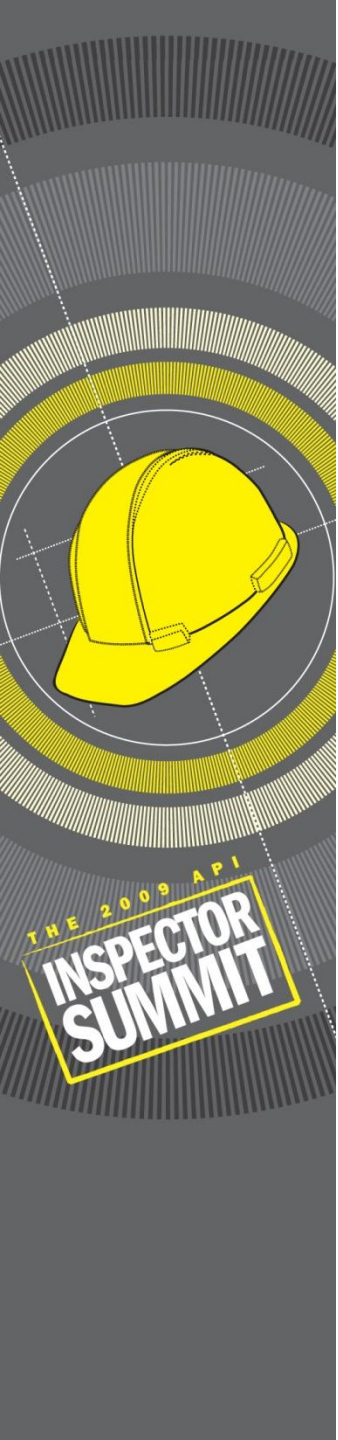
# **Objective 4**


## **Advantages and Technical Basis for Conducting Pre-Service Base Line Inspections**

Pre- Service PMI

Focus

Implementation & Documentation:





**Objective 4**  
**Advantages and Technical Basis for**  
**Conducting Pre-Service Base Line Inspections**  
**Implementation**

**Site specific QA/QC Manual**

**Pre-Hydro Check List (QA signature required)**

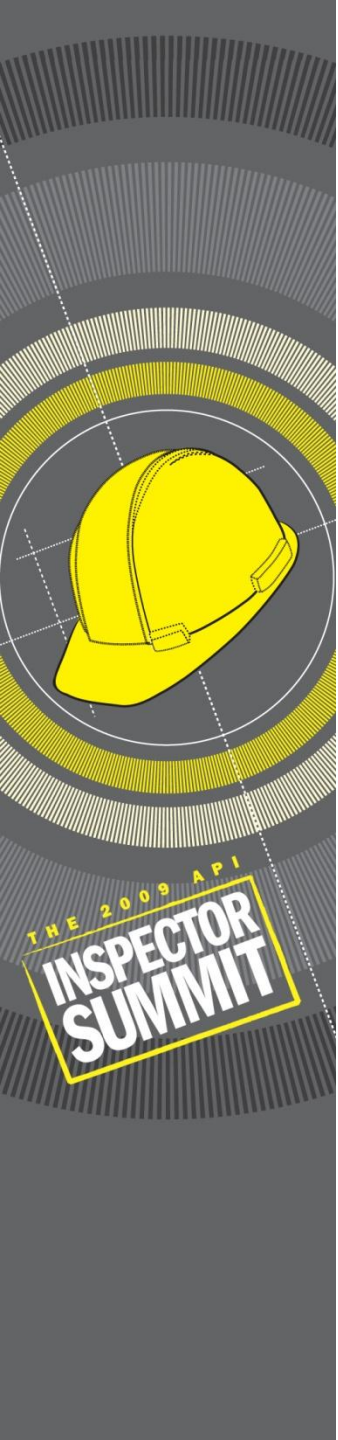
- 1. Properly Supported**
- 2. All welding complete (shoes, guides, high & low point drains)**
- 3. All NDT complete**
- 4. (IF alloy) All PMI complete (welds, SBP, valve bodies & trim-stem)**

## **Objective 4**

# **Advantages and Technical Basis for Conducting Pre-Service Base Line Inspections**

### **Documentation:**

- 1. Spread Sheet and Marked Up Construction Iso.**
- 2. Separate AutoCAD layer on Inspection CAD Drawing linked to material data base.**
- 3. Retro Spread sheet now, AutoCAD later.**



# End of Objective 4 End of Presentation

## Questions ???

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