SRV Related Guidance

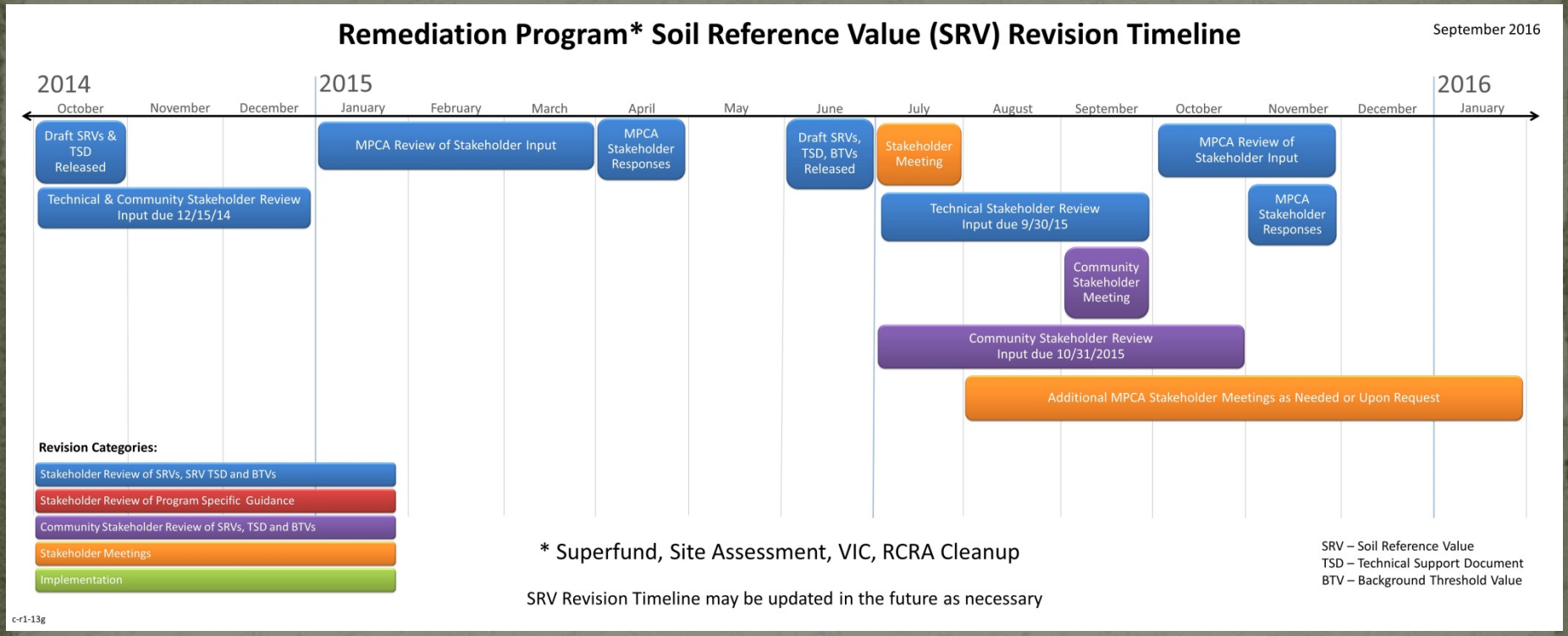
Dakota Lodge

October 31, 2016

PUG, SIG & SRV Work Groups

Minnesota Pollution Control Agency

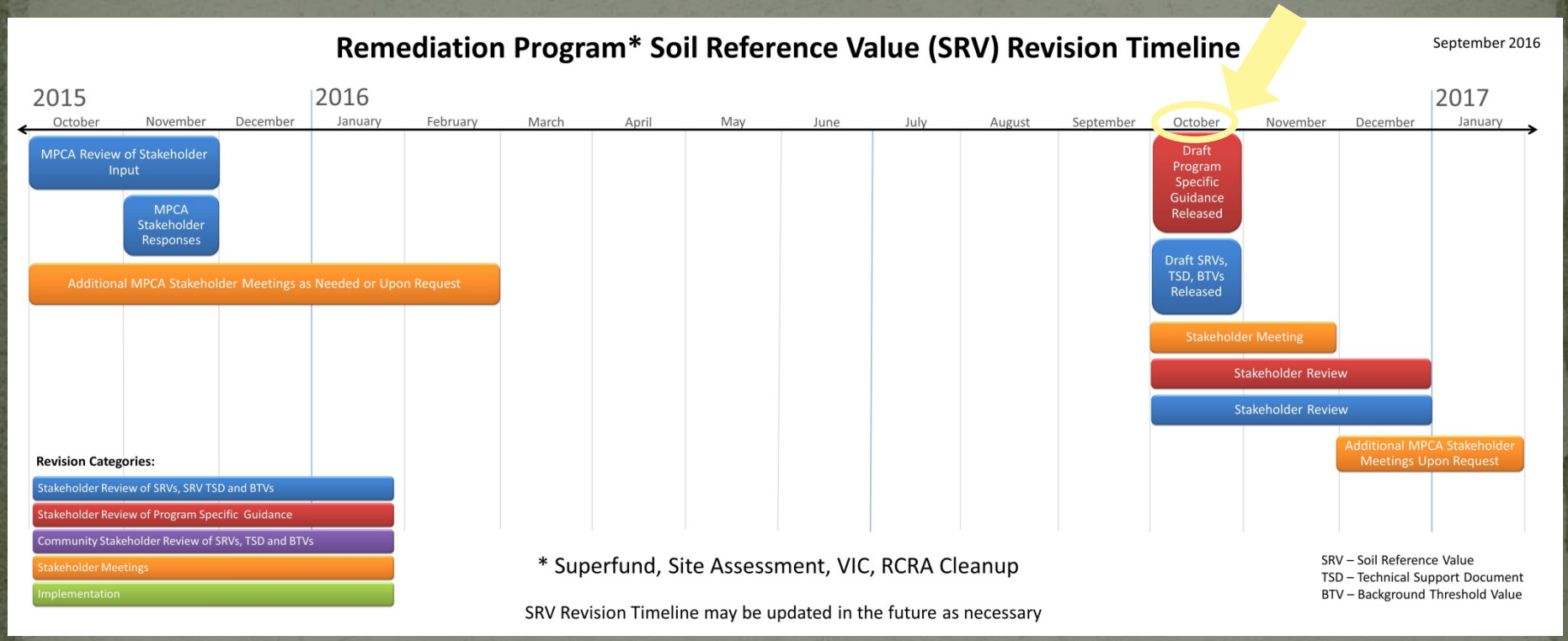
SRV Revision Timeline



Please submit input by December 2

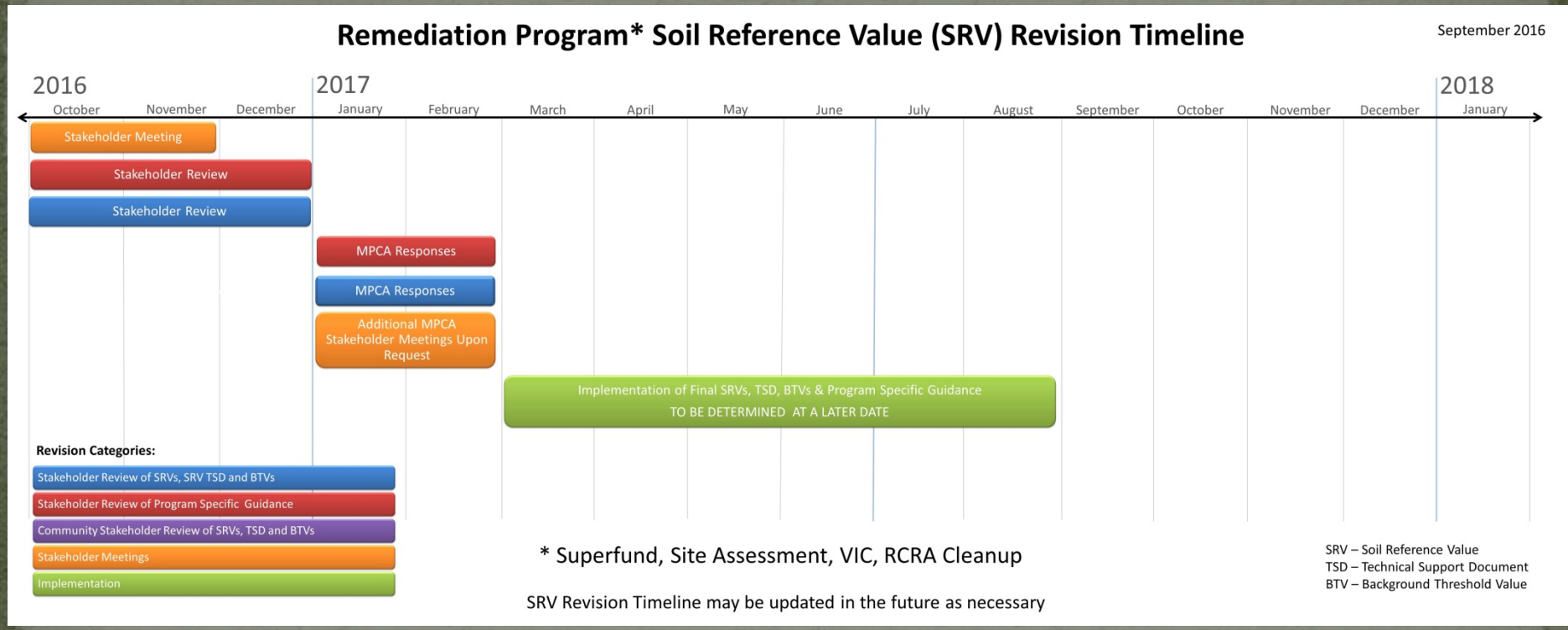
SRVcomments.pca@state.mn.us.

SRV Revision Timeline



Please submit input by December 2 SRVcomments.pca@state.mn.us.

SRV Revision Timeline



Please submit input by December 2
SRVcomments.pca@state.mn.us.

PUG, SIG & SRV Work Group Staff

- Authors
  - John Betcher
  - Bonnie Brooks
  - Mark Elliot
  - Tim Grape
  - Lynne Grigor
  - Jennifer Jevnisek
  - Gary Krueger
- Reviewers
  - Barb Gnabasik
  - Amy Hadiaris
  - Mark Otsby
  - David Stellmach
  - MPCA Remediation Staff

SRV Related Documents

SRV Technical Support Document (TSD)
How SRVs were derived and intended use

Background Threshold Value (BTV) Evaluation
How BTVs were derived and intended use

SRV Spreadsheet
Any site in Minnesota

SRV Spreadsheet - Site Specific
Site Specific SRVs

Property Use Guidance (PUG)
Land use considerations for VIC, Superfund, RCRA programs

Soil Investigation Guidance (SIG)
(SRV Range of Risk Spreadsheet)
Soil Investigation process for VIC, Superfund, RCRA programs

SRV Spreadsheets

SRV Spreadsheet

- VOC definition change – consistent with EPA and ISVs
  - New Definition
    - Henry's Law Constant greater than 1E-05 atm-m^3/mole
      OR
    - Vapor pressure greater than 1 mm Hg
  - Previous Definition
    - Henry's Law Constant greater than 1E-05 atm-m^3/mole
      AND
    - Molecular weight less than 200 g/mole
  - Listed on "Comparison" tab of SRV Spreadsheet
- TCDD & BaP equivalent tab
  - Additional columns for multiple samples
  - Incorporate use of the Kaplan Meier method

Soil Investigation Guidance (SIG)

Scope of SIG

- Human Health Only
  - Does NOT include ecological
- Soil Only
  - Does NOT include other media
  - Does NOT include Soil leaching (SLVs)
- Provides useful information that can be used to conduct a human health SOIL investigation which is only part of the SITE Investigation
