THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

Date Distributed: December 17, 2012

SUBGROUP ON INSPECTION GENERAL

AGENDA

Meeting of January 15, 2013
Mobile, Alabama

The National Board of Boiler & Pressure Vessel Inspectors
1055 Crupper Avenue
Columbus, Ohio 43229-1183
Phone: (614)888-8320
FAX: (614)847-1828

1. **Call to Order – 8:00 a.m.**

2. **Announcements**

3. **Adoption of the Agenda**

4. **Approval of Minutes of July 18, 2012**

5. **Review of the Roster (Attachment 1)**

6. **Action Items (Attachment 2)**

NB12-1501 ***Part 2 SG Inspection General*** Review inspection requirements so as to align with installation requirements in Part 1. (No Attachment)

January 2012
A Task group of V. Newton, M. Horbaczewski, J. Daiber and J. Safarz was assigned.

July 2012
A report was given by Mr. Newton. Part 1 and Part 2 are being reviewed.

January 2013
Mr. Mooney is expected to report.

NB13-0601 ***Part 2, 4.4.7 and 4.4.8, SG Inspection General*** List item "j" in part be relocated to 4.4.8.7 Evaluating Pressure Retaining Items Containing Local thin areas, with the relocated text place between current list item "e" and "f' of section 4.4.8.7 with the existing list items following this insert then re-designated as list items "g" and "h" respectively. (Attachment 2, pp. 1-6)

January 2013
A report is expected.

NB13-0701 ***Part 2 4.4.7 j) 1) SG Inspection General*** Revise wording to clarify the rule in this section. (Attachment 2, p. 7)

January 2013
A report is expected.

7. **New Business**

8. **Future Meetings**

July 15-19, 2013, Columbus, Ohio
January 13-16, 2013, San Antonio, Texas

9. **Adjournment**

Respectfully Submitted,

Bill Smith
Secretary
:rh

ATTACHMENT 1

SG on Inspection General

Member	Title	ExpirDate	Interest Category
Canonico, Dr. Domenic A.		8/31/2015	General Interest
Dobbins, Robert		2/28/2014	Auth Inpection Agencies
Getter, Jim	Chairman	8/31/2015	Manufacturer
Horbaczewski, Mark		2/20/2014	Users
McRae, Greg		2/20/2014	Manufacturer
Mooney, Mark		1/31/2013	Auth Inpection Agencies
Mullins, Virgil		7/31/2014	Manufacturer
Newton, Venus		1/31/2013	Auth Inpection Agencies
Pate, Ralph		2/28/2014	Jurisdictional Authorities
Richardson, John		8/31/2015	Manufacturer
Safarz, Jason		7/21/2013	General Interest
Smith, Bill	Secretary		

Total Members	11

NB13-0601

Proposed revision NBIC Part 2, sections 4.4.7 and 4.4.8

30 August 2012

Purpose: Request for consideration of Code revision

Background: NBIC Part 2, 4.4.7 Determining Inspection Intervals, addresses the process for establishing the inspection interval for a PRI based on the as-found condition of a PRI. Section 4.4.7.2 Method for Estimating Inspection Intervals for Exposure to Corrosion, provides a list of items guiding the Code user through the process of establishing an inspection interval for a PRI having corrosion damage, except for list item "j" Local Metal Loss, which contains guidance for evaluation or PRI having local thin areas.

NBIC Part 2, 4.4.8.7 Evaluating Pressure-Retaining Items Containing Local Thin Areas specifically addresses local thin area created by pitting.

It is requested that list item "j", in part, be relocated to 4.4.8.7 Evaluating Pressure-Retaining Items Containing Local Thin Areas, with the relocated text place between current list items "e" and "f" of section 4.4.8.7 with the existing list items following this insert then re-designated as list items "g" and "h" respectively.

Proposal is shown on following pages.

The objective is to move the "evaluation" guidance currently in 4.4.7 to section 4.4.8 which addresses "evaluation", making the Code more user-friendly.

Proposed revision NBIC Part 2, sections 4.4.7 and 4.4.8

30 August 2012

This page for reference only.

c) Damage may also be caused by mechanical forces such as thermal shock, cyclic temperature changes, vibration, pressure surges, excessive temperature, external loading, and material and fabrication defects.

