Sustainability and Remediation
November 13, 2006
Wilmington, Delaware

Integrating sustainability with remediation recognizes that remedial actions can have substantial off-site impacts and that it is possible to distinguish between and select remedial actions based on sustainability. This meeting was formed to bring together various stakeholders in remediation—industry, government agencies, environmental groups, consultants, and academia—to develop the ability to use sustainability concepts in decision-making. Individuals from these stakeholder groups were invited to the meeting, and those individuals that participated are listed below (teleconference attendees are noted by asterisks and appear at the end of the listing). Participant contact information is provided in Attachment 1.

Dave Ellis (meeting host), DuPont
Mike Rominger (meeting facilitator), DuPont
Kathy Adams (meeting recorder), Writing Unlimited

Brandt Butler, URS Corporation
Jim Cummings, EPA
Stephanie Fiorenza, BP
Rich Galloway, Honeywell
Mark Harkness, GE
Dave Major, GeoSyntec Consultants
John McAuliffe, Honeywell
Gene Peck, URS Corporation
Dick Raymond, Terra Systems
Dawn Rittenhouse, DuPont
Sheryl Telford, DuPont
Dan Watts, New Jersey Institute of Technology

Janice Barber*, Dow Chemical Company
Bob Boughton*, California EPA
Paul Hadley*, California EPA
Lawrence Houlden*, Archon
Stella Karnis*, Canadian National
Janine MacGregor*, NJDEP
Eric Petrovskis*, GeoSyntec Consultants

Meeting Opening

The meeting began with a roll call of attendees. Mike Rominger (DuPont meeting facilitator) read an anti-trust statement and discussed meeting logistics. Prior to the meeting, export control compliance was verified.

The meeting began with a short presentation from Dawn Rittenhouse (DuPont Director of Sustainability) outlining her company's stake and recent corporate efforts in sustainability. Dawn presented a brief history of DuPont, the legacy challenges resulting from past manufacturing operations, the company's core values, and vision. She also presented the company's progress to date in reducing its environmental footprint by de-linking production and emissions/pollution. Dawn detailed the sustainability goals that DuPont announced in October 2006. Dawn's presentation is included as Attachment 2.

Dave Ellis (DuPont) gave the opening remarks, focusing on the diversity of the group as well as its power when working together. He concluded by asking participants what the group needed to do to get the full potential of what sustainability offers.

Participants then introduced themselves and answered the question "What would Captain Kirk report back to StarFleet Command regarding remediation activity on Earth?" Responses were varied and focused on the need for both more resources and improvements in technology selection, the length of time required to achieve remediation, and the lack of efficient investment in soil and groundwater cleanups.

Role of Sustainability in Remediation

Dave Ellis (DuPont Corporate Remediation Group) presented his company's current view of the role of sustainability in remediation (see Attachment 3 for the presentation). DuPont defines sustainable approaches as those that achieve at least one of the following:

- Minimize or eliminate energy consumption or the consumption of other natural resources.
- Reduce or eliminate releases to the environment, especially to the air.
- Harness or mimic a natural process
- Result in the reuse or recycling of land or otherwise undesirable materials.

Three case studies of previously implemented sustainable remedial actions were presented: (1) use of a windmill to power a soil vapor extraction system in New York, (2) use of slag to remediate arsenic-contaminated soil in Indiana, and (3) use of scrap iron and gypsum from a wastewater treatment plant to treat metals in groundwater in Delaware. Dave discussed each of the case studies, describing how each remedial solution was sustainable.

Dave then presented an example sustainability analysis for four types of remedies: bioremediation (green dots on slides), construction (e.g., excavation and off-site disposal) (pink dots on slides), pump and treat (blue dots on slides), and miscellaneous in situ approaches (e.g., surfactant flushing) (orange dots on slides). The cleanup costs of these remedies were plotted versus carbon dioxide emissions, water loss, and exposure hours. Discussions during this presentation focused on risk issues (e.g., determining the level of cleanup necessary with detection limits continuing to decrease) and other aspects of the decision-making process (e.g., societal value, implementability).

Sustainability Estimation Tool

Brandt Butler (URS Corporation) presented a sustainability estimation tool currently being used by DuPont to evaluate and compare sustainability indicators to the degree necessary to choose between potential remedial actions (see Attachment 3 for the presentation). He began by presenting a conceptual framework for the analysis wherein remediation project data (i.e., "known" data such as size, volume, quantity) are input along with potential remedial options to calculate sustainable metrics. Based on these calculations, the relative merits of the remedies are assessed. This conceptual framework was applied to two case studies: a landfill in Pennsylvania and a hypothetical site. Sustainability metrics for each potential technology were calculated based on the known site characteristic data for both case studies. Participants discussed the tool and some of the implementation issues associated with it. All agreed that it was a good starting point to including sustainability concepts in the remedy selection process.

Open Discussion

The open discussion portion of the meeting began with general agreement that sustainability in remediation is a valid concept and one worth working on implementing, but one with many obstacles. Discussions throughout the day and during the open discussion portion of the meeting can be categorized into the key issues listed below. A longer listing of key issues was identified at the meeting; the list below combines related issues together and focuses only on those issues that participants identified as important.

- Regulatory Support and Application
  Discussion of this issue revolved around the necessity of obtaining regulatory support in order to effectively apply the concept of sustainability in remediation. Participants agreed that achieving regulatory support would require a change in the current thought process. Participants from regulatory agencies responded that if the approach is protective of human health and the environment and does not slow the cleanup process, it would receive their support. Key questions associated with this issue were discussed and focused on how to tack sustainable concepts onto the current site cleanup structure (e.g., perhaps adding sustainability to the nine criteria associated with feasibility studies).
- Public Involvement and Perspectives
  Discussion of this key issue revolved around ensuring that environmental groups and other nongovernment organizations are involved in this effort so that all perspectives are integrated in the process. Group consensus was that without environmental group input and support, future efforts would be diminished. With their involvement, differences in perspectives could be identified and addressed. The idea would be to have resolution that incorporates local and regional perspectives without losing the global perspective of sustainability. Action items were developed to recruit participants from these stakeholder groups (see "Path Forward" section).
- Economic Incentives
  Discussion of this key issue revolved around the necessity of providing economic incentives (e.g., tax credits, climate exchange) to encourage the use of sustainable concepts in remediation. Some participants agreed that the development of economic incentives would make or break turning the idea of sustainability into a reality. Economic incentives would encourage industry and government to transform their thinking process and consider new technologies or a combination of technologies for a particular site. This, in turn, would spur greater innovation in technology development.
- Metrics
  Discussions of this key issue revolved around the need to develop metrics for sustainability in remediation and to determine how to begin the process. Discussions focused on the uncertainty of what to measure, how to obtain measurements, and how to document and verify measurements. It was noted that differing perspectives of stakeholders would lead to different metrics and that some type of standards were

needed. Discussion topics included temporal issues, sensitivity analysis, and uncertainty. The key issue of metrics was identified as a potential topic at the next meeting.