- Is NOT intended to replace VIC, RCRA or Superfund SITE investigation guidance

Scope of SIG

- Subjects covered
  - Soil contaminants
  - Soil exposure pathways
  - Potential human receptors
  - Field screening
  - Soil sampling
  - Risk characterization
  - Soil reference values (SRVs)
  - Risk management options
  - Site specific background
  - Site specific risk assessments

Scope of SIG

- Section 1 – Introduction
  - 1 page overview of what is and is NOT included
  - Breaks down SOIL investigation into 4 parts
    - Background investigation
    - Initial soil investigation
    - Remedial soil investigation
    - Site specific risk assessment
  - Important to differentiate that this document only pertains to the SOIL portion of the SITE investigation
  - Difficult to separate the SOIL and SITE investigation at times
  - High level overview of investigation process since guidance will be used by multiple programs

SIG Sections

- Section 2 – Soil Investigation
  - High level overview – NOT intended to be comprehensive
  - Includes the following SOIL investigations
    - Background investigation
    - Initial soil investigation
    - Remedial soil investigation
    - (Site specific risk assessment is included in a later section)
  - Table provides more details regarding what the SITE investigation phases are referred to in each program
    - No additional detail is provided regarding differences in specific program SITE investigations
    - Guidance pertains only to items that will be useful for the SOIL investigation

SIG Sections

- Section 2 – Soil Investigation
  - (Table inside text)

MPCA program soil investigation approaches

Soil investigation phases	VIC/Brownfields	RCRA	Superfund
Information investigation	Phase I ESA	Preliminary review and visual site inspection components of RCRA Facility Assessment (RFA)	Preliminary assessment (PA)
Initial soil investigation	Phase II ESA, and/or limited site investigation	Sampling visit component of RFA	Site inspection or site investigation (SI)
Remedial soil investigation	Phase II ESA, site investigation	RCRA facility investigation (RFI)	Remedial investigation (RI)