4.4.7 DETERMINING INSPECTION INTERVALS

a) The maximum period between internal inspections or a complete inservice evaluation of pressure-retaining items shall not exceed one-half of the estimated remaining service life of the vessel or ten years, whichever is less. The method for estimating inspection intervals of pressure-retaining items subject to internal erosion or corrosion is discussed in NBIC Part 2, 4.4.7.1 and 4.4.7.2.

b) Inspection intervals can be revised beyond the maximum period stated above, provided the owner-user has submitted technical justification for revising the inspection interval, subject to review and acceptance by the Jurisdiction, where required.

c) Data used in engineering assessment methods to develop revised inspection intervals for pressure-retaining items shall be re-evaluated every five years, when a change in operation occurs, or after discovery of new and/or altered damage mechanisms.

4.4.7.1 METHOD FOR ESTIMATING INSPECTION INTERVALS FOR PRESSURE-RETAINING ITEMS SUBJECT TO EROSION OR CORROSION

Assessment guidelines for pressure-retaining items subject to corrosion or erosion are provided in this section. These guidelines are based on actual thickness measurements within the area of concern. Minimum required wall thickness shall be based on allowable stress of the material. Applicability and limitations of this guideline are as follows:

a) Original design criteria are known;

b) Item is not operating in the creep range;

c) Item does not contain crack-like indications;

d) Service stresses are known; and

e) Maintenance and operating history are known.

4.4.7.2 METHOD FOR ESTIMATING INSPECTION INTERVALS FOR EXPOSURE TO CORROSION

a) When the pressure-retaining item is exposed to service temperatures below the creep range, and the corrosion rate controls the remaining wall thickness of the pressure-retaining item, the inspection interval shall be calculated by the formula below or by other industry methods as accepted by the Jurisdiction.

$$\text{remaining life (years)} = \frac{t_{(actual)} - t_{(required)}}{\text{corrosion rate}}$$

$t_{(actual)}$ = thickness in inches (mm) measured at the time of inspection for the limiting section used in the determination of $t_{(required)}$

$t_{(required)}$ = minimum allowable thickness in inches (mm) for the limiting section of the pressure-retaining item or zone. It shall be the greater of the following:

1) The calculated thickness, exclusive of the corrosion allowance, required for the pressure relieving device set pressure, static head, or other loading and design temperature, or

2) The minimum thickness permitted by the provision of the applicable Section of the original code of construction.

Corrosion Rate = inches (mm) per year of metal removal as a result of corrosion.

b) Any suitable nondestructive examination method may be used to obtain thickness measurements provided the instruments employed are calibrated in accordance with the manufacturer's specification or an acceptable national standard.

1) If suitably located existing openings are available measurements may be taken through the openings.

2) When it is impossible to determine thickness by nondestructive means, a hole may be drilled through the metal wall and thickness gage measurements taken.

c) For new pressure-retaining items or PRI's for which service conditions are being changed, one of the following methods shall be employed to determine the probable rate of corrosion from which the remaining wall thickness, at the time of the next inspection, can be estimated:

1) The corrosion rate as established by data for pressure-retaining items in the same or similar service;

2) If the probable corrosion rate cannot be determined by the above method, on-stream thickness determinations shall be made after approximately 1,000 hours of service. Subsequent sets of thickness measurements shall be taken after additional similar intervals until the corrosion rate is established.

d) Corrosion Resistant Lining
When part or all of the pressure-retaining items have a corrosion resistant lining, the interval between inspections of those sections so protected may be based on recorded experience with the same type of lining in similar service, but shall not exceed ten years, unless sufficient data has been provided to establish an alternative inspection interval. If there is no experience on which to base the interval between inspections, performance of the liner shall be monitored by a suitable means, such as the use of removable corrosion probes of the same material as the lining, ultrasonic examination, or radiography. To check the effectiveness of an internal insulation liner, metal temperatures may be obtained by surveying the pressure-retaining item with temperature measuring or indicating devices.

e) Two or More Zones
When a pressure-retaining item has two or more zones of pressure or temperature and the required thickness, corrosion allowance, or corrosion rate differ so much that the foregoing provisions give significant differences in maximum periods between inspections for the respective zones (e.g., the upper and lower portions of some fractionating towers), the period between inspections may be established individually for each zone on the basis of the condition applicable thereto, instead of being established for the entire vessel on the basis of the zone requiring the more frequent inspection.

f) Above-Ground Pressure Vessels
All pressure vessels above ground shall be given an external examination after operating the lesser of five years, or one quarter of remaining life, preferably while in operation. Alternative intervals resulting in longer periods may be assigned provided the requirements of this section have been followed. Inspection shall include determining the condition of the exterior insulation, the supports, and the general alignment of the vessel on its supports. Pressure vessels that are known to have a remaining life of over ten years or that are prevented from being exposed to external corrosion (such as being installed in a cold box in which the atmosphere is purged with an inert gas, or by the temperature being maintained sufficiently