- Financial Models
  Discussions of this key issue revolved around the need to develop new financial models to evaluate sustainable remedies. The concept of sustainability in remediation involves a new style of economic analysis.

Path Forward

The following path forward items were identified at the meeting and distributed to meeting participants via e-mail on November 21, 2006:

1. Meeting participants who are interested in continuing to work on integrating sustainability with remediation should communicate with their management about the effort and send relevant information regarding their company's sustainability perspectives to Dave Ellis by December 11, 2006. These perspectives will be used to help ensure that all perspectives are represented. Responses will be compiled and shared before the next meeting.

2. The next meeting will be held in Wilmington, Delaware in January 2007. The group will be surveyed to determine a specific meeting date. A draft agenda based on feedback from the November 2006 meeting will be circulated. Active feedback and suggestions are encouraged.

3. The team believes that environmental group participation is imperative to gain additional sustainability perspectives and input on the priorities identified in the November meeting. A "volunteer" will be recruited to encourage interested environmental group members to participate in the January 2007 meeting.

4. Dave Ellis volunteered to coordinate development of a glossary of terms in order to provide a framework to guide future discussions. Participants are asked to send Dave a list of terms that need to be defined (and, if possible, suggested definitions) by December 11, 2006. A draft glossary will be shared before the next meeting.

5. Dave Ellis will circulate several DuPont sustainability estimation tools to those who will commit to providing a peer review of them. The peer review should address whether the concept of these estimation tools seems appropriate and whether the tools are designed at a useful level of detail. Suggestions for improvements to the specific tools shared are also encouraged. Please e-mail Dave directly if you are willing to provide a peer review.

6. After the January meeting and assuming the group wants to continue its efforts as a group, a working mission and vision statement will be developed. Participants should consider what might be included in such statements.

Attachment 1
Participant Contact Information

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Name	Organization
Dave Ellis	DuPont
Mike Rominger	DuPont
Kathy Adams	Writing Unlimited
Brandt Butler	URS Corporation
Jim Cummings	EPA
Stephanie Fiorenza	BP
Rich Galloway	Honeywell
Mark Harkness	General Electric
Dave Major	GeoSyntec Consultants
John McAuliffe	Honeywell
Gene Peck	URS Corporation
Dick Raymond	Terra Systems
Dawn Rittenhouse	DuPont
Sheryl Telford	DuPont
Dan Watts	New Jersey Institute of Technology
Janice Barber	Dow
Bob Boughton	California EPA
Paul Hadley	California EPA
Lawrence Houlden	Archon
Stella Karnis	Canadian National
Janine MacGregor	NJDEP
Eric Petrovskis	GeoSyntec Consultants

Attachment 2
DuPont Sustainability Goals

Sustainability: A Competitive Edge?

