Sustainable Remediation Forum (SURF)
SURF 32: June 21, 2016

MEETING NOTES PENDING

Attachment 1
SURF 32 Participant Contact Information

Attachment 1
Participant Contact Information

Name	Company	Email	Phone Number
Kathy Adams	Writing Unlimited	kadams2@comcast.net	(302) 438-3764
Tom Antonoff	GE	tom.antonoff@ge.com	(518) 796-5971
Buddy Bealer	Shell	leroy.bealer@shell.com	(484) 632-7955
James Bet	Boeing	james.n.bet@boeing.com	(206) 679-0433
Sarah Bird	Department of Energy EM-12	sbird@fiu.edu	(904) 214-5390
Ali Boroumand	Gradient	aboroumand@gradientcorp.com	(617) 938-9987
Nicole Bradley	de maximis, inc.	nbradley@demaximis.com	(619) 546-8377
Dee Brncich	Brncich Environmental Consulting, LLC	dbrncich@brnenvcon.com	(630) 352-9421
Gareth Buckland	DOE EM-11	gareth.buckland@em.doe.gov	(301) 903-9446
Lindsay Burton	ExxonMobil	lindsay.f.burton@exxonmobil.com	(571) 389-2243
Paul Brandt Butler	AECOM	brandt.butler@aecom.com	(610) 832-3575
Rebecca Carmine-Shaw	Ecology and Environment, Inc.	rcarmine-shaw@ene.com	(716) 684-8060
Arie den Dekker	RSK The Netherlands	adendekker@rskgroup.nl	(000) 000-0000
Arlette De Santiago	Brown and Caldwell	ADeSantiago@brwncald.com	(770) 673-3646
Russell Downey	Pfizer Inc	russell.g.downey@pfizer.com	(908) 901-6079
Gary Drendel	Tetra Tech	gary.drendel@tetratech.com	(303) 980-3546
Anastasia Duarte	Tesoro Refining and Marketing Company	anastasia.e.diarte@tsocorp.com	(253) 896-8801
Lauren Duncan	Brown and Caldwell	lduncan@brwncald.com	(303) 239-5417
Tom Ei	DuPont	tom.a.ei@dupont.com	(302) 999-0589
Emerald Erickson-Mulanax	Farallon Consulting	eerickson@farallonconsulting.com	(425) 295-0825
Paul Favara	CH2M	Pfavara@ch2m.com	(352) 384-7967
Gustavo Gomez	Biograss Extra	gustavo.gomez@biograssextra.com	(614) 140-8777
Amanda Griskell	DeepEarth Technologies, Inc.	amanda@cool-ox.com	(708) 396-0100
Nancy Grosso	DuPont	nancy.r.grosso@dupont.com	(302) 999-3114
Elie Haddad	Haley & Aldrich	ehaddad@haleyaldrich.com	(408) 961-4806
Paul Hadley	Self	hadley1304@aol.com	(530) 601-8666
Melissa Harclerode	CDM Smith	harclerodema@cdmsmith.com	(732) 590-4616
Diana Hasegan	GHD	diana.hasegan@ghd.com	(425) 563-6501
Lyndsey Howard	Pinnacle Engineering	lhoward@pineng.com	(612) 710-7545

Attachment 1
Participant Contact Information

David Hutnick	Kleinfelder, Inc.	dhutnick@kleinfelder.com	(610) 594-1444
Sarah Jensen	US Department of Energy	sarah.jensen@hq.doe.gov	(202) 586-2295
Alexandra Kramer	Department of Energy, Office of Environmental Management	alexandra.kramer@hq.doe.gov	(415) 902-8003
Kyle Lefton	LA Metro	leftonk@metro.net	(213) 922-2206
Colleen Liddell	Ford Motor Company	ckoch1@ford.com	(313) 322-9834
Jewel Lipps	US Environmental Protection Agency	Lipps.Jewel@epa.gov	(703) 603-7187
Barbara Maco	WACTOR & WICK LLP	BarbaraMaco@ww-envlaw.com	(510) 205-0416
Mike Makerov	bnsf	mike.makerov@bnsf.com	(909) 386-4081
Michael Marinovich	Advisian (WorleyParsons)	michael.marinovich@advisian.com	(587) 893-8687
Justine Marshall	GHD	justine.marshall@ghd.com	(402) 680-7351
Stephen Matney	AGVIQ	smatney@tikigaq.com	(757) 213-8583
Patti McCall	Tetra Tech	patti.mccall@tetratech.com	(734) 213-4069
Lisa McCarthy	Reterro	lmccarthy@reterro.com	(925) 227-1192
Amanda McNally	AECOM	amanda.mcnally@aecom.com	(412) 396-9940
Mark Meyers	Anchor QEA	mmeyers@anchorqea.com	(201) 571-0926
Christopher Mickle	Cardno	christopher.mickle@cardno.com	(919) 999-4029
Mike Miller	CDM Smith	millerme@cdmsmith.com	(617) 452-6295
Robert Montgomery	World Bank	rmontgomery1@worldbank.org	(202) 473-8998
Beth Moore	US DOE	beth.moore@em.doe.gov	(202) 586-6334
Sara Morey	EMES	sara.j.morey@exxonmobil.com	(832) 288-7143
Chris Murnane	U.S. Department of Energy	christopher.murnane@em.doe.gov	(202) 586-7580
Deepti N	Battelle	naird@battelle.org	(510) 846-5935
Deepti Nair	battelle	naird@battelle.org	(510) 846-5935
Mark Nielsen	Ramboll Environ	mnielsen@ramboll.com	(215) 523-5602
Nicole Nieves	USACE - Omaha District	t.nicole.nieves@usace.army.mil	(402) 995-2282
Scott Pittenger	Norfolk Southern Corporation	scott.pittenger@nscorp.com	(470) 925-6728
Thomas Potter	Massachusetts Department of Environmental Protection	Thomas.Potter@state.ma.us	(617) 292-5628
Andrew Punsoni	Cascade Technical	apunsoni@cascade-env.com	(925) 768-8377
Sara Rasmussen	US EPA	rasmussen.sara@epa.gov	(703) 308-8399
Dick Raymond	Terra Systems, Inc.	draymond@terrasystems.net	(302) 798-9553