SIG Sections

- Section 2 – Soil Investigation
  - Table - contaminants found at different types of sites

Site type	VOCs	SVOCs	PAHs	Fuels (GRO, DRO, Fuel Oil, TPH)	Pesticides	Metals and metalloids	Cyanide	PCBs	PCP	Selenium/Molybdenum	Explosives/Propellant	Dioxin/Furans	Asbestos
Agricultural *	Please contact the Minnesota Department of Agriculture												
Adhesives	x	x	x			x							
Ash and slag disposal			x			x						x	
Asphalt plant, disposal			x					x					
Autobody shop	x	x		x		x							
Aviation and aerospace mfg	x	x		x		x							
Battery recycling and disposal						x							
Cement plants	x		x			x		x					x
Ceramics works						x							x
Chemical and dye manufacturing/recycling	x	x				x		x					
Chlor-Alkali manufacturing	x	x				x							

SIG Sections

- Section 3 – Field Screening
  - Field screening methods with brief description
  - Table - Advantages and disadvantages

Screening method	Contaminant	Method advantages	Method limitations
PID/FID (organic vapor screening analysis)	VOCs	Rapid and inexpensive Useful to focus sampling High concentrations of VOCs (>1000 ppm vapor) may suggest NAPL presence	Readings sensitive to effective contaminant volatility, water content, sample temperature, and sample handling Some units can be bulky and heavy Not sensitive enough to obtain conclusive results for chlorinated VOCs present at low levels

SIG Sections

- Section 4 – Soil Sampling
  - Soil sample collection tools - Table

Tool	Advantages	Disadvantages	Comments
Hand auger	Allows sampling in shallow sub-surface areas difficult to access Allows safer shallow sub-surface sampling in areas with buried utilities	Limited sampling depths Difficult to penetrate hard materials Sample may be disrupted and aerated	
Hand scoop, trowel or shovel	Easy to acquire large sample volume from surface layer or exposed sampling horizon Quick, uncomplicated; does not require expensive equipment or trained operators Allows access to remote, small, crowded areas	Difficult to obtain deeper subsurface samples	Used to sample surface soil
Subcoring samplers	Allows collection of headspace-free samples for VOC analyses from exposed surfaces or cores Targets discrete layers for sampling	Samples limited to discrete layer with limited volume Biased sample selection may not be representative of entire target interval Difficult to obtain samples in hard soil or when rocks and debris are present	Used to sample soil from ground, split-spoon, or soil pile Some vendors offer efficient systems for collection and storage of samples Soil may be easily extruded into sample containers

  - Soil sample collection methods
  - Sampling design

SIG Sections

- Section 5 – Using Soil Reference Values
  - Data presentation
  - Non-detect data
    - Kaplan Meier method in ProUCL
  - Exposure concentration
    - Point – acute risks
    - Area – chronic, subchronic, short-term
  - Risk characterization
    - How to use SRV spreadsheet (applicable to all sites)
      - Acute SRV compared to maximum
      - Chronic or cancer SRV compared to 95 UCL of mean
      - Background Threshold Value (BTV) compared to maximum
  - Uncertainty

SIG Sections

- Section 6 – Additional Soil Considerations
  - Applicable to sites being redeveloped
  - Potential to re-use soil onsite in ways that will eliminate any potential human health risk pathway
    - Decrease in amount of soil that needs to be removed

SIG Sections

- Section 7 – Site Specific Background
  - Steps to evaluate background beyond comparison of Background Threshold Value (BTV) to maximum
    - Site dataset vs. statewide applicable BTV
      - Graphical displays
      - Proportions Test
    - Site dataset vs. background dataset
      - Entire site dataset vs. entire background dataset
        - Graphical displays
        - Student's t-Test
        - Wilcoxon-Mann-Whitney Test
        - Gehan Test
        - Tarone-Ware Test
      - Entire site dataset vs. site specific BTV
        - Graphical displays
        - Proportions Test

SIG Sections

- Section 7 – Site Specific Background
  - Proportions Test
    - EPA ProUCL
    - Determines if a specific percentage of samples exceeds the Background Threshold Value (BTV) or site specific BTV
    - Allowable percentage is of exceedance is 5%
  - "Results from the hypothesis test alone are not intended to indicate that the site dataset is or is not representative of background. The results are intended to provide an additional line of evidence that is used along with other site information to arrive at a reasonable site specific decision."

SIG Sections

- Section 8 – Site Specific Risk Assessment
  - Begins with parts of some sections repeated from Section 5 to make stand alone section but some is new information also
    - May be confusing to user to point them to earlier sections then need to figure out a way to point them back
  - Establishing site specific cleanup values – 2 options
    - Site specific SRVs
    - Range of potential chronic SRVs (range of potential risk)
      - Use this information to determine cleanup values
  - Provides instructions regarding use of the SRV Spreadsheet – Site Specific

SIG Sections

- Section 8 – Site Specific Risk Assessment
  - Table – Allowable SRV parameter modifications

Parameter	Res/Rec-Single Family Home Modification Allowed	Res/Rec-MFH - Multi Family Housing [1] Modification Allowed	Res/Rec-MFH Other [2] Modification Allowed	Res/Rec-Recreational Modification Allowed	Com/Ind Modification Allowed	Approval Required [3]	Modification Can Be Made in Site Specific SRV Spreadsheet	Modification Requires Modified SRV Spreadsheet from MPCA Risk Assessor	Appropriate Purpose of Modification
Acute noncancer SRV									
Toxicity Value	X	X	X	X	NA	X		X	Value is more appropriate to use with different species of chemical present
Ingestion Rate	X	X	X	X	NA	X	X		Present a range of potential risks based on appropriate central and upper percentile estimates
Cancer and chronic noncancer SRVs									
Excess Lifetime Cancer Risk (ELCR)	X	X	X	X	X	X	X		Present a range of potential risks based on ELCR's from 1E-06 to 1E-04
Hazard Quotient (HQ)	X	X	X	X	X	X	X		Present a range of potential risks based on HQ's from 0.2 to 1

SIG Sections

- Section 8 – Site Specific Risk Assessment
  - "SRV Range of Risk" spreadsheet
    - Display different SRVs used in a site specific risk assessment
    - Residential, Recreational, Industrial