Dawn Rittenhouse
Director, Sustainable Development

The miracles of science™

DuPont in 1802

100 employees

1 site

1 country

1 product

12 customers

DuPont in 2006

60,000 employees

210 sites

70 countries

~ 500,000 SKU's

> 400,000 customers

$36 billion investment

$27 billion revenue

Core Values

Safety and Health

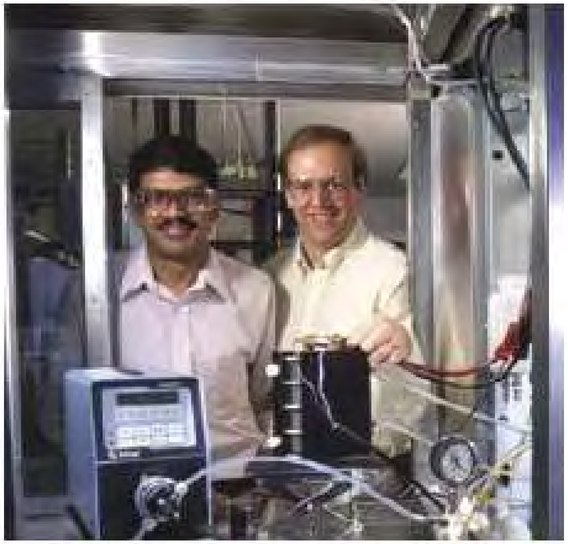
Environmental Stewardship

High Ethical Standards

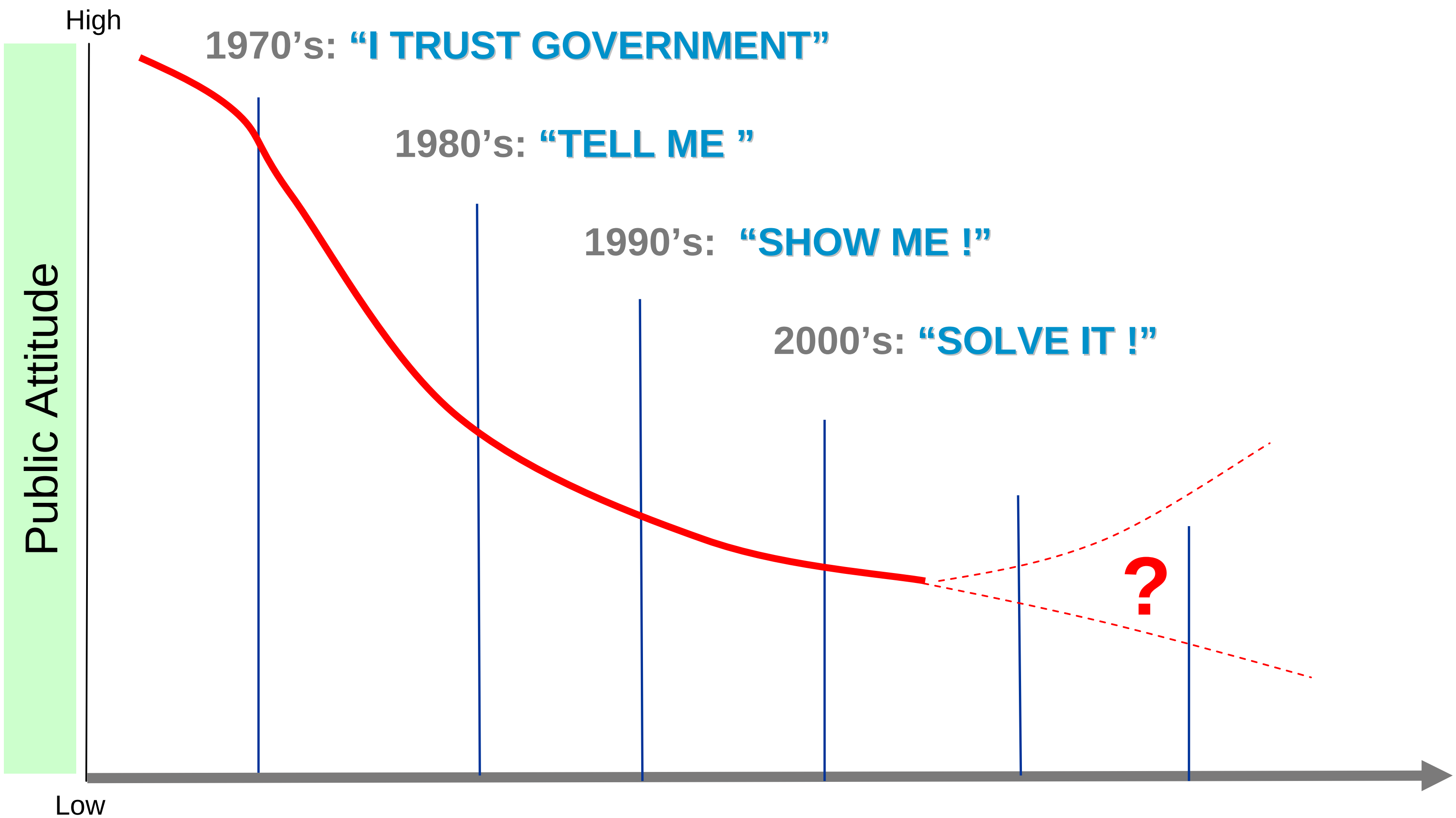
Respect for People

The Vision of DuPont

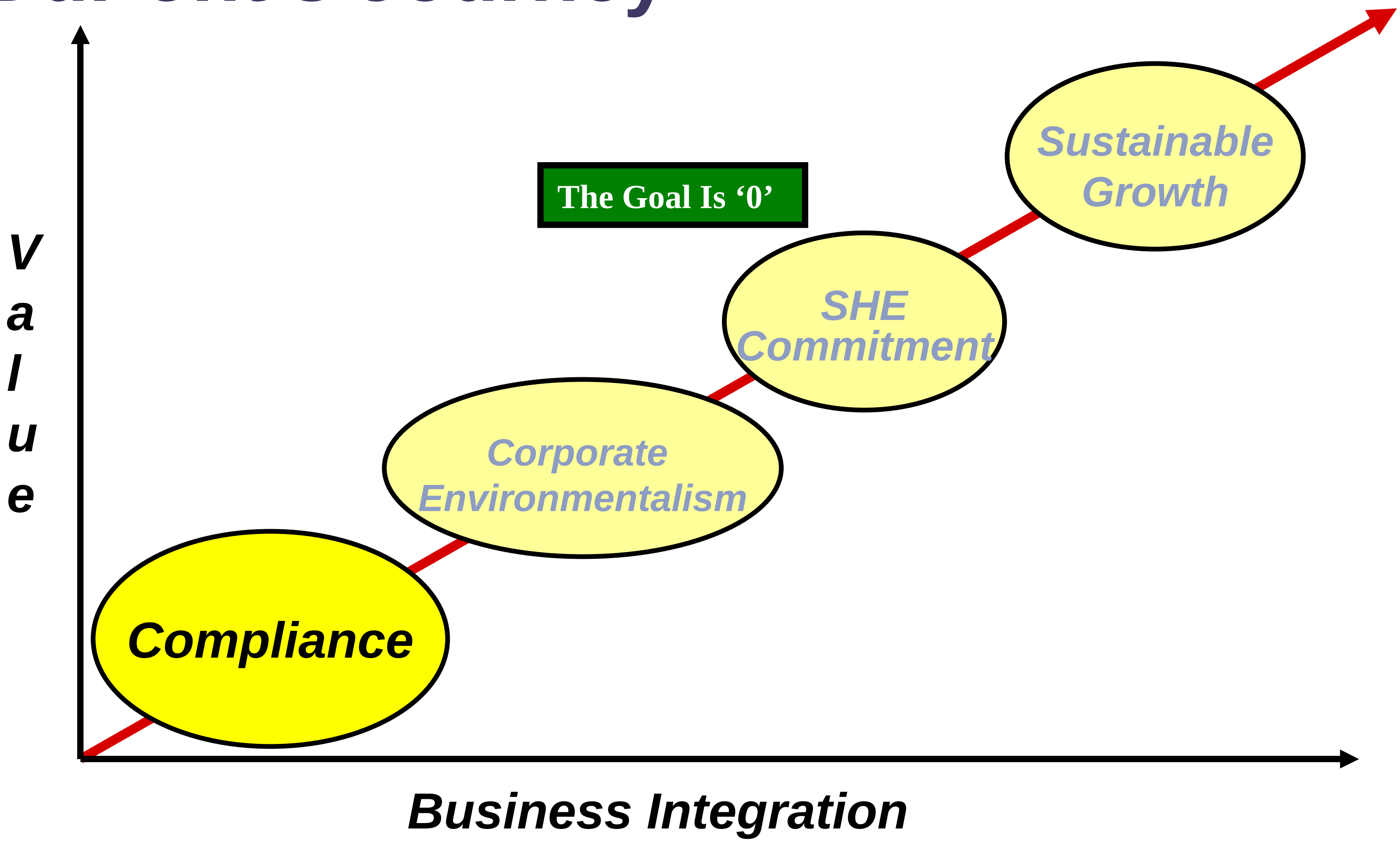
To be the world's most dynamic science company, creating sustainable solutions essential to a better, safer, healthier life for people everywhere.