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low or sufficiently high to preclude the presence of water), need not have the insulation removed for the external inspection. However, the condition of the insulating system and/or the outer jacketing, such as the cold box shell, shall be observed periodically and repaired if necessary.

g) Interrupted Service

1) The periods for inspection referred to above assume that the pressure-retaining item is in continuous operation, interrupted only by normal shutdown intervals. If a pressure-retaining item is out of service for an extended interval, the effect of the environmental conditions during such an interval shall be considered.

2) If the pressure-retaining item was improperly stored, exposed to a detrimental environment or the condition is suspect, it shall be given an inspection before being placed into service.

3) The date of next inspection, which was established at the previous inspection, shall be revised if damage occurred during the period of interrupted service.

h) Circumferential Stresses
For an area affected by a general corrosion in which the circumferential stresses govern the MAWP, the least thicknesses along the most critical plane of such area may be averaged over a length not exceeding:

1) The lesser of one-half the pressure vessel diameter, or 20 in. (500 mm) for vessels with inside diameters of 60 in. (1.5 m) or less, or

2) The lesser of one-third the pressure vessel diameter, or 40 in. (1 m), for vessels with inside diameters greater than 60 in. (1.5 m), except that if the area contains an opening, the distance within which thicknesses may be averaged on either side of such opening shall not extend beyond the limits of reinforcement as defined in the applicable Section of the ASME Code for ASME Stamped vessels and for other vessels in their applicable codes of construction.

Move text to follow 4.4.8.7 "e"

i) Longitudinal Stresses
If because of wind loads or other factors the longitudinal stresses would be of importance, the least thicknesses in a length of arc in the most critical plane perpendicular to the axis of the pressure vessel may be averaged for computation of the longitudinal stresses. The thicknesses used for determining corrosion rates at the respective locations shall be the most critical value of average thickness. The potential for buckling shall also be considered.

j) Local Metal Loss
Corrosion pitting shall be evaluated in accordance with NBIC Part 2, 4.4.8.7. Widely scattered corrosion pits may be left in the pressure-retaining item in accordance with the following requirements:

1) Their depth is not more than one-half the required thickness of the pressure-retaining item wall (exclusive of corrosion allowance);

2) the total area of the pits does not exceed 7 sq. in. (4500 sq mm) within any 50 sq. inches (32000 sq. mm); and

3) the sum of their dimensions (depth and width) along any straight line within this area does not exceed 2 in. (50 mm).

k) Weld Joint Efficiency Factor
When the surface at a weld having a joint efficiency factor of other than one is corroded as well as surfaces remote from the weld, an independent calculation using the appropriate weld joint efficiency factor

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7) Dimensional verification checks;

d) If visual distortion or changes in the microstructure or mechanical properties are noted, consider replacing the component or a detailed engineering analysis shall be performed to verify continued safe operation.

e) Techniques for evaluating fire damage are referenced in applicable standards. See NBIC Part 2, 1.3. A1

4.4.8.6 EVALUATING EXPOSURE OF PRESSURE-RETAINING ITEMS TO CYCLIC FATIGUE

a) A fatigue evaluation should be performed if a component is subject to cyclic operation. The allowable number of cycles (mechanical or thermal) at a given level of stress should be adequate for the specified duration of service to determine suitability for continued operation.

b) Data requirements and history information should be obtained as identified in NBIC Part 2, 4.4.5.

c) Techniques for evaluating fatigue are referenced in applicable standards. See NBIC Part 2, 1.3.

4.4.8.7 EVALUATING PRESSURE-RETAINING ITEMS CONTAINING LOCAL THIN AREAS

a) Local thin areas can result from corrosion/erosion, mechanical damage, or blend/grind techniques during fabrication or repair, and may occur internally or externally. Types of local thin areas are grooves, gouges, and pitting. When evaluating these types of flaws, the following should be considered:

1) Original design and current operating conditions;

2) Component is not operating in the creep range;

3) Material has sufficient toughness;

4) Not operating in cyclic service;

5) Does not contain crack-like indications;

6) Flaws are not located in knuckle regions of heads or conical transitions;

7) Applied loads;

8) The range of temperature or pressure fluctuation.

b) Where appropriate, crack-like indications should be removed by blend/grinding, and evaluated as a local thin area.