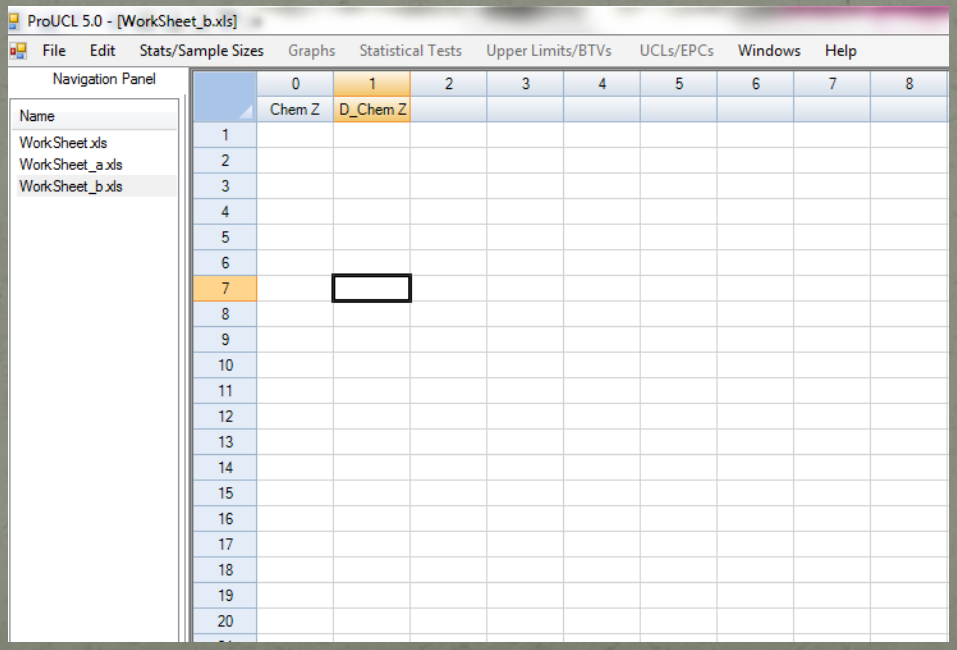
Soil Reference Value (SRV) Modifications	Noncancer Risk [1] DEFAULT 0.2	Noncancer Risk [1] MODIFIED 0.5	Cancer Risk [2] DEFAULT 1E-05	Cancer Risk [2] MODIFIED 1E-04	Exposure Frequency days/year RME [3] DEFAULT 250/350 days/year	Exposure Frequency days/year CTE [4] MODIFIED 190/290 days/year	Exposure Duration years RME [5] DEFAULT 26 years	Exposure Duration years CTE [6] MODIFIED 12 years	Ingestion Rate DEFAULT RME [7] DEFAULT 100 adult 200 child mg/day	Ingestion Rate MODIFIED CTE [8] MODIFIED 50 adult 100 child mg/day
NO Modifications- Provided For Comparison Purposes										
2016 SRV	X		X		X		X		X	
2016 BTV	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Exposure Frequency Modification										
SRV M1	X		X			X	X		X	
Exposure Duration Modification										
SRV M2	X		X		X			X	X	
Ingestion Rate Modification										
SRV M3	X		X		X		X			X
Vegetative Cover Modification										
SRV M4	X		X		X		X		X	
Exposure Frequency, Exposure Duration Modifications										
SRV M5	X		X			X		X	X	

SIG Sections

- Appendix A – Calculating 95 UCL of the Mean
  - Instructions for calculating 95 UCL of mean in EPA's ProUCL including screen shots

· If your data contains non-detect values, name the second column with the same name as the first column with a "D_" attached to the beginning.

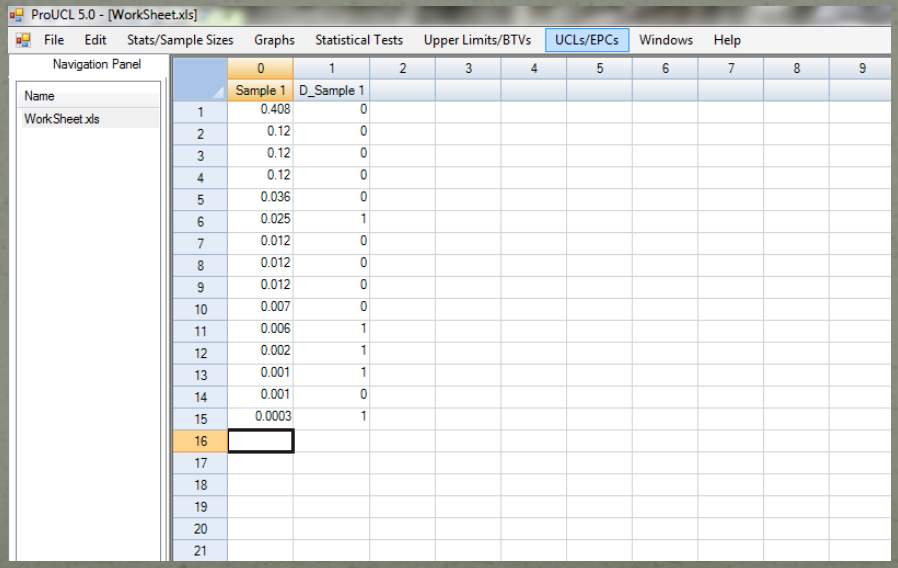
o If your data does NOT contain any nondetect values, do NOT name the second column.



SIG Sections

- Appendix B - Calculating TCDD and B[a]P Equivalents
  - Instructions for using Kaplan Meier method to calculate TCDD and B[a]P equivalent concentration in EPA's ProUCL including screen shots

1. Repeat this procedure for each additional sample listed in the "SRV Spreadsheet" using additional columns across the spreadsheet (ex. "Sample 2" would be entered into columns 2 and 3 in the ProUCL spreadsheet)



Property Use Guidance (PUG)

PUG Overview

- Revision of Existing Property Use Guidance from 1990s
  - New Emphasis on Risk Management Responsibilities
  - Expanded Information on Notifications and Institutional Controls
- No Changes in Current Policies or Approach
  - Exception is Developing Soil Vapor Policy
- Compatible with draft SRV Technical Support Document and draft Soil Investigation Guidance
- General Overview of Approach, not Site-Specific Requirements

PUG Sections

- Current, Planned and Future Land Use
- Conducting Investigations
  - Responsible Party and Non-responsible Party Considerations for Investigation Extent
- Determining Response Actions
  - Complete Cleanup
  - Risk Management and Future Responsibilities
- Accessibility Zones

PUG Sections

- Notifications and Institutional Controls, Easements and Access Agreements
  - Use, Content and Legal Descriptions
  - Typical Use Related to Standards and Criteria in Attachments and Figures
- Land Use Categories and Risk Management
  - SRV Technical Support Document Land Use Categories
  - Detailed Description of Land Use Categories in Relation to Risk Management
- Other Considerations
  - Special Wastes, Solid Wastes, Soil Maintenance Zones

PUG Attachments and Figures

- Attachments by Land Use Category
- Notifications and Institutional Controls
  - Use overview statement
  - Standards and Criteria
  - Matching Figures with Standards and Criteria, and Soil Maintenance Zones
- Easement or Access Agreement Statement
- Government Agency Designated Areas of Concern
- Use as Generalizations, Not Site-Specific Requirements