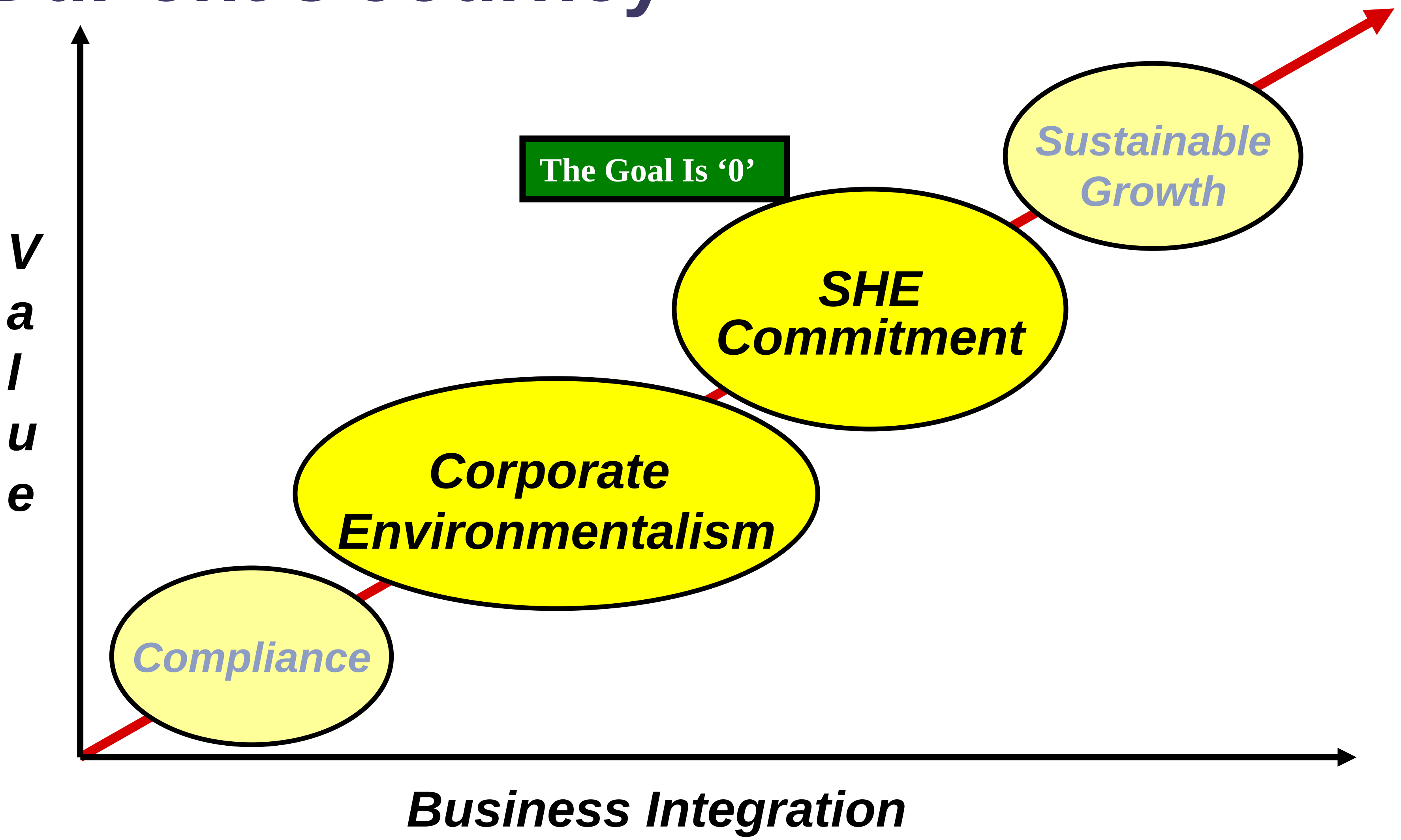
Stakeholders Perception



DuPont's Journey



DuPont's Journey



Progress to Date

Reduced Footprint

	1990 to Present
Safety & Health	World Leader
Major Incidents	90% Reduction
Air Toxics	75% Reduction
Air Carcinogens	92% Reduction
Hazardous Waste (Dry)	44% Reduction
U.S. TRI “Releases”	77% Reduction
GHG Emissions	72% Reduction

