Conduct of Engineering
Request for Variance or Alternate Method

1.0 General

1.1 Document Number: VAR-10667	1.2 Revision: 0

1.3 Brief Descriptive Title: Tube Bending Guidance Deletion from ESM Chapter 6, D20 Rev. 6

1.4 Affected Program: Engineering Standards	1.5 Request Type: Variance
1.6a Affected Tech Area 99	1.6b Affected Buildings Sitewide

1.7 Requestor: Oruch, Tobin H   Organization: ES-FE Conduct of Engineering Office

1.8 Revision History

Revision Number   Changes and Comments

0   Initial issue.

2.0 Affected Conduct of Engineering Program/Documents

| 2.1 Affected "P" Document:

N/A

If against the P document itself, revision (or *N/A*):

N/A | 2.2 Subordinate or related document(s) [AP, master spec, LANL ESM chapter & section; or code, Order, standard, etc.]: Document Title/No.: Engineering Standards Manual STD-342-100, Chapter 6-Mechanical, Section D20, Plumbing/Piping/Vessels

Revision 6

Document Title/No.: Enter text..

Revision Enter text..

Document Title/No.: Enter text..

Revision Enter text.. |

2.3 Section/Paragraph: Enter text..

STD-342-100, ESM Ch 6, Section D20, D2090 Other Plumbing and Piping Systems (R&D, Prog, & FAC), 1.0, G

2.4 Specific Requirement(s) as Written in the Document(s):

Enter text..

G. Tube Bending[29]

1. When selecting tubing outside the scope of the UPC and UMC, design with accounting for pressure, erosion/corrosion, and ovality and wall thinning resulting from bending in the applicable ASME code. *Guidance: ASME B31.3 bending is addressed in ESM Chapter 17. Table D2090-2 can also be used to determine wall thinning for a given bend radius.*

[29] ASME B31.3

<div align="center">

Table D2090-2 [30]

</div>

Tubing OD (inch)	For Tube Bend ≤ 180⁰	Centerline Calculated Bend Radius (diameters)	Wall Thinning (%)
	Centerline Bend Radius (inch)		
1/8	5/16	2.5	17
1/4	9/16	2.25	18
1/4	5/8	2.5	17
1/4	3/4	3.0	14
5/16	25/32	2.5	17
5/16	15/16	3.0	14
3/8	15/16	2.5	17
1/2	1-1/4	2.5	17
1/2	1-1/2	3.0	14
5/8	1-9/16	2.5	17
3/4	1-7/8	2.5	17
1	2-1/2	2.5	17

[30] FWO Calculation Number: 00-00-CALC-M-0002.

2.5 Contractual, preference, or other basis for requirement in 2.4:

Contract: Integrated Safety Management per 10 CFR 851

2.6 Type of VAR from ESM Chap 1, Z10 [*Applies only to standards variances*)	2.7 Discipline
Type 2	Mechanical Pressure Safety (secondary)

3.0 Request Information & Comments

3.1 NCR required (work has occurred)?   No

   If Yes, NCR Number: Enter text.

3.2 System/Component Affected N/A OpSystem Acronym & Name [Select OpSysAcronymAndName] System Number or Name [Select SystemNumberOrName]	3.3 Highest ML Level ML-1

3.4 Proposal with Justification/Compensatory Measures:

Background/Justification:

LANL calculation 00-00-CALC-M-0002-R0 (Attachment 1) was signed 4/29/2002 and released 6/29/2002.

There was no allowance for pipe bending in the ASME B31.3 1999-code edition (see paragraph 304.2.1) or in the ASME B31.9 1998-code edition (see paragraph 904.2.1) (refer to Attachment 2).

This calculation did not meet the ASME B31.3-1999-code edition or the ASME B31.9 1982-code edition because pipe bends were required to meet the straight pipe requirements (Attachment 2).

The ASME B31.3 2002-code edition was modified to contain prescriptive methods to calculate wall thickness of piping bends, but the calculation does not meet the revised paragraph 304.2.1.

Calculation 00-00-CALC-M-0002-R0 was not compliant with the ASME B31.3 or B31.9 when it was issued and it should be removed from the ESM Chapter 6.

Compensatory Measures:

Edit the text of paragraph 1.0.G and remove Table D2090-2 in ESM Ch 6, Section D20, D2090.