SRV Related Guidance

Break

Minnesota Pollution Control Agency

Site Specific SRVs

Site Specific SRVs

- Tools provided
  - Site specific SRV parameter modifications table
    - Table B-1 in SRV Technical Support Document
    - Table 4 in Soil Investigation Document
    - Lists allowable parameter modifications
  - SRV Spreadsheet – Site Specific
    - Calculates SRVs based on user entered modifications
  - SRV range of risks spreadsheet
    - Use to display SRVs based on different modifications
  - Soil Investigation Guidance
    - Instructions in Section 8.0
  - All available on MPCA's Remediation website
    - https://www.pca.state.mn.us/waste/risk-based-site-evaluation-guidance

Site Specific SRVs

- Site Specific SRV parameter modifications table
  - Lists allowable parameter modifications (SIG Table 4)

Parameter	Res/Rec-Single Family Home Modification Allowed	Res/Rec-MFH - Multi Family Housing [1] Modification Allowed	Res/Rec-MFH Other [2] Modification Allowed	Res/Rec-Recreational Modification Allowed	Com/Ind Modification Allowed	Approval Required [3]	Modification Can Be Made in Site Specific SRV Spreadsheet	Modification Requires Modified SRV Spreadsheet from MPCA Risk Assessor	Appropriate Purpose of Modification
Acute noncancer SRV									
Toxicity Value	X	X	X	X	NA	X		X	Value is more appropriate to use with different species of chemical present
Ingestion Rate	X	X	X	X	NA	X	X		Present a range of potential risks based on appropriate central and upper percentile estimates
Cancer and chronic noncancer SRVs									
Excess Lifetime Cancer Risk (ELCR)	X	X	X	X	X	X	X		Present a range of potential risks based on ELCR's from 1E-06 to 1E-04
Hazard Quotient (HQ)	X	X	X	X	X	X	X		Present a range of potential risks based on HQ's from 0.2 to 1

Site Specific SRVs

- SRV Spreadsheet – Site Specific
  - Calculates SRV based on user entered modifications

Residential/Recreational SRVs (mg/kg)

Equation 1. Residential/Recreational Cancer Soil Reference Value (SRV) Without ADAFs

$$SRV = \frac{CR * AT}{\left[CSF * RBA * EFing * CF * \left(\frac{EDi * IRi}{BWi}\right) + \left(\frac{EDc * IRc}{BWc}\right) + \left(\frac{EDa * IRa}{BWa}\right)\right] + \left[\frac{CSF}{ABSgi} * EFder * ABSd * CF * \left(\frac{EDi * AFi * SAi}{BWi}\right) + \left(\frac{EDc * AFc * SAc}{BWc}\right) + \left(\frac{EDa * AFa * SAa}{BWa}\right)\right] + \left[EFinh * CF2 * ED * IUR * \left(\frac{1}{PF} + \frac{1}{VF}\right)\right]}$$

Exposure Parameter	Value	Units	Reference
CR-Cancer Risk	1.0E-05	none	MPCA Cancer Risk
AT-Averaging Time	25550	days	70 * 365 days/year
CSF-Cancer Slope Factor	Chemical Specific	(mg/kg-day)-1	Refer to "Chemical Info" worksheet
RBA-Relative Bioavailability [1]	Chemical Specific	none	Refer to "Chemical Info" worksheet
EFing-Exposure Frequency Ingestion - **Non VOCs**	350	days/year	EPA 2014, MPCA 2015
EFing-Exposure Frequency Ingestion - **VOCs**	250	days/year	EPA 2014, MPCA 2015
EFder-Exposure Frequency Dermal	250	days/year	EPA 2014, MPCA 2015
EFinh-Exposure Frequency Inhalation	250	days/year	EPA 2014, MPCA 2015
CF-Conversion Factor	1.00E-06	mg/kg	None
CF2-Conversion Factor	1.00E+03	µg/kg	None
ED-Exposure Duration (Total)	26	years	EPA 2014
EDi-Exposure Duration (0-2 years)	2	years	EPA 2002, EPA 2005, MDH 2010
EDc-Exposure Duration (2-16 years)	14	years	EPA 2002, EPA 2005, MDH 2010
EDa-Exposure Duration (16-26 years)	10	years	EPA 2002, EPA 2005, MDH 2010
IRi-Ingestion Rate (0-2 years)	200	mg/day	EPA 2014
IRc-Ingestion Rate (2-16 years)	200	mg/day	EPA 2014
IRa-Ingestion Rate (16-26 years)	100	mg/day	EPA 2014

Site Specific SRVs

- SRV Range of Risks Spreadsheet
  - Used to display SRVs based on different modifications

Soil Reference Value (SRV) Modifications	Noncancer Risk [1] DEFAULT 0.2	Noncancer Risk [1] MODIFIED 0.5	Cancer Risk [2] DEFAULT 1E-05	Cancer Risk [2] MODIFIED 1E-04	Exposure Frequency days/year RME [3] DEFAULT 250/350 days/year	Exposure Frequency days/year CTE [4] MODIFIED 190/290 days/year	Exposure Duration years RME [5] DEFAULT 26 years	Exposure Duration years CTE [6] MODIFIED 12 years	Ingestion Rate DEFAULT RME [7] DEFAULT 100 adult 200 child mg/day	Ingestion Rate MODIFIED CTE [8] MODIFIED 50 adult 100 child mg/day
NO Modifications- Provided For Comparison Purposes										
2016 SRV	X		X		X		X		X	
2016 BTV	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Exposure Frequency Modification										
SRV M1	X		X			X	X		X	
Exposure Duration Modification										
SRV M2	X		X		X			X	X	
Ingestion Rate Modification										
SRV M3	X		X		X		X			X
Vegetative Cover Modification										
SRV M4	X		X		X		X		X	
Exposure Frequency, Exposure Duration Modifications										
SRV M5	X		X			X		X	X	

Site Specific SRVs

- Soil Investigation Guidance
  - Instructions in Section 8.0

8.8.1.2 Characterizing chronic risks

An exposure area concentration (averaged over the entire exposure area) is used to evaluate chronic risks. The 95% upper confidence level (95 UCL) of the mean of the contaminants discrete samples should be compared to the LUC chronic SRV or site specific cleanup value. If the 95 UCL is greater than the maximum concentration too few samples may have been obtained. In this case, if additional samples are not an option, the maximum concentration should be used. Other cases where the maximum concentration should be used are: when comparing to a BTV, using composite or incremental samples or when there is not enough data to calculate a 95 UCL of the mean (less than 8 samples). This evaluation is accomplished by using the SRV spreadsheet – Site specific can be used to establish site specific acute cleanup values as follows in one of two ways:

- Derive a **site specific chronic SRV** based on modification of the allowed parameters.
  - Use the site specific chronic SRV as the site specific chronic cleanup value.
- Derive multiple site specific chronic SRVs using different modifications of the allowed parameters to show a **range of potential chronic SRVs** (a range of potential risks based on comparison to the site exposure concentration to the different chronic SRVs).
  - Establish an appropriate site specific chronic cleanup value using that information combined with site specific information regarding the site scenario.