Production increased ⇧40% during this period

Reducing DuPont’s Footprint

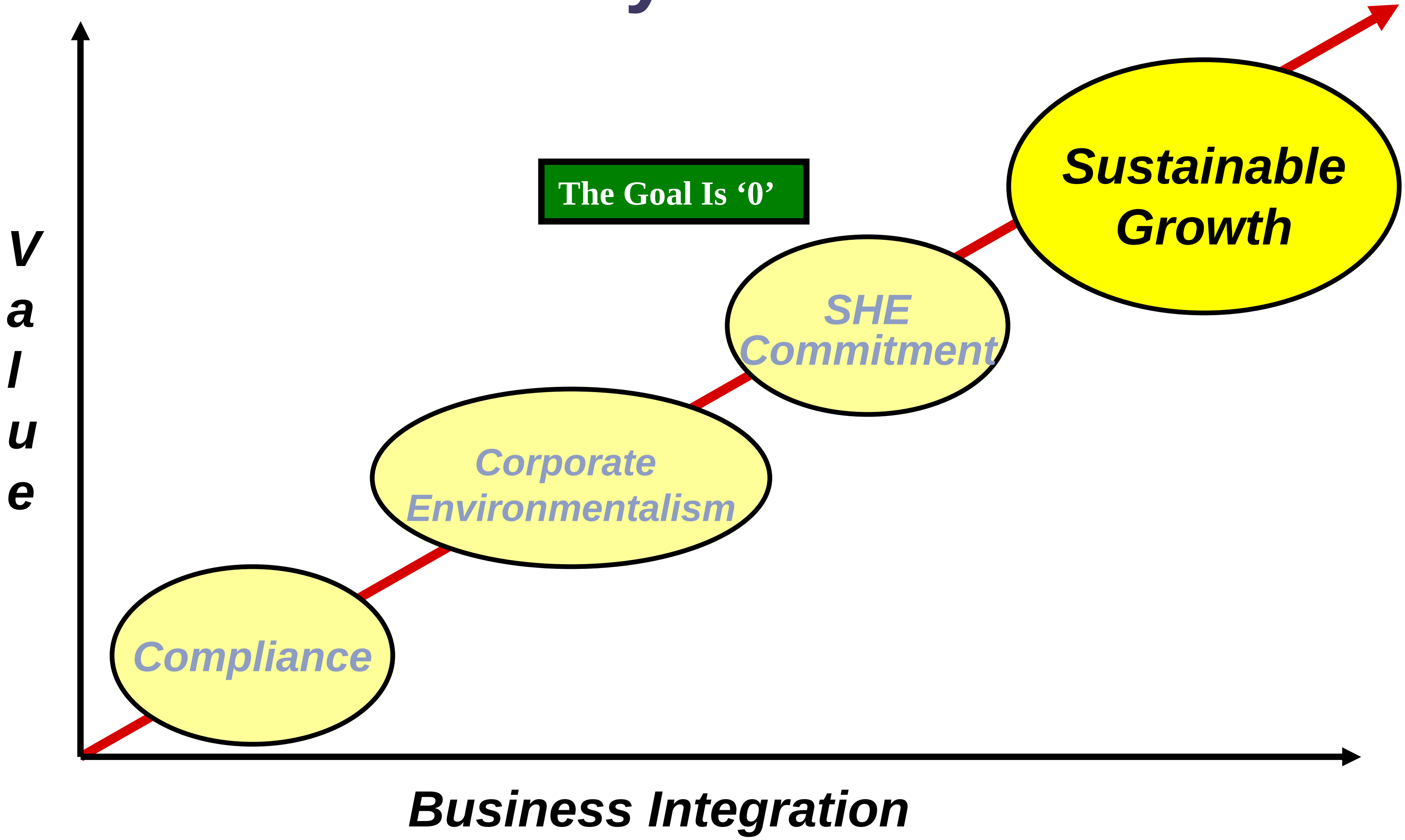
2015 Goals

- Greenhouse Gas Emissions
- Water Conservation
- Fleet Fuel Efficiency
- Air Carcinogens
- Independent Verification

2010 Goals

- Energy flat with 1990 – currently down 7%
- 10% renewable energy at cost competitive with best available fossil fuels – currently around 5.5%

DuPont's Journey



2015 Goals – Serving the Marketplace

- **Environmentally Smart Market Opportunities from R&D Efforts**
- Products that Reduce Greenhouse Gas Emissions
- Revenues from Non-Depletable Resources
- Products that Protect People

Market Opportunities

Tyvek® Housewrap

Nomex® in windmills

Fuel Cells

2015 Goals – Serving the Marketplace

- Environmentally Smart Market Opportunities from R&D Efforts
- Products that Reduce Greenhouse Gas Emissions
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- Products that Protect People

DuPont - BP Biofuels Partnership
Biobutanol Development & Launch

RENEWABLE FEEDSTOCKS

BIOBUTANOL

WORLDWIDE FUEL MARKETS

- **Powerful partnership**
- **Shared commitment**
- **Global reach**
- **Complementary capabilities**

DuPont Refrigerants Vision—
The Science of Cool™





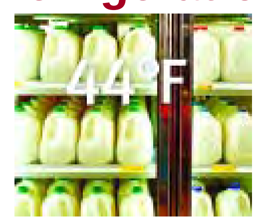

We will use our science and technology, market knowledge and global reach to provide sustainable materials and solutions to enhance personal comfort; enable food preservation; improve industrial processing and reduce environmental footprints.

Next Generation Refrigerants & Cooling Technologies

Mobile A / C

Stationary A / C

Stationary Refrigeration



- **Refrigerant Fluids**
- **Emission Reducing Seal Technologies & System Monitoring**
- **Lubricants & Secondary Fluids**
- **Not in Kind Cooling Technologies**

2015 Goals – Serving the Marketplace

- Environmentally Smart Market Opportunities from R&D Efforts
- Products that Reduce Greenhouse Gas Emissions
- **Revenues from Non-Depletable Resources**
- Products that Protect People

Bio-PDO™ and Sorona® Commercialization

TATE & LYLE

MOHAWK

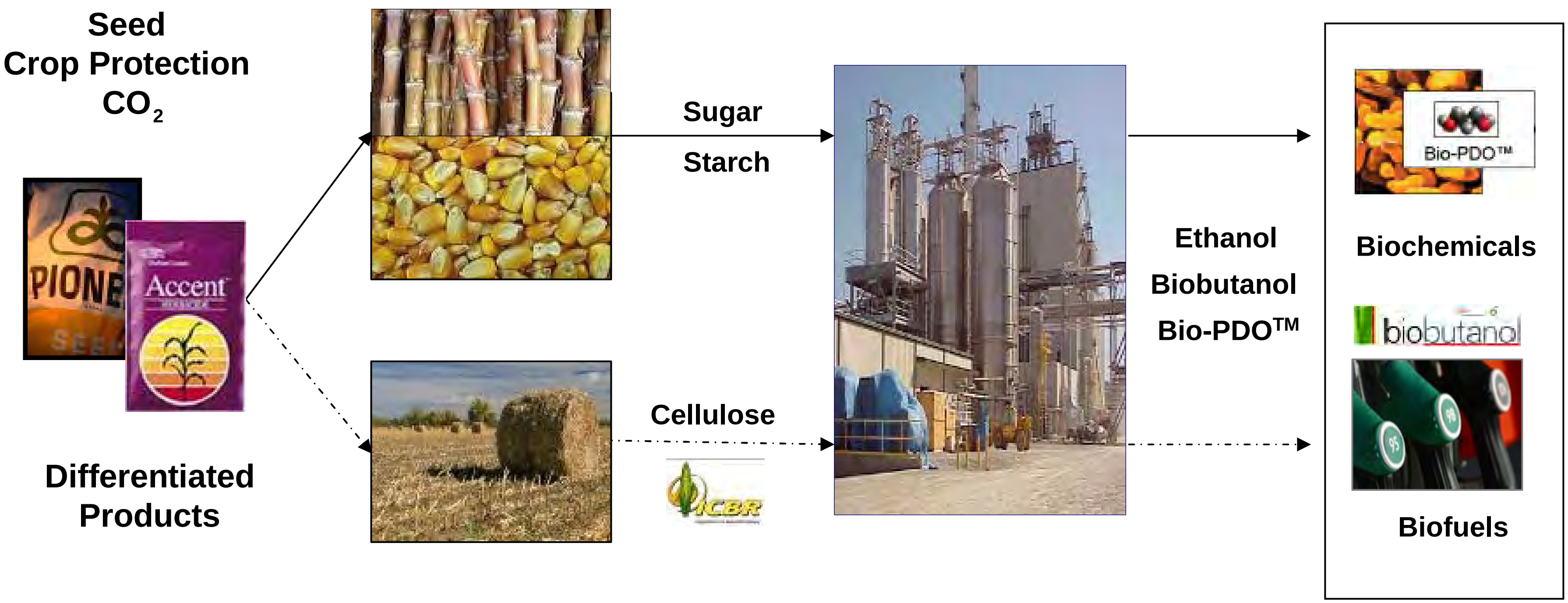
SMARTSTRAND made with DuPont Sorona® polymer