Attachment 1
Participant Contact Information

Cheryl Rietjens	DeepEarth Technologies, Inc.	cheryl@cool-ox.com	(708) 396-0100
John Simon	Gnarus Advisors	jsimon@gnarusllc.com	(202) 505-1906
Alexis Smoot	Department of Energy	Alexis.Smoot@em.doe.gov	(301) 903-9946
John Sohl	COLUMBIA Technologies	jsohl@columbiatechnologies.com	(301) 455-7644
Tom Statham	JBS&G	tomstatham@gmail.com	(006) 393-9689
Teri Stripes	City of Spokane	tstripes@spokanecity.org	(509) 625-6300
Roy Thun	Bridge Environmental	roy.thun@bridgeenviro.com	(661) 287-3855
Karina Tipton	Brown and Caldwell	ktipton@brwncald.com	(201) 574-4719
Erin Toothaker	EA Engineering, Science, and Technology, Inc., PBC	etoothaker@eaest.com	(410) 584-7000
Lynn Tucker	Ford Motor Company	ltucke33@ford.com	(313) 248-7552
John Tunks	CH2M	john.tunks@ch2m.com	(720) 286-5271
Marisa Tychon	The Boeing Company	marisa.k.tychon@boeing.com	(562) 304-8094
Raymond Vaske	AECOM	ray.vaske@aecom.com	(513) 562-0244
Paloma Vila	Roux Associates, Inc.	pvila@rouxinc.com	(856) 832-3756
Kyle Waldron	Tesoro	Kyle.A.Waldron@tsocorp.com	(907) 529-0297
Kat Walenter	Craig Communications	kat@craig-communications.com	(510) 672-0117
Li Wang	Greenment	liwangcn@outlook.com	(412) 353-9417
Rick Wice	tetrat tech	rick.wice@tetratech.com	(412) 921-7172
John Wood	U.S. Department of Energy	john.wood@emcbc.doe.gov	(513) 246-0505

Attachment 2
President's Update

President's Update

SURF
SUSTAINABLE REMEDIATION FORUM

SURF 2016 Update

John Simon, President

SURF Mission

Maximize the overall environmental, societal and economic benefits from the site cleanup process by:

- Advancing the science and application of sustainable remediation (SR)
- Developing best practices
- Exchanging professional knowledge
- Providing education and outreach

SURF Overview

About SURF

- Founded in 2006
- Incorporated as a non-profit in 2010
- Collaborate with International SURF organizations
- Life cycle sustainability perspective: environmental, social, and economic pillars

Members

- Industry
- Government
- Regulators
- Vendors
- Academics
- Consultants
- NGOS

Sponsors

- GOLD: Boeing, CH2M, Shell
- SILVER: AECOM, Amec Foster Wheeler, Cascade Drilling, CDM Smith, Haley & Aldrich, Terra Systems
- BRONZE: Envirocon, ExxonMobil, Tetra Tech

SURF
SUSTAINABLE REMEDIATION FORUM

Publication Topics

- Sustainable Remediation Topics
- Footprint Analysis and LCA
- Sustainable Remediation Metrics
- Integrating Sustainable Remediation into Property Development
- Water Conservation and Reuse
- Social Impacts
- Climate Change and Resiliency
- Benefits of Sustainable Remediation

SURF
SUSTAINABLE REMEDIATION FORUM

SURF Priority Initiatives

- Meetings/programs
- Partner w/another organization for conferences
- Quarterly “free” webinar pilot
- Communicate value of SR outside of SURF
- Proprietary database of SR products/services
- Strengthen case study initiative
- Climate change & resiliency technical initiative

SURF Priority Initiatives

- Academic outreach
- Awards
- Coordination w/EPA
- Communications
- Groundwater conservation & reuse initiative
- Social dimensions initiative

Advancing SR & SURF

Challenge Yourself

Join us

Participate

Attachment 3
Integrating the Social Element in Remedial Decision Making: State of the Practice and Way Forward