c) Data requirements and history information should be obtained as identified in NBIC Part 2, 4.4.5.

d) Required measurements for evaluation of local thin areas shall include:

1) Thickness profiles within the local region;

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2) Flaw dimensions;

3) Flaw to major structural discontinuity spacing;

4) Vessel geometry;

5) Material properties.

e) Required measurements for evaluation of pitting corrosion shall include:

1) Depth of the pit;

reletter to "g"

2) Diameter of the pit;

3) Shape of the pit;

4) Uniformity.

f) Widely scattered corrosion pits may be left in the pressure-retaining item in accordance with the following requirements:
1) Their depth is not more than one-half the required thickness of the pressure-retaining item wall (exclusive of corrosion allowance);
2) the total area of the pits does not exceed 7 sq. in. (4500 sq mm) within any 50 sq. inches (32000 sq. mm); and
3) the sum of their dimensions (depth and width) along any straight line within this area does not exceed 2 in. (50 mm).

f) If metal loss is less than specified corrosion/erosion allowance and adequate thickness is available for future corrosion, then monitoring techniques should be established. If metal loss is greater than specified corrosion/erosion allowance and repairs are not performed, a detailed engineering evaluation shall be performed to ensure continued safe operation.

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g) Techniques for evaluating local thin areas and pitting are referenced in applicable standards. See NBIC Part 2, 1.3.

4.5 RISK-BASED INSPECTION ASSESSMENT PROGRAMS

4.5.1 SCOPE

a) This Section describes the basic elements, principles, and guidelines of a risk-based inspection (RBI) program. This Section does not address any one method but is intended to clarify the elements associated with a RBI program. Risk assessment is a process to evaluate continued safe operation of a pressure-containing component. This process is based on sound engineering practices, proven risk assessment experience, and management principles. There are numerous risk-based assessment methods being applied throughout many industries. Details for developing and implementing risk-based inspection programs are defined in other referenced standards.

Implementation of a risk-based inspection (RBI) assessment program allows an owner-user to plan inspection frequencies based on assessing probability of failure (POF) and consequence of failure (COF) (risk = POF x COF). Risk assessment programs involve a team concept based on knowledge, training and experience between engineers, inspectors, operators, analysts, financial, maintenance, and management personnel. Appropriate and responsible decisions must be made from input by all team members to ensure safe operation of systems and their components. Organizational commitment and cooperation is required to successfully implement and maintain a RBI program.

4.5.2 DEFINITIONS

COF — Consequence of Failure. Outcome from a failure. There may be one or more outcomes from a single failure.

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The objective is to move the "evaluation" guidance currently in 4.4.7 to section 4.4.8 which addresses "evaluation", making the Code more user-friendly.

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c) Damage may also be caused by mechanical forces such as thermal shock, cyclic temperature changes, vibration, pressure surges, excessive temperature, external loading, and material and fabrication defects.

4.4.7 DETERMINING INSPECTION INTERVALS

a) The maximum period between internal inspections or a complete inservice evaluation of pressure-retaining items shall not exceed one-half of the estimated remaining service life of the vessel or ten years, whichever is less. The method for estimating inspection intervals of pressure-retaining items subject to internal erosion or corrosion is discussed in NBIC Part 2, 4.4.7.1 and 4.4.7.2.

b) Inspection intervals can be revised beyond the maximum period stated above, provided the owner-user has submitted technical justification for revising the inspection interval, subject to review and acceptance by the Jurisdiction, where required.

c) Data used in engineering assessment methods to develop revised inspection intervals for pressure-retaining items shall be re-evaluated every five years, when a change in operation occurs, or after discovery of new and/or altered damage mechanisms.

4.4.7.1 METHOD FOR ESTIMATING INSPECTION INTERVALS FOR PRESSURE-RETAINING ITEMS SUBJECT TO EROSION OR CORROSION

Assessment guidelines for pressure-retaining items subject to corrosion or erosion are provided in this section. These guidelines are based on actual thickness measurements within the area of concern. Minimum required wall thickness shall be based on allowable stress of the material. Applicability and limitations of this guideline are as follows:

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b) Item is not operating in the creep range;

c) Item does not contain crack-like indications;

d) Service stresses are known; and

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4.4.7.2 METHOD FOR ESTIMATING INSPECTION INTERVALS FOR EXPOSURE TO CORROSION

a) When the pressure-retaining item is exposed to service temperatures below the creep range, and the corrosion rate controls the remaining wall thickness of the pressure-retaining item, the inspection interval shall be calculated by the formula below or by other industry methods as accepted by the Jurisdiction.