Allowed modifications to chronic SRV parameters are listed in Table 4. This table presents when a specific modification is allowed under a LUC, when MPCA approval is necessary, whether the change may be made in the spreadsheet or if it requires a MPCA risk assessor to make the change and the appropriate use of the modification. There are many parameters that can be modified for chronic SRVs. The SRV Range of Risks Spreadsheet should be used to display the different SRVs so they can be easily

Site Specific SRVs

- Example
  - Recreational site - benzo[a]pyrene (BaP)
    - Surrounded by business and commercial property
    - Paved trails surrounded by thick woods and vegetation
    - NO bare soil
    - No child play areas (playgrounds, ball fields, etc.)
    - Soil is NOT disturbed during recreational activities
    - Maintenance and utility work accomplished using appropriate precautions
  - BaP background threshold value (BTV) = 1 mg/kg
  - Two options
    - **Calculate site specific SRV**
    - Use a range of risks to establish cleanup value

Site Specific SRVs

- Recreational site – Benzo[a]pyrene
  - SRV Range of Risks Spreadsheet
    - "Res-Rec – Recreational" tab

Soil Reference Value (SRV) Modifications	Noncancer Risk [1] DEFAULT 0.2	Noncancer Risk [1] MODIFIED 0.5	Cancer Risk [2] DEFAULT 1E-05	Cancer Risk [2] MODIFIED 1E-04	Exposure Frequency days/year RME [3] DEFAULT 250/350 days/year	Exposure Frequency days/year CTE [4] MODIFIED INSERT HERE [11] days/year	Exposure Duration years RME [5] DEFAULT 26 years	Exposure Duration years CTE [6] MODIFIED INSERT HERE [11] years	Ingestion Rate DEFAULT RME [7] DEFUALT 100 adult 200 child mg/day	Ingestion Rate MODIFIED CTE [8] MODIFIED 50 adult 100 child mg/day	Vegetative Cover percentage RME [9] DEFAULT 50%	Vegetative Cover percentage CTE [10] MODIFIED INSERT HERE [11] %	Modified Residential/ Recreational SRV mg/kg	Basis (Choose Cancer or Noncancer)
NO Modifications- Provided For Comparison Purposes														
2016 SRV	X		X		X		X		X		X			
2016 BTV	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				Background
Exposure Frequency Modification														
SRV M1	X		X			X	X		X		X			
Exposure Duration Modification														
SRV M2	X		X		X			X	X		X			
Ingestion Rate Modification														
SRV M3	X		X		X		X			X	X			
Vegetative Cover Modification														

Site Specific SRVs

- Recreational site – Benzo[a]pyrene
  - SRV Range of Risks Spreadsheet
    - "Res-Rec – Recreational" tab

Soil Reference Value (SRV) Modifications	Noncancer Risk [1] DEFAULT 0.2	Noncancer Risk [1] MODIFIED 0.5	Cancer Risk [2] DEFAULT 1E-05	Cancer Risk [2] MODIFIED 1E-04	Exposure Frequency days/year RME [3] DEFAULT 250/350 days/year	Exposure Frequency days/year CTE [4] MODIFIED 144 days/year	Exposure Duration years RME [5] DEFAULT 26 years	Exposure Duration years CTE [6] MODIFIED INSERT HERE [11] years	Ingestion Rate DEFAULT RME [7] DEFUALT 100 adult 200 child mg/day	Ingestion Rate MODIFIED CTE [8] MODIFIED 50 adult 100 child mg/day	Vegetative Cover percentage RME [9] DEFAULT 50%	Vegetative Cover percentage CTE [10] MODIFIED INSERT HERE [11] %	Modified Residential/ Recreational SRV mg/kg	Basis (Choose Cancer or Noncancer)
NO Modifications- Provided For Comparison Purposes														
2016 SRV	X		X		X		X		X		X			
2016 BTV	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				Background
Exposure Frequency Modification														
SRV M1	X		X			X	X		X		X			
Exposure Duration Modification														
SRV M2	X		X		X			X	X		X			
Ingestion Rate Modification														
SRV M3	X		X		X		X			X	X			
Vegetative Cover Modification														

  - Exposure frequency of 4 days/week
  - Only exposed outdoor, no indoor exposure
  - Modify parameters in SRV spreadsheet- Site Specific

Site Specific SRVs

- Recreational site – Benzo[a]pyrene
  - Open SRV Spreadsheet – Site Specific
    - "Res-Rec Equations" tab
    - Modify all exposure frequency parameters to 144

Residential/Recreational SRVs (mg/kg)

Equation 1. Residential/Recreational Cancer Soil Reference Value (SRV) Without ADAFs

$$SRV = \frac{CR * AT}{\left[CSF * RBA * EFing * CF * \left(\frac{EDi * IRi}{BWi}\right) + \left(\frac{EDc * IRc}{BWc}\right) + \left(\frac{EDa * IRa}{BWa}\right)\right] + \left[\frac{CSF}{ABSgi} * EFder * ABSd * CF * \left(\frac{EDi * AFi * SAi}{BWi}\right) + \left(\frac{EDc * AFc * SAc}{BWc}\right) + \left(\frac{EDa * AFa * SAa}{BWa}\right)\right] + \left[EFinh * CF2 * ED * IUR * \left(\frac{1}{PF} + \frac{1}{VF}\right)\right]}$$

Exposure Parameter	Value	Units	Reference
CR-Cancer Risk	1.0E-05	none	MPCA Cancer Risk
AT-Averaging Time	25550	days	70 * 365 days/year
CSF-Cancer Slope Factor	Chemical Specific	(mg/kg-day)-1	Refer to "Chemical Info" worksheet
RBA-Relative Bioavailability [1]	Chemical Specific	none	Refer to "Chemical Info" worksheet
EFing-Exposure Frequency Ingestion - **Non VOCs**	350	days/year	EPA 2014, MPCA 2015
EFing-Exposure Frequency Ingestion - **VOCs**	250	days/year	EPA 2014, MPCA 2015
EFder-Exposure Frequency Dermal	250	days/year	EPA 2014, MPCA 2015
EFinh-Exposure Frequency Inhalation	250	days/year	EPA 2014, MPCA 2015
CF-Conversion Factor	1.00E-06	mg/kg	None
CF2-Conversion Factor	1.00E+03	µg/kg	None

Site Specific SRVs

- Recreational site – Benzo[a]pyrene
  - Open SRV Spreadsheet – Site Specific
    - "Res-Rec Equations" tab
    - Modify all exposure frequency parameters to 144

Residential/Recreational SRVs (mg/kg)

Equation 1. Residential/Recreational Cancer Soil Reference Value (SRV) Without ADAFs

$$SRV = \frac{CR * AT}{\left[CSF * RBA * EFing * CF * \left(\frac{EDi * IRi}{BWi}\right) + \left(\frac{EDc * IRc}{BWc}\right) + \left(\frac{EDa * IRa}{BWa}\right)\right] + \left[\frac{CSF}{ABSgi} * EFder * ABSd * CF * \left(\frac{EDi * AFi * SAi}{BWi}\right) + \left(\frac{EDc * AFc * SAc}{BWc}\right) + \left(\frac{EDa * AFa * SAa}{BWa}\right)\right] + \left[EFinh * CF2 * ED * IUR * \left(\frac{1}{PF} + \frac{1}{VF}\right)\right]}$$