Integrating the Social Element in Remedial Decision Making

Integrating the Social Element in Remedial Decision-Making: State of the Practice and Way Forward

SURF Technical Initiative Team

Presenter: Melissa Harclerode, SURF TI Lead

Tenth International Conference on Remediation of Chlorinated and Recalcitrant Compounds

May 25, 2015

Palm Springs, CA

SURF

SUSTAINABLE REMEDIATION FORUM

Presentation Overview

- SURF & Technical Initiative Team
- Collaborative Paper
  - Main Societal Impact Categories
  - Assessment Techniques
  - Future Research
- SURF Social Aspect TI's Next Steps
  - Meaningful Stakeholder Engagement

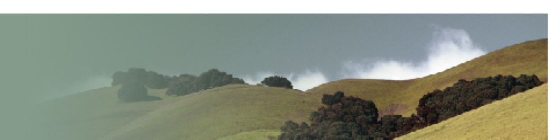
SURF Technical Initiative Team

Professional Organizations

- SURF (USA)
- SURF-Canada
- SURF-Italy
- SURF-Taiwan
- SURF-UK
- Common Forum
- International Organization for Standardization (ISO)

Academics

- University of Venice, Italy
- University of Brighton, UK
- University of Nottingham, UK
- University of Saskatchewan, Canada
- Montclair State University, New Jersey, USA
- University of Illinois at Chicago, USA
- University KU Leuven, Belgium

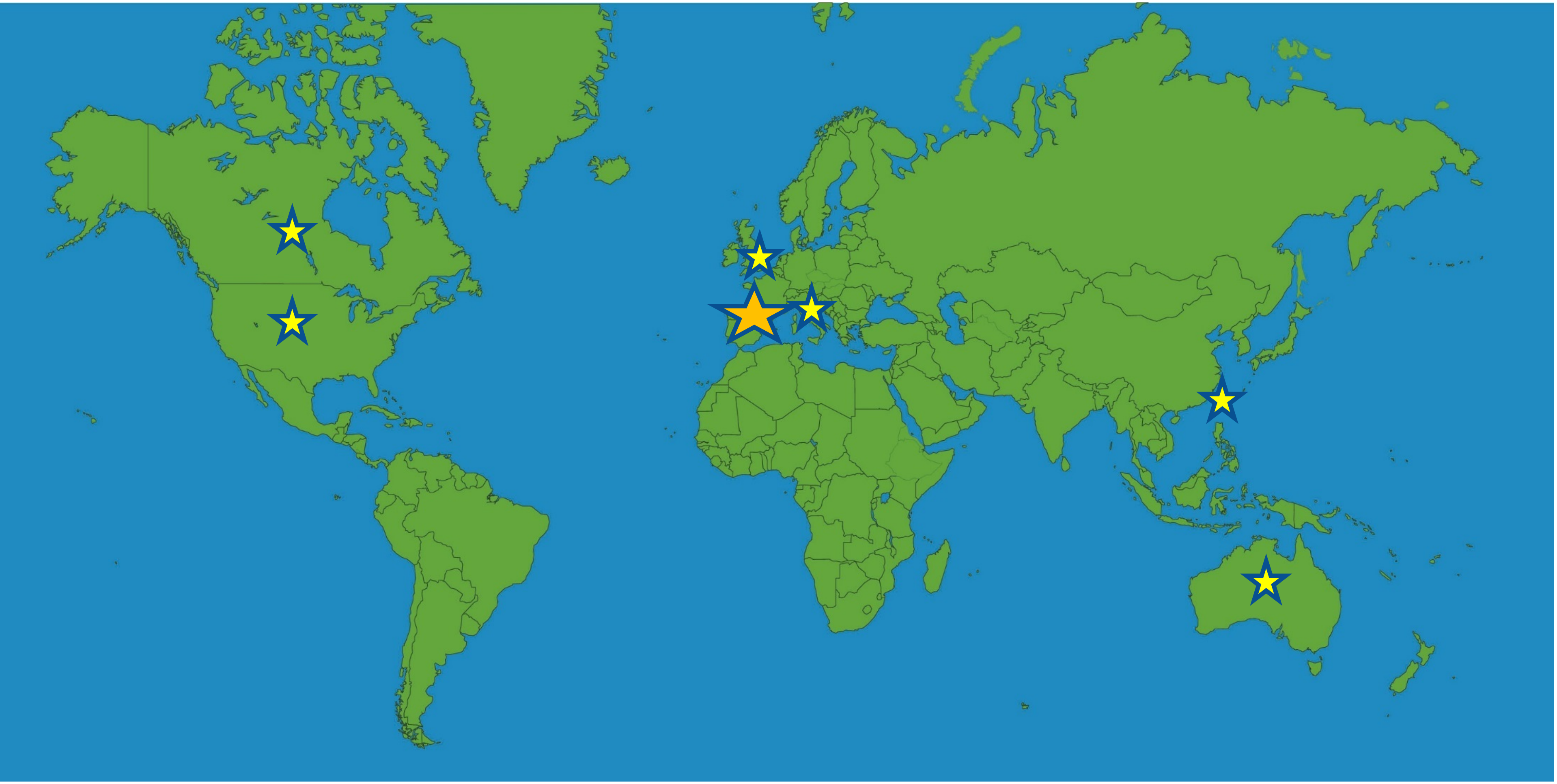


1. ***Status Quo***
   - social domain assessed among various countries and organizations