DUPONT

DuPont Biorefinery Value Chain

Carbohydrates to Fuels & Chemicals

Agricultural Inputs → Plant Feedstocks → Conversion to Sugars → Fermentation Processes → Biofuels Biochemicals

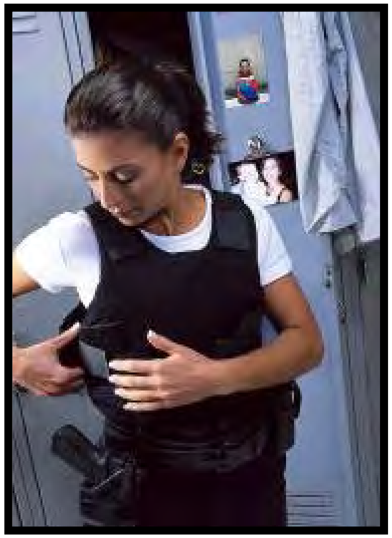


2015 Goals – Serving the Marketplace

- Environmentally Smart Market Opportunities from R&D Efforts
- Products that Reduce Greenhouse Gas Emissions
- Revenues from Non-Depletable Resources
- **Products that Protect People**

Kevlar®

- 40 years of protection
- High-performance auto tires, gloves, chaps and helmets
- Has saved the lives of 3,000 police and security officers



DU PONT®

The miracles of science™

Attachment 3
Role of Sustainability in Remediation and Sustainability Estimation Tool

DuPont's Work on Sustainability in Remediation

David Ellis
DuPont Engineering

Brandt Butler
URS Diamond

November 13, 2006

Why Did DuPont Invite You Here Today?

- To address the question: “How might we make better remediation decisions that include the sustainability perspective?”
- To learn from different perspectives and experiences
- To enlist your help
- To learn from different perspectives
- To learn what others are doing in this area

Discussion Structure

The Case for Remediation Sustainability – Dave Ellis

Remediation Sustainability – Brandt Butler

- Methodology
- Examples
- Site X

DuPont's Path Forward – Dave Ellis

Open Discussion

Some Observations on Cleanups

Cleanups consume large amounts of money, time, and resources and accomplish little risk reduction

Few cleanup technologies work. Those do not work in a lot of places

Science tells us that cleanup rates are limited by diffusion and desorption, some cleanups take centuries

Cleanups emit CO_2 and other greenhouse gasses, send a lot of material to landfills, occupy substantial number of worker hours, etc., etc…

Dirt is constantly being buried and permanently lost in landfills. Why?

Surely we can do better!

DUPONT

Sustainability and Cleanup Methods

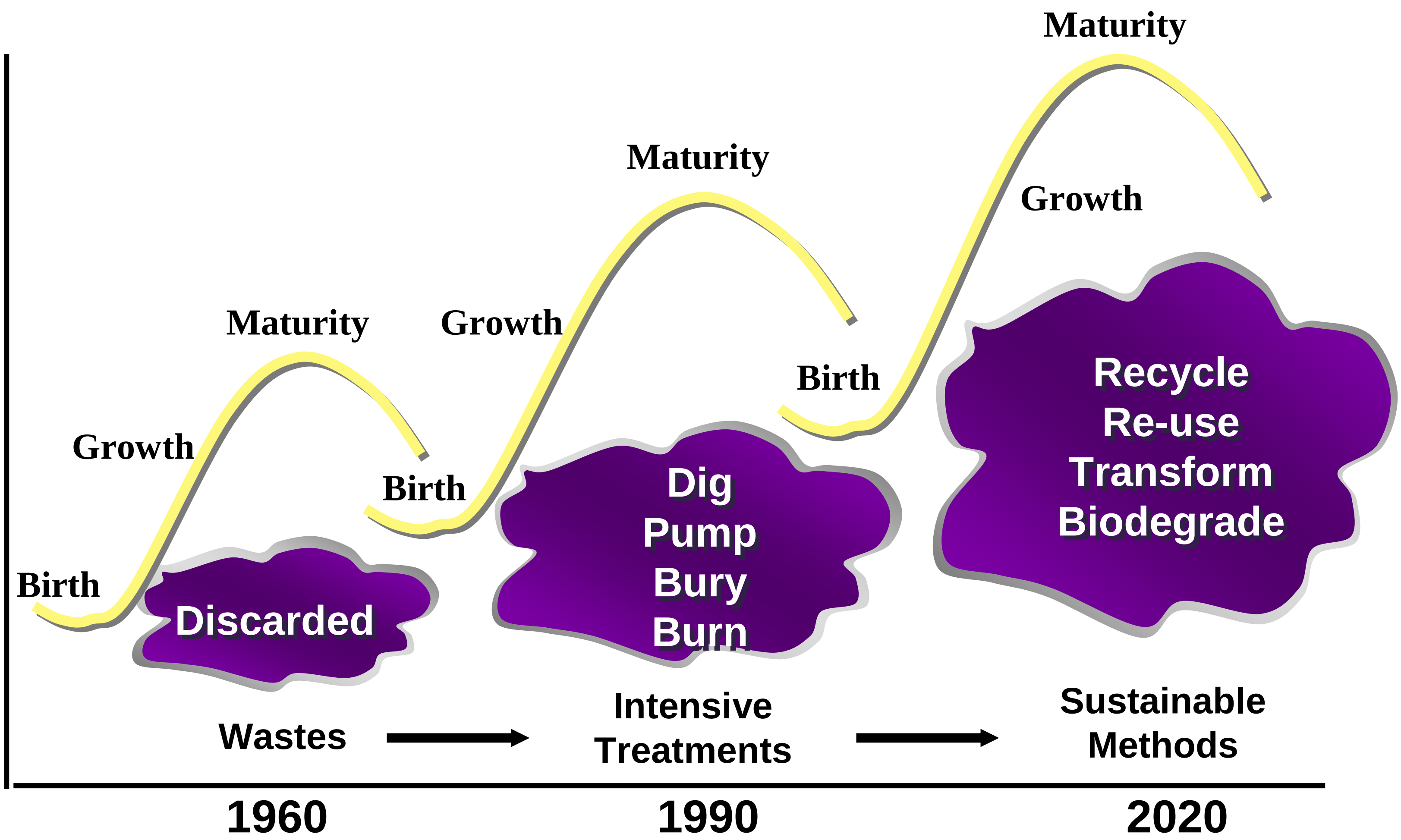
DuPont is trying to learn how we can connect sustainability and remediation

If a cleanup will take centuries, DuPont wants to be certain to use the most sustainable methods we can identify, and suggests that more sustainable cleanup methods should be given priority.

Selecting a sustainable remedy considers: protecting HH&E, global warming, recycling, resource preservation, waste generation, safety, etc…

However, without a common language or system of measurement, these claims will be confusing.

How Can We Transform Our Thought Process?



DuPont's Earlier Sustainability Actions

We emphasized using recycled materials to build remedies

We substituted wastes for reagents in building cleanups

Three examples which won awards:

- Ferdula, NY – Wind powered remediation
- East Chicago, IN – slag to clean up arsenic
- Newport, DE – iron grinding chips, gypsum from WWT

Wind Powered Remediation

A 30’ x 2,200’ trench with 43,000 tons of slag cleans up arsenic

The finished cleanup
No moving parts, no arsenic


Magnesite
Scrap iron
WWT
Gypsum
Sand
Newport, DE:
Waste materials ready to mix

Newport, DE - The finished remediation

Sustainable Remediation Principles

Our working concepts:

DuPont, in fulfilling its obligation to remediate sites to be protective of human health and the environment will embrace sustainable approaches to remediation that provide a net benefit to the environment.

To the extent possible, these approaches will:

- Minimize or eliminate energy consumption or the consumption of other natural resources;
- Reduce or eliminate releases to the environment, especially to the air
- Harness or mimic a natural process;
- Result in the reuse or recycling of land or otherwise undesirable materials.

Two Characteristics Types of Sustainable Remedies

Remedies that permanently eliminate a contaminant from soil, water, air volumes, e.g.

- **Soil washing**
- **Oxidation/reduction**
- **Biodegradation**

Remedies that provide other "green" benefits relative to other remedies, e.g.

- **Lower CO_2 production**
- **Use renewable resources**
- **Designed and operated to optimize long-term net environmental benefits**

These approaches are not mutually exclusive

Thinking Differently About Cleanups

Similar to life cycle analysis

Understand each major task

Define the major inputs and outputs

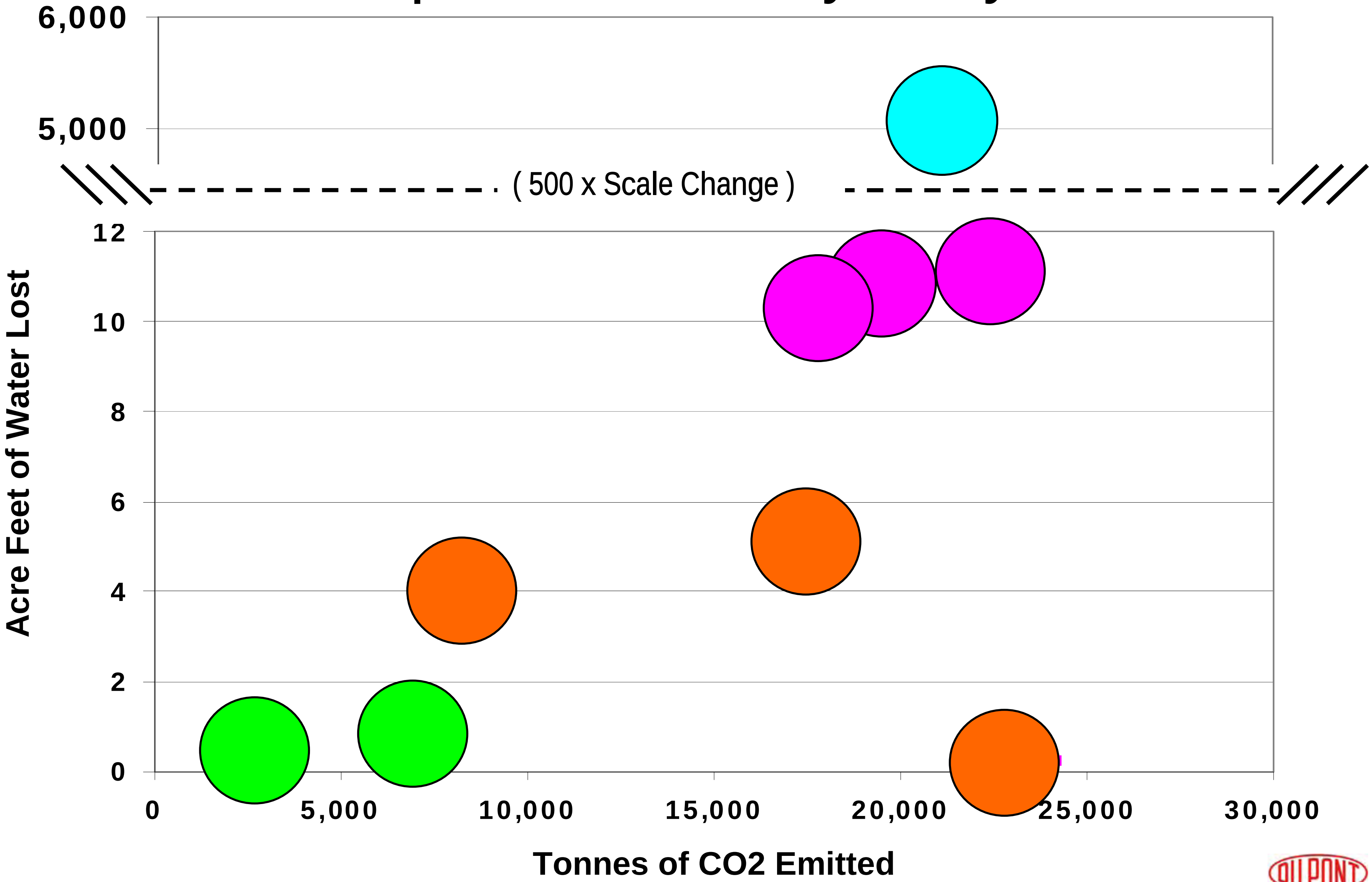
Think resources instead of contaminants

Sum up those you can identify

Don’t over analyze – it’s dark underground

The process of thinking differently changes perspectives and leads to less expensive yet more effective solutions

Example Sustainability Analysis



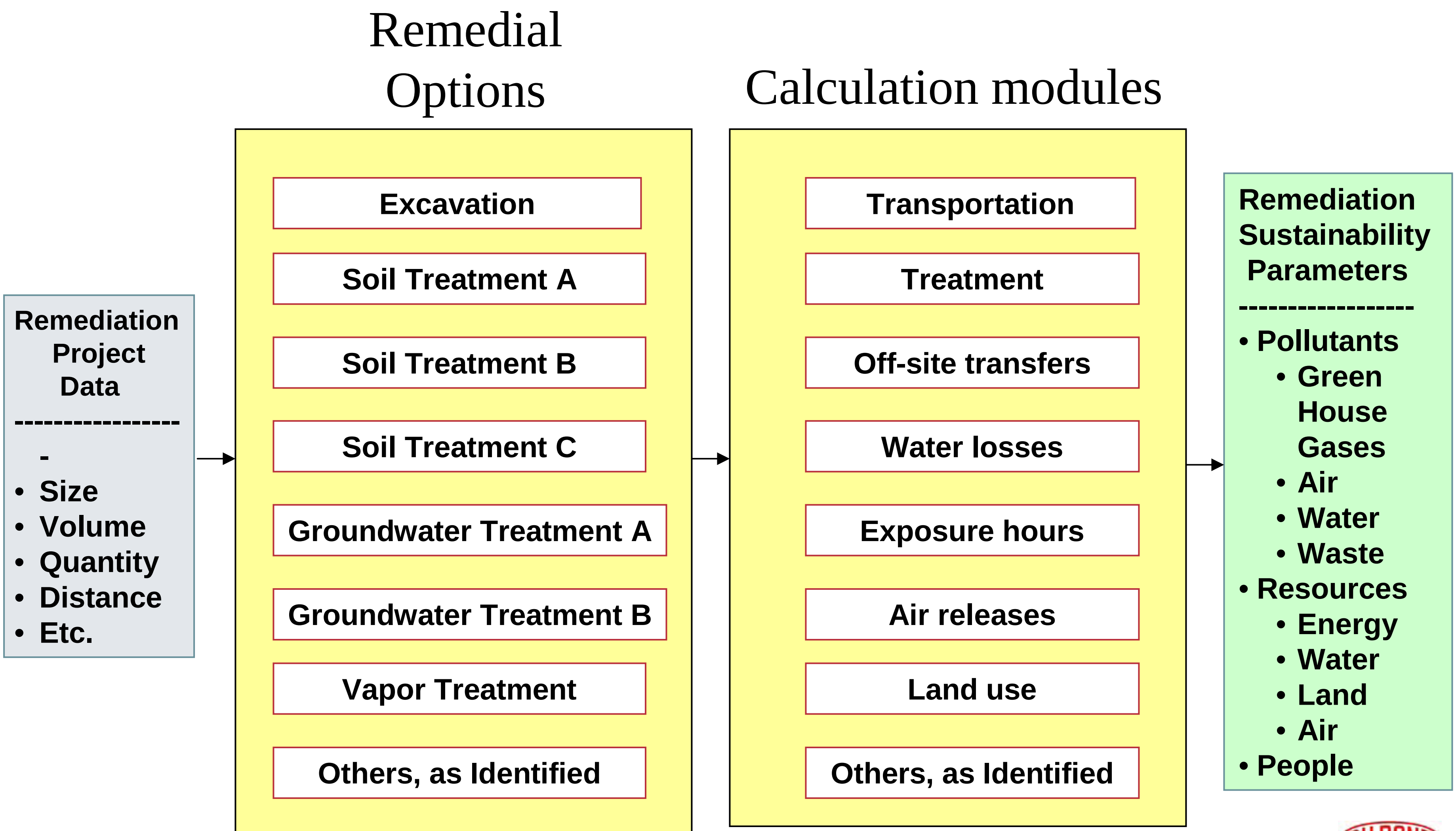
Conceptual Framework

Evaluation Methodology

Site Assessments

Hypothetical Site X

Conceptual Framework for Sustainability Analysis



Creating the Modules

- **Is there an existing evaluation for a similar process?**

- **Revise or create new module(s) by revisiting assumptions and calculations**
  - Different processes
  - Better understanding of actions or assessment factors
  - Data sources: EPA (AP-42), state websites, Google!

- **Peer-review with URS team and CRG support**

Sustainability Measurements

Natural Resources

- Energy
- Treatment Materials
- Water
- Land

Pollutants

- CO_2 (Fuel and degradation)
- NOx, SOx, VOCs, PM-10
- Water discharges
- Hazardous and Non-hazardous Waste

Exposure Hours

- Contractors
- Oversight

Sites and Remedy Evaluations Completed

Landfill Leachate

- Offsite GW Disposal
- Spray Irrigation
- Wetland

Soil Stabilization

- Dig & Haul
- Ex-Situ Treatment
- Capping

Bioremediation

- Pump and Treat
- Bio-stimulation

Example Sustainability Assessment: Managing Landfill Leachate

Former industrial landfill
- 13 hectare
- Soil cap, grass
- 200 m^3/yr leachate

Current off-site disposal
- Leachate collection
- Every two weeks
- Transport (640 km)
- Disposal at POTW

Alternate technologies
- Constructed wetland
- Spray irrigation

Landfill Technology Assessment

Technology	Energy Consumption	Resource Use	Releases to Environment
Off-site disposal	• Transportation - Disposal • Electricity - Pumping - Disposal	• Diesel fuel	• Carbon dioxide • Mobile-source pollutants • Fixed-source (electricity) pollutants
Constructed wetlands	• Construction - Holding cell - Wetlands • Electricity - Pumping	• Diesel fuel • Soil for holding cell	• Carbon dioxide (fuel less fixation) • Mobile-source construction equipment pollutants • Fixed-source (electricity) pollutants