Exposure Parameter	Value	Units	Reference
CR-Cancer Risk	1.0E-05	none	MPCA Cancer Risk
AT-Averaging Time	25550	days	70 * 365 days/year
CSF-Cancer Slope Factor	Chemical Specific	(mg/kg-day)-1	Refer to "Chemical Info" worksheet
RBA-Relative Bioavailability [1]	Chemical Specific	none	Refer to "Chemical Info" worksheet
EFing-Exposure Frequency Ingestion - **Non VOCs**	144	days/year	EPA 2014, MPCA 2015
EFing-Exposure Frequency Ingestion - **VOCs**	144	days/year	EPA 2014, MPCA 2015
EFder-Exposure Frequency Dermal	144	days/year	EPA 2014, MPCA 2015
EFinh-Exposure Frequency Inhalation	144	days/year	EPA 2014, MPCA 2015
CF-Conversion Factor	1.00E-06	mg/kg	None

Site Specific SRVs

- Recreational site – Benzo[a]pyrene
  - Open SRV Spreadsheet – Site Specific
    - "Res-Rec Worksheet" tab
    - Site specific BaP SRV

Chemical [13]	Acute SRV [1] (mg/kg)	Site Maximum Concentration (mg/kg) Dry Weight [1]	Final Chronic SRV (mg/kg)	Basis [14]	BTV Applies to Acute & Chronic (mg/kg)
2,4,5-Trichlorophenol	NA		1300	Noncancer	NA
2,4,6-Trichlorophenol	NA		13	Noncancer	NA
Polyaromatic Hydrocarbons					
Acenaphthene	NA		1300	Noncancer	NA
Anthracene	NA		6500	Noncancer	NA
Benzo[a]pyrene (BaP equivalents) [10]	NA		1.2	Cancer	1
Fluoranthene	NA		510	Noncancer	NA

Site Specific SRVs

- Recreational site – Benzo[a]pyrene
  - SRV Range of Risks Spreadsheet
    - "Res-Rec – Recreational" tab

Soil Reference Value (SRV) Modifications	Noncancer Risk [1] DEFAULT 0.2	Noncancer Risk [1] MODIFIED 0.5	Cancer Risk [2] DEFAULT 1E-05	Cancer Risk [2] MODIFIED 1E-04	Exposure Frequency days/year RME [3] DEFAULT 250/350 days/year	Exposure Frequency days/year CTE [4] MODIFIED 144 days/year	Exposure Duration years RME [5] DEFAULT 26 years	Exposure Duration years CTE [6] MODIFIED INSERT HERE [11] years	Ingestion Rate DEFAULT RME [7] DEFUALT 100 adult 200 child mg/day	Ingestion Rate MODIFIED CTE [8] MODIFIED 50 adult 100 child mg/day	Vegetative Cover percentage RME [9] DEFAULT 50%	Vegetative Cover percentage CTE [10] MODIFIED INSERT HERE [11] %	Modified Residential/ Recreational SRV mg/kg	Basis (Choose Cancer or Noncancer)
NO Modifications- Provided For Comparison Purposes														
2016 SRV	X		X		X		X		X		X			
2016 BTV	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				Background
Exposure Frequency Modification														
SRV M1	X		X			X	X		X		X			
Exposure Duration Modification														
SRV M2	X		X		X			X	X		X			
Ingestion Rate Modification														
SRV M3	X		X		X		X			X	X			
Vegetative Cover Modification														

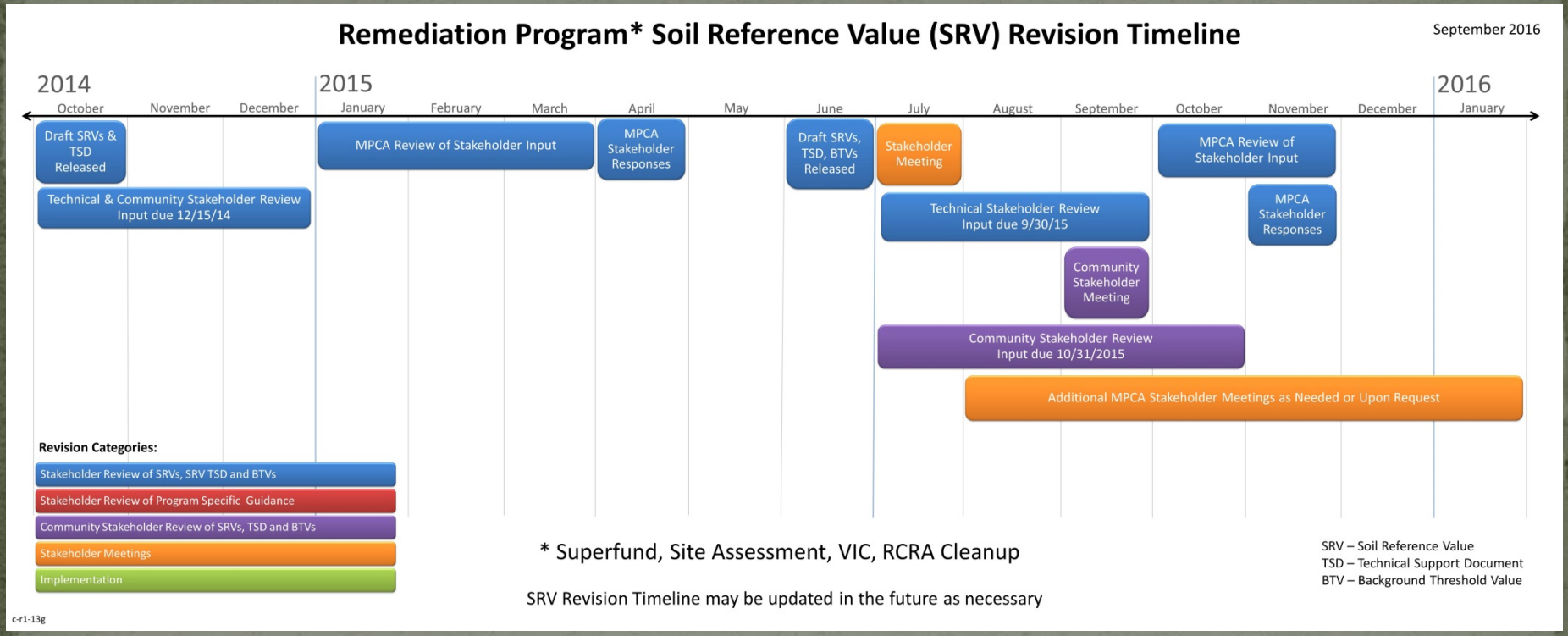
  - Modify additional parameters
    - Calculate a different Site specific SRV
    - Use a range of risks to establish a cleanup value

SRV Related Guidance

Questions?