2. **Methodologies & Case Studies**
   - quantitatively and qualitatively evaluate societal impacts

3. **Findings**
   - challenges, obstacles, and a path forward

International Framework Review



Main Societal Impact Categories

1. Stakeholder Engagement

2. Health and Safety

**on-site worker & community*

Main Societal Impact Categories

3. Benefits Community at Large

- Improve Quality of Life
  - property value
  - social and human capital
  - reuse of treated media/materials
  - redevelopment of the property

4. Alleviate Undesirable Community Impact

- Neighborhood/Locality Scale
  - noise
  - odor
  - congestion
  - business disruptions
  - compromising local heritage and cultural concerns

Main Societal Impact Categories

5. Economic Vitality

- contracting local
- investing in new skilled training and education
- incorporating redevelopment

6. Social Justice

- vulnerable populations
- social equity
- reused brownfields for equitable use

Main Societal Impact Categories

7. Regional and Global Societal Impacts

8. Value of Ecosystem Services and Natural Resources Capital

Main Societal Impact Categories

9. Risk-Based Land Management and Remedial Solutions

- distribute resources to effectively address the site-specific human health, environmental justice, and community issues associated with contaminated sites

10. Contribution to Local and Regional Sustainability Policies and Initiatives

- renewable energy
- climate change adaptation
- regional land use policies
- ecological restoration goals
- resource consumption

Before

After

Assessment Techniques

**Case Studies Provided as Supplemental Material to the Publication*

Social Science Methodologies

- **Understand and Identify**

1. **social factors** that act as **drivers** and **barriers** to sustainable practices and risk management activities

2. **vulnerable stakeholders** that are affected by remediation

3. sustainability **objectives priority**

Rating & Scoring System Evaluations

- A rating metric and an aggregation rule that combines individual ratings into a single overall score

Social Sustainability Matrix			
	No Remedy	In-situ S/S	Excavate and Haul
Social	-7	13	13
Socio-Institutional	-11	11	8
Socio-Economic	-9	10	9
Socio-Environmental	-4	11	-3
Grand Score	-31	45	27

Social Sustainability Evaluation Matrix (SSEM Tool)

Dimension	Key Measure
Socio-Economic	Disruption of businesses and local economy during construction/remediation
	Employment opportunities during construction/remediation
	Employment opportunities post-construction/remediation
	Degree of project investment toward Local Business Entities (LBEs)
	Degree of project investment toward Disadvantaged Business Entities (DBEs)
	Post-construction/remediation 3rd party business generation
	Relative degree of increased tax revenue from Site Reuse
	Relative degree of increased tax revenue from nearby properties
	Degree to which green/sustainable or other "new economy" businesses may be created
	Degree of stimulated informal activities/economy
	Degree of anticipated partnership and collaboration with outside investors/institutions

Score				
Positive Impact		No Impact or Not Applicable	Negative Impact	
Ideal	Improved		Diminished	Unacceptable
2	1	0	-1	-2

Developed by Dr. Reddy, UIC

Surveys

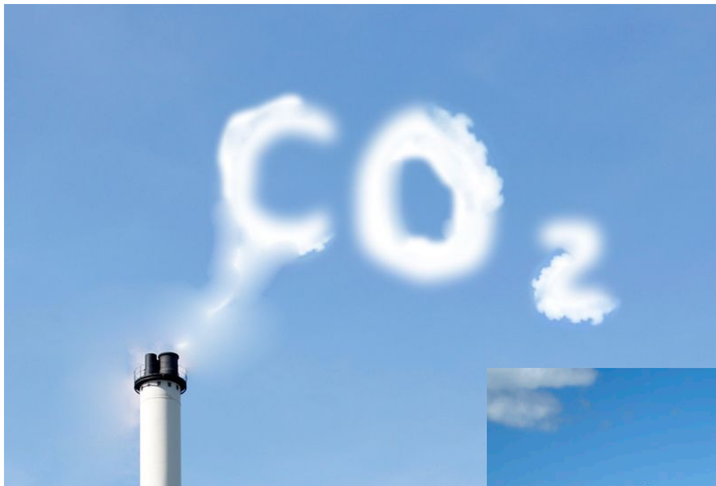
- Flexible, inexpensive method to evaluate generalizable social impact indicators, perceived local economic benefits, and community well-being
- Transparent communication tools
- Community can fully participate in the review of survey results

Multi-Criteria Decision Analysis (MCDA)

- Platform for stakeholders to place value (or weights) on TBL objectives and project alternatives.
  - Employment Equity versus Water Quality Type

- Web-based tools available
  - Minimize travel and meetings required
  - Incorporates bias into the evaluation
  - Analyzes statistical significance of indicators
  - Option to conduct a sensitivity analysis