$$\text{remaining life (years)} = \frac{t_{(actual)} - t_{(required)}}{\text{corrosion rate}}$$

$t_{(actual)}$ = thickness in inches (mm) measured at the time of inspection for the limiting section used in the determination of $t_{(required)}$

$t_{(required)}$ = minimum allowable thickness in inches (mm) for the limiting section of the pressure-retaining item or zone. It shall be the greater of the following:

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1) The calculated thickness, exclusive of the corrosion allowance, required for the pressure relieving device set pressure, static head, or other loading and design temperature, or

2) The minimum thickness permitted by the provision of the applicable Section of the original code of construction.

Corrosion Rate = inches (mm) per year of metal removal as a result of corrosion.

b) Any suitable nondestructive examination method may be used to obtain thickness measurements provided the instruments employed are calibrated in accordance with the manufacturer's specification or an acceptable national standard.

1) If suitably located existing openings are available measurements may be taken through the openings.

2) When it is impossible to determine thickness by nondestructive means, a hole may be drilled through the metal wall and thickness gage measurements taken.

c) For new pressure-retaining items or PRI's for which service conditions are being changed, one of the following methods shall be employed to determine the probable rate of corrosion from which the remaining wall thickness, at the time of the next inspection, can be estimated:

1) The corrosion rate as established by data for pressure-retaining items in the same or similar service;

2) If the probable corrosion rate cannot be determined by the above method, on-stream thickness determinations shall be made after approximately 1,000 hours of service. Subsequent sets of thickness measurements shall be taken after additional similar intervals until the corrosion rate is established.

d) Corrosion Resistant Lining
When part or all of the pressure-retaining items have a corrosion resistant lining, the interval between inspections of those sections so protected may be based on recorded experience with the same type of lining in similar service, but shall not exceed ten years, unless sufficient data has been provided to establish an alternative inspection interval. If there is no experience on which to base the interval between inspections, performance of the liner shall be monitored by a suitable means, such as the use of removable corrosion probes of the same material as the lining, ultrasonic examination, or radiography. To check the effectiveness of an internal insulation liner, metal temperatures may be obtained by surveying the pressure-retaining item with temperature measuring or indicating devices.

e) Two or More Zones
When a pressure-retaining item has two or more zones of pressure or temperature and the required thickness, corrosion allowance, or corrosion rate differ so much that the foregoing provisions give significant differences in maximum periods between inspections for the respective zones (e.g., the upper and lower portions of some fractionating towers), the period between inspections may be established individually for each zone on the basis of the condition applicable thereto, instead of being established for the entire vessel on the basis of the zone requiring the more frequent inspection.

f) Above-Ground Pressure Vessels
All pressure vessels above ground shall be given an external examination after operating the lesser of five years, or one quarter of remaining life, preferably while in operation. Alternative intervals resulting in longer periods may be assigned provided the requirements of this section have been followed. Inspection shall include determining the condition of the exterior insulation, the supports, and the general alignment of the vessel on its supports. Pressure vessels that are known to have a remaining life of over ten years or that are prevented from being exposed to external corrosion (such as being installed in a cold box in which the atmosphere is purged with an inert gas, or by the temperature being maintained sufficiently

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low or sufficiently high to preclude the presence of water), need not have the insulation removed for the external inspection. However, the condition of the insulating system and/or the outer jacketing, such as the cold box shell, shall be observed periodically and repaired if necessary.

g) Interrupted Service

1) The periods for inspection referred to above assume that the pressure-retaining item is in continuous operation, interrupted only by normal shutdown intervals. If a pressure-retaining item is out of service for an extended interval, the effect of the environmental conditions during such an interval shall be considered.

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For an area affected by a general corrosion in which the circumferential stresses govern the MAWP, the least thicknesses along the most critical plane of such area may be averaged over a length not exceeding:

1) The lesser of one-half the pressure vessel diameter, or 20 in. (500 mm) for vessels with inside diameters of 60 in. (1.5 m) or less, or

2) The lesser of one-third the pressure vessel diameter, or 40 in. (1 m), for vessels with inside diameters greater than 60 in. (1.5 m), except that if the area contains an opening, the distance within which thicknesses may be averaged on either side of such opening shall not extend beyond the limits of reinforcement as defined in the applicable Section of the ASME Code for ASME Stamped vessels and for other vessels in their applicable codes of construction.