G. Tube Bending[29]
1. When selecting tubing outside the scope of the UPC and UMC, design with accounting for pressure, erosion/corrosion, and ovality and wall thinning resulting from bending in the applicable ASME code. Guidance: ASME B31.3 pipe bends is addressed in ESM Chapter 17, PS-REQUIREMENTS, 8.8.B. ~~Table D2090-2 can also be used to determine wall thinning for a given bend radius.~~

[29] ~~ASME B31.3~~

~~Table D2090-2~~ [30]

	For Tube Bend ≤180⁰		
~~Tubing OD (inch)~~	~~Centerline Bend Radius (inch)~~	~~Centerline Calculated Bend Radius (diameters)~~	~~Wall Thinning (%)~~
~~1/8~~	~~5/16~~	~~2.5~~	~~17~~
~~1/4~~	~~9/16~~	~~2.25~~	~~18~~
~~1/4~~	~~5/8~~	~~2.5~~	~~17~~
~~1/4~~	~~3/4~~	~~3.0~~	~~14~~
~~5/16~~	~~25/32~~	~~2.5~~	~~17~~
~~5/16~~	~~15/16~~	~~3.0~~	~~14~~
~~3/8~~	~~15/16~~	~~2.5~~	~~17~~
~~1/2~~	~~1-1/4~~	~~2.5~~	~~17~~
~~1/2~~	~~1-1/2~~	~~3.0~~	~~14~~
~~5/8~~	~~1-9/16~~	~~2.5~~	~~17~~
~~3/4~~	~~1-7/8~~	~~2.5~~	~~17~~
~~1~~	~~2-1/2~~	~~2.5~~	~~17~~

Table D2090-2 heading: Wall Thinning when Bending Tubing

[30] ~~FWO Calculation Number: 00-00-CALC-M-0002.~~

3.5 Attachments
 Attachment 1: 00-00-CALC-M-0002-R0
 Attachment 2: ASME B31.9 and B31.3 Code Citations

3.6a Project ID N/A	3.6b: Project Name N/A	3.6c: Code of Record Date B31.3 1999 and later editions or B31.9 1982 and later editions

3.7 Duration: Lifetime	3.8a If Finite Period, Start Date: Click to enter a date.	3.8b End Date: Click to enter a date

3.8c Provide the PFITS number for tracking removal/correction: [PFITSNum]

3.9 USQD/USID required (Nuclear, High/Mod Hazard)? Yes

   If Yes, USQD/USID Number   PF400-24-1415, WCRR-24-1414, RANT-24-1413, TWF-24-1412, RLW-24-1411, CMR-24-1410, TA55-24-1408

3.10 QA Review for process change matters potentially affecting LANL's NQA-1 implementation

   Is a QPA Determination required?: No   If **Yes**, then: Choose an item.
   QPA Comments: Enter text..

3.11 POC Determination: Accept
        POC Comments: Enter text..

3.12 Management Program Owner's (SMPO) Approval for P341 and APs; P342, ESM, ML-1 and -2, and Contract Matters; and P343

SMPO Determination: Accept
   Comments: Enter text..

4.0 Participant Signatures   <u>NOTE</u>: *DO NOT ADD NAMES FROM WITHIN WORD! <u>Save and close the form first</u>, then do 1-4 below:*
1. *From the SharePoint library, select the document, then click the **ellipsis (...)** in the second column; a small dialog appears*
2. *In the small dialog click the **ellipsis** again*
3. *Click **Edit Properties** and check out the document if prompted toEnter names using the controls provided, then **Save***

4.1 POC (Management Program Owner's Representative): Ladach, Michael J	Organization ES-WPD	Signature
4.2 Facility Design Authority Representative [FDARName] FDAR signature not required ☒	Organization Enter text..	Signature
4.3 LANL Owning Manager (FOD or R&D/Program) [FODorPrgmMgrName] FOD or Program Manager signature not required ☒	Organization Enter text..	Signature

Form 2137: VAR-10667, Page 4

4.4 Quality Reviewer's Name: [QPAName] QPA review/signature not required ☒	Organization Enter text.	Signature
4.5 Safety or Security Management Program Owner's Approval for P341 and APs; P342, ESM and Contract Matters; and P343 Richardson, Michael Joseph SMPO signature not required (Type 1 variance) ☐	Organization ES-DO	Signature
4.6 Additional Signer 1 Swartz, Ari Ben Role: ESM Chapter 17 POC	Organization ES-OPS	Signature
4.7 Additional Signer 2 [AdditionalSigner2] Role: Enter text.	Organization Enter text.	Signature

4.8 CoE Administrator Signature Leyba, Matthew Anthony NOTE: The CoE Admin is always the last signature placed on this document. The date of that signing is the date of this document.	Signature