Societal Implications: Global Monetized Impacts



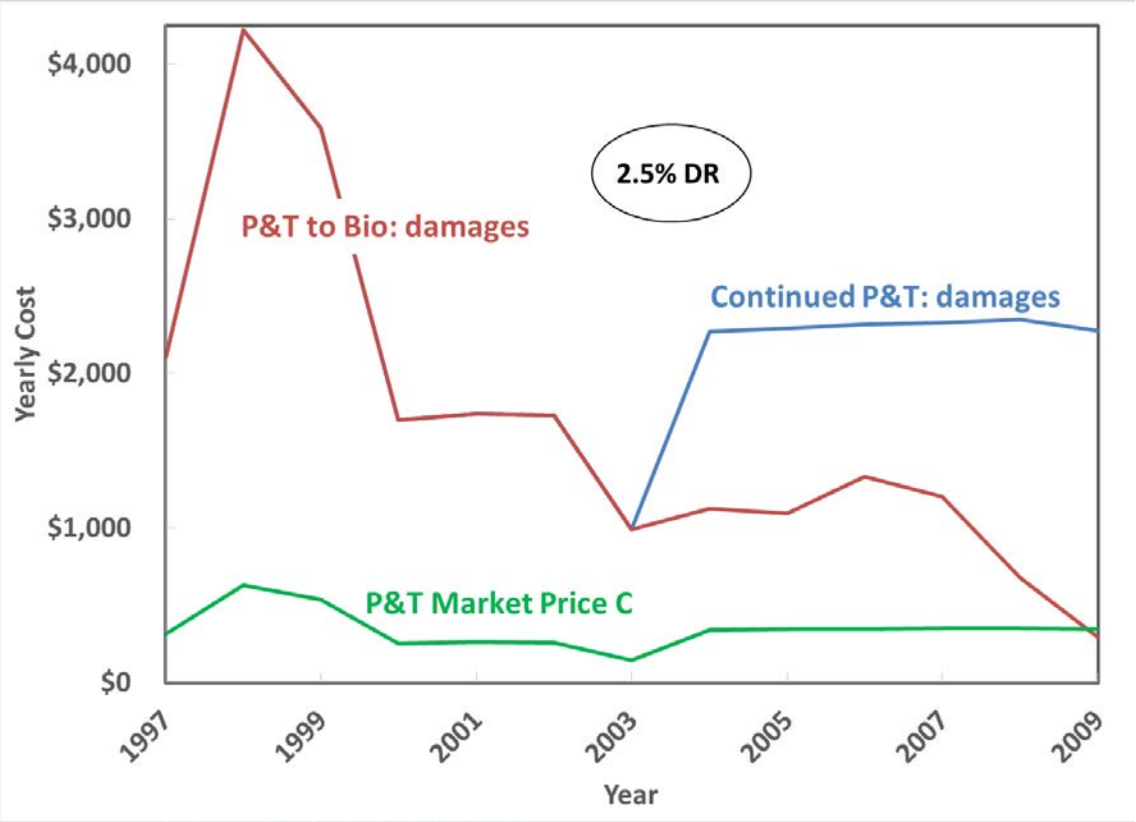
- Financial implications of chemical emissions and utilizing resources

  - e.g., climate adaptation and resiliency funding

USG EO 12866 - Technical Support Document - Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis

Socio-Economic Cost Benefit Analysis

- Monetized benefits to society vs. monetized costs to society of undertaking particular courses of action



Findings

Future Research, Next Steps, & Closing Thoughts

Future Research Needs

1. *Value of Social Cost Metrics*

2. *Risk Perception of Reuse*

3. *Integrated and Objective-led Assessment Approach*

4. *Life-Cycle Assessment*

Future Research Needs

5. ***Meaningful Stakeholder Engagement***

SustRem 2016

4th International Conference on Sustainable Remediation (SustRem)
April 26 - 28, 2016
Le Centre Sheraton Montreal, Montreal, Quebec, Canada

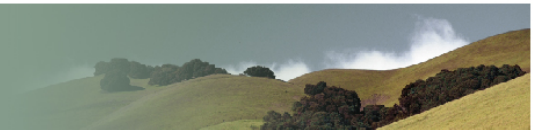
SURF TI Next Steps

- Meaningful Stakeholder Engagement
  - SURF and SuRF Canada holding workshops
    - *The Role of Stakeholder Collaboration in Sustainable Remediation: Its Purpose, Benefit, and Process*
  - SURF TI International Collaborative
    - *Engagement roadmap development*
    - *Social case study template*

Closing Thoughts

- The principle of Occam's Razor (parsimony) (Hiroshi, 1997) should apply. It is better to be comprehensive in the coverage of social issues than to be sophisticated in the quantification of a few.

- Social impact assessment of remediation is more mature and further developed than widely believed.
  - Take advantage of available tools and experts!



Thank You

from the entire SURF Technical Initiative Team

Come Join the SURF Social Aspect TI!