Move text to follow 4.4.8.7 "e"

i) Longitudinal Stresses
If because of wind loads or other factors the longitudinal stresses would be of importance, the least thicknesses in a length of arc in the most critical plane perpendicular to the axis of the pressure vessel may be averaged for computation of the longitudinal stresses. The thicknesses used for determining corrosion rates at the respective locations shall be the most critical value of average thickness. The potential for buckling shall also be considered.

j) Local Metal Loss
Corrosion pitting shall be evaluated in accordance with NBIC Part 2, 4.4.8.7. Widely scattered corrosion pits may be left in the pressure-retaining item in accordance with the following requirements:

1) Their depth is not more than one-half the required thickness of the pressure-retaining item wall (exclusive of corrosion allowance);

2) the total area of the pits does not exceed 7 sq. in. (4500 sq mm) within any 50 sq. inches (32000 sq. mm); and

3) the sum of their dimensions (depth and width) along any straight line within this area does not exceed 2 in. (50 mm).

k) Weld Joint Efficiency Factor
When the surface at a weld having a joint efficiency factor of other than one is corroded as well as surfaces remote from the weld, an independent calculation using the appropriate weld joint efficiency factor

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7) Dimensional verification checks;

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e) Techniques for evaluating fire damage are referenced in applicable standards. See NBIC Part 2, 1.3. A1

4.4.8.6 EVALUATING EXPOSURE OF PRESSURE-RETAINING ITEMS TO CYCLIC FATIGUE

a) A fatigue evaluation should be performed if a component is subject to cyclic operation. The allowable number of cycles (mechanical or thermal) at a given level of stress should be adequate for the specified duration of service to determine suitability for continued operation.

b) Data requirements and history information should be obtained as identified in NBIC Part 2, 4.4.5.

c) Techniques for evaluating fatigue are referenced in applicable standards. See NBIC Part 2, 1.3.

4.4.8.7 EVALUATING PRESSURE-RETAINING ITEMS CONTAINING LOCAL THIN AREAS

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2) Component is not operating in the creep range;

3) Material has sufficient toughness;

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7) Applied loads;

8) The range of temperature or pressure fluctuation.

b) Where appropriate, crack-like indications should be removed by blend/grinding, and evaluated as a local thin area.

c) Data requirements and history information should be obtained as identified in NBIC Part 2, 4.4.5.

d) Required measurements for evaluation of local thin areas shall include:

1) Thickness profiles within the local region;

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2) Flaw dimensions;

3) Flaw to major structural discontinuity spacing;

4) Vessel geometry;

5) Material properties.

e) Required measurements for evaluation of pitting corrosion shall include:

1) Depth of the pit;

2) Diameter of the pit;

3) Shape of the pit;

4) Uniformity.

reletter to "g"

f) Widely scattered corrosion pits may be left in the pressure-retaining item in accordance with the following requirements:
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3) the sum of their dimensions (depth and width) along any straight line within this area does not exceed 2 in. (50 mm).

f) If metal loss is less than specified corrosion/erosion allowance and adequate thickness is available for future corrosion, then monitoring techniques should be established. If metal loss is greater than specified corrosion/erosion allowance and repairs are not performed, a detailed engineering evaluation shall be performed to ensure continued safe operation.

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g) Techniques for evaluating local thin areas and pitting are referenced in applicable standards. See NBIC Part 2, 1.3.

4.5 RISK-BASED INSPECTION ASSESSMENT PROGRAMS

4.5.1 SCOPE

a) This Section describes the basic elements, principles, and guidelines of a risk-based inspection (RBI) program. This Section does not address any one method but is intended to clarify the elements associated with a RBI program. Risk assessment is a process to evaluate continued safe operation of a pressure-containing component. This process is based on sound engineering practices, proven risk assessment experience, and management principles. There are numerous risk-based assessment methods being applied throughout many industries. Details for developing and implementing risk-based inspection programs are defined in other referenced standards.

Implementation of a risk-based inspection (RBI) assessment program allows an owner-user to plan inspection frequencies based on assessing probability of failure (POF) and consequence of failure (COF) (risk = POF x COF). Risk assessment programs involve a team concept based on knowledge, training and experience between engineers, inspectors, operators, analysts, financial, maintenance, and management personnel. Appropriate and responsible decisions must be made from input by all team members to ensure safe operation of systems and their components. Organizational commitment and cooperation is required to successfully implement and maintain a RBI program.

4.5.2 DEFINITIONS

COF — Consequence of Failure. Outcome from a failure. There may be one or more outcomes from a single failure.