Minnesota Pollution Control Agency

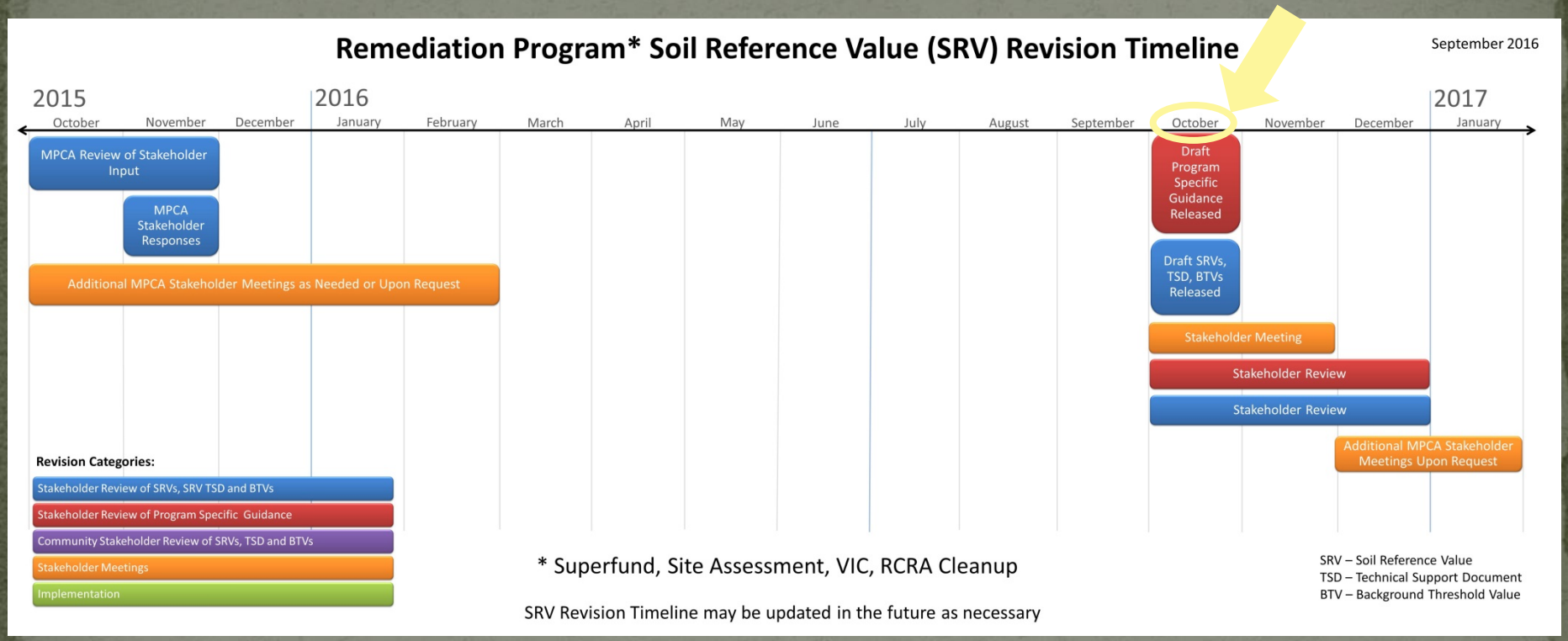
SRV Revision Timeline



Please submit input by December 2

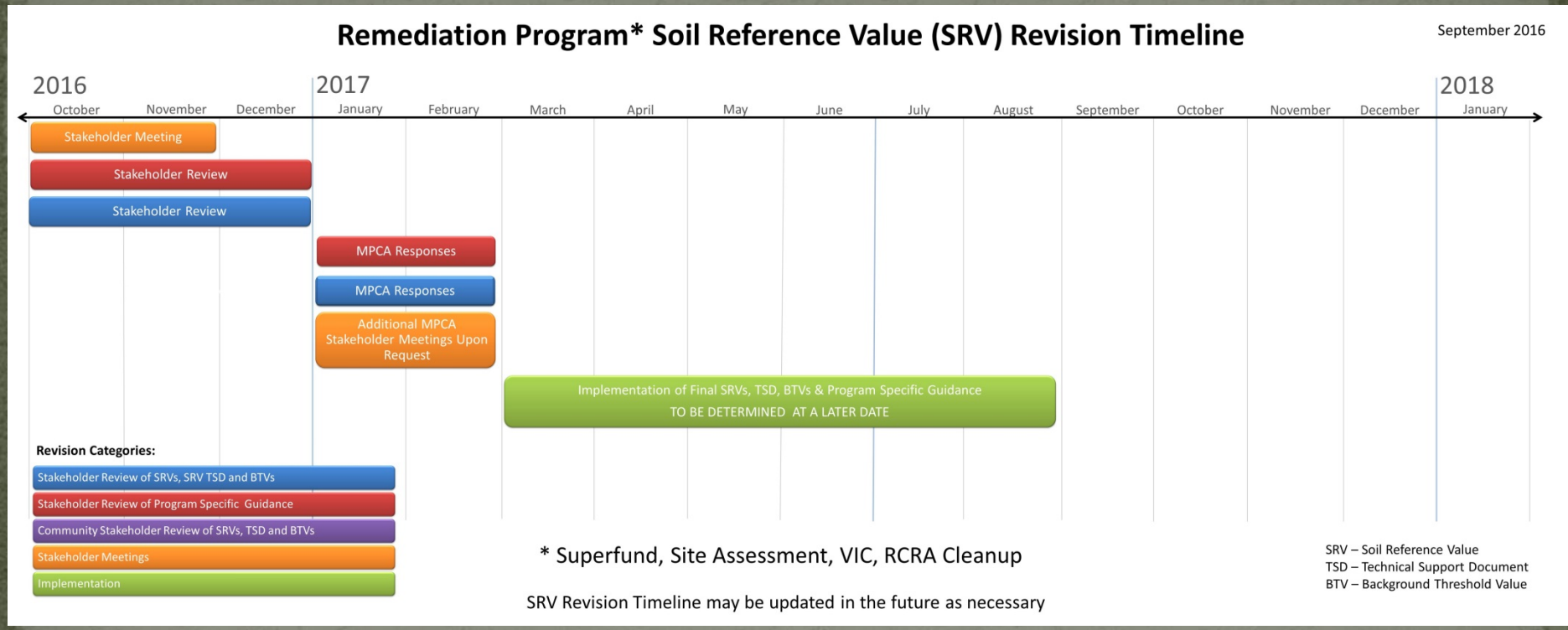
SRVcomments.pca@state.mn.us.

SRV Revision Timeline



Please submit input by December 2 SRVcomments.pca@state.mn.us.

SRV Revision Timeline



Please submit input by December 2
SRVcomments.pca@state.mn.us.