Melissa Harclerode, PhD, ENV SP
harclerodema@cdmsmith.com

Attachment 4

Beneficial Reuse of Treated Groundwater for Plant Operations

Beneficial Reuse of Treated Groundwater for Plant Operations

Beneficial Reuse of Treated Groundwater for Plant Operations

SURF 32 – June 2016

William A. Butler, P.E., BCEE – ERM – Atlanta, GA

Mitchell Gertz – Solvay Specialty Polymers – West Deptford, NJ

SOLVAY
asking more from chemistry®

The world's leading sustainability consultancy

ERM

Contents

- Background
- Challenges
- Solution
- Benefits
- Results




SOLVAY
asking more from chemistry®

The world's leading sustainability consultancy

ERM

Solvay Plant – West Deptford, NJ

SOLVAY
asking more from chemistry®

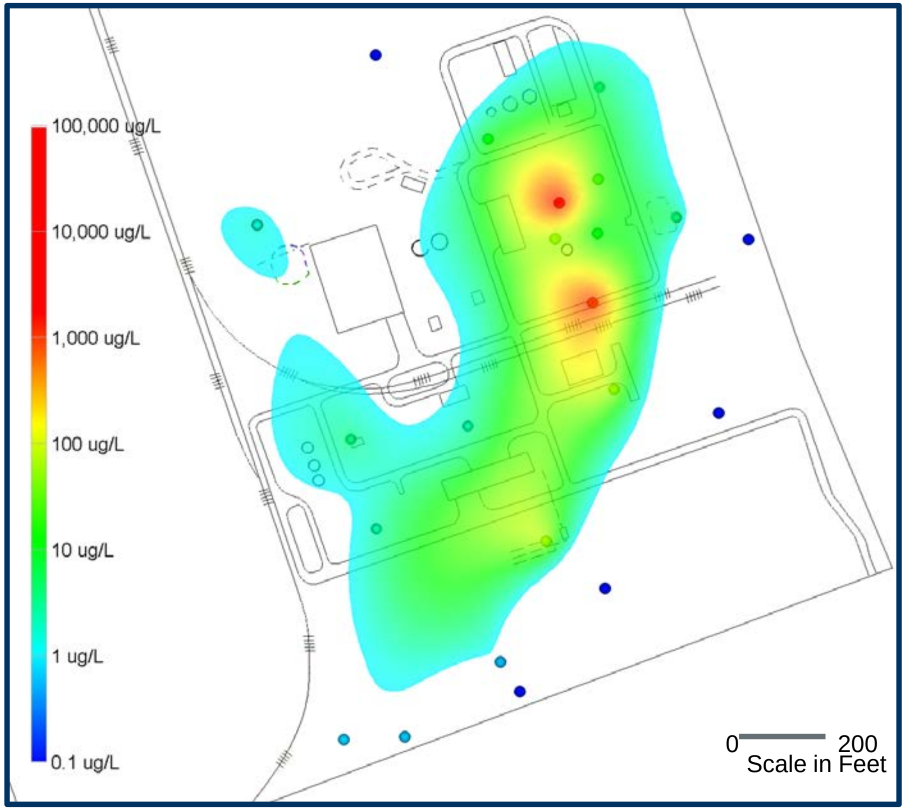
The world's leading sustainability consultancy

ERM

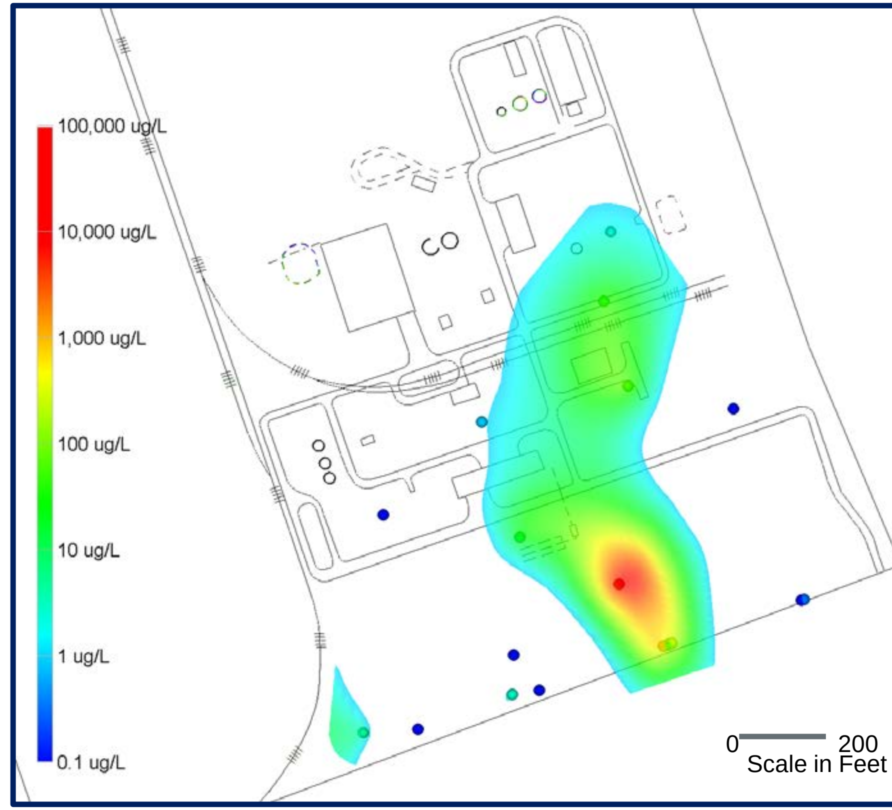
Background

- Geology/Hydrogeology
  - Depth to water ranges from 15 to 20 ft bgs
  - Groundwater flow is toward SSE – away from Delaware River
  - Potomac-Raritan-Magothy aquifer system – critical-stressed aquifer
  - Fine to coarse sands with some clay and gravel lenses until a confining clay layer encountered at 80 ft bgs
  - Plant water supply wells screened below the confining clay layer
- Groundwater plume extends off site with COCs exceeding NJ GWQS
  - 1,1,1-trichloroethane; 1,1-dichloroethene and carbon tetrachloride
  - Site-specific compounds (SSC): 1-chloro-1,1-difluoroethane (142b); 1,1-dichloro-1 fluoroethane (141b); and 1,1,1-trifluoroethane (143a)
  - Low pH (3-5) on site – naturally lower pH off site (5-6.5)

Isoconcentration Maps



Shallow Groundwater



Deep Groundwater

Challenges

- Remedial Action Objective
  - Reduce off-site migration of COCs at concentrations exceeding NJ GWQSs
  - Reduce potential vapor intrusion risks on and off site
- NJDEP would not approve MNA
- In Situ Remediation Treatability Studies
  - Anaerobic bioremediation
  - Chemical reduction – ZVI
  - Oxidation – persulfate
  - Limited success for site-specific compounds
- Air Sparging/SVE Pilot Test
  - COCs and SSCs can be effectively removed
  - Layered geology and installing within an active plant makes it difficult to cost-effectively implement

Challenges

- Groundwater pump and treat selected
  - Technically viable alternative – although not preferred
  - 4 extraction wells in shallow, unconfined aquifer – 264 gpm
  - Initial design included 2 injection wells
  - NJ GWQS – stringent discharge limits
  - Need to treat for aluminium, iron and manganese in addition to COCs
  - Air stripper, chemical precipitation, two-stage ion exchange, neutralization
  - High capital and O&M cost – how can costs be reduced?
- Treated groundwater discharge alternatives
  - Potential cost reduction?
  - Other benefits?

Solution – Discharge Alternatives Evaluation

Option	Pros	Cons
Discharge to Groundwater	1. No interference with plant operations 2. Returns water to stressed aquifer	1. Need DGW permit 2. Additional treatment for metals 3. High capital and O&M cost
Discharge to Surface Water	1. Existing NJDPES permit in place 2. Reuse of existing WWTP equipment	1. Required permit modification 2. Potential impact to river 3. Additional treatment for metals 4. High capital and O&M cost
Discharge to POTW	1. Existing discharge permit in place 2. Reuse of existing WWTP equipment	1. Requires permit amendment 2. Additional treatment for metals 3. Infrastructure required 4. High capital and O&M cost
Reuse	1. Reduces load on lower, critically-stressed aquifer 2. Less stringent treatment requirements 3. No additional treatment for plant use 4. Reuse of existing WWTP equipment 5. Lower capital and O&M cost	1. Water allocation permit and DRBC Docket modifications needed 2. Treatment Works Approval (TWA) needed 3. Potential impact to plant operations

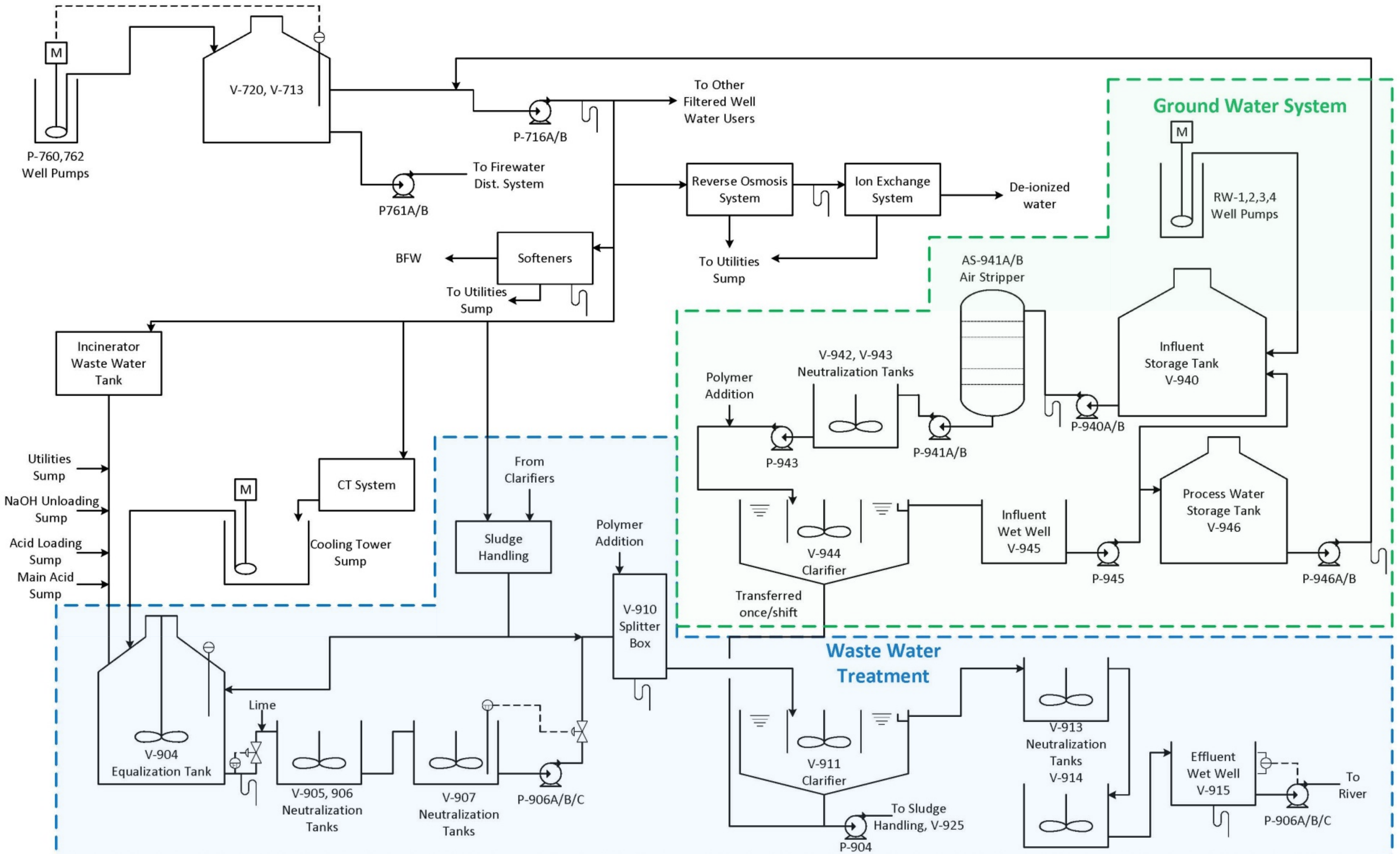
Solution – Groundwater Reuse

- Existing Plant Water Supply
  - Two wells screened below the confining clay layer
  - Water Allocation Permit in place
  - Groundwater treated using ion exchange to remove iron
- Groundwater Reuse
  - Off set volume of groundwater pumped from existing water supply wells
  - No impacts to plant operations due to shallow groundwater quality – water quality actually better in regards to iron
  - Existing ion exchange system sufficient to meet plant needs
  - Both NJDEP BWA and DRBC approved Water Allocation Permit modification
    - 572 gpm maximum rate
    - Provided flexibility to allow pumping from either aquifer as long as total allocated rate not exceeded
  - Treatment Works Approval received from NJDEP

Solution – Groundwater Treatment

- **Four (4) recovery wells** – 264 GPM average, 422 GPM max predicted through modelling
- **Equalization tank** – existing tank being used
- **Two (2) low-profile, tray air strippers** rated for 250 GPM each
- **Two-stage neutralization** – existing tanks being used
- **Clarifier** – existing clarifier being used
- **Sludge tank** – existing tank being used – sludge being combined with existing WWTP sludge handling/dewatering equipment
- **Interim post-treatment storage tank** – existing tank being used
- **Existing ion exchange system** being used to treat combined groundwater before plant use
- **NJDEP approved air permit** without air emission control as long as VOC and SSC emissions remain below permitted rates

Groundwater and Wastewater Flow Diagram



SOLVAY
asking more from chemistry®

The world's leading sustainability consultancy

ERM

Groundwater Treatment System

Recovery Well with Temporary Iron Precipitation Control

Recovery Well Flow Meters & Controls

Equalization Tank

SOLVAY
asking more from chemistry®

The world's leading sustainability consultancy

ERM

Groundwater Treatment System

Clarifier

Air Strippers

Benefits

- Lower cost treatment system ($2.5M savings)
  - No additional treatment via ion exchange required for metals
  - Existing WWTP equipment reused
  - Less stringent treatment requirements
- 175 MGY less groundwater pumped from a critically-stressed aquifer
- Less electrical power consumption and thus greenhouse gas generation
- Water supply options available in the event of water-use restrictions
- Less risk of discharging groundwater above permitted limits
- Less risk of system downtime compared to a more complex system

Results Since 2011 Start-Up

- ≥ 90% plume capture
  - Limited due to high COC concentrations that required limiting the pumping rate to maintain air emission rates below permitted levels
- Plant operations improved and costs decreased
  - Better groundwater quality resulted in **$50,000/year less treatment and chemical cost** for existing ion exchange system – in addition to $2.5M cost savings
  - Less ion exchange regeneration resulted in less discharge of regeneration backwash water to POTW
- Modifications to treatment system
  - Iron precipitation control – inhibitor added at recovery wells to reduce precipitation
  - Polishing step added to improve water quality for reuse
    - Proactive measure – NJDEP did not require this
    - Sand filtration and GAC added post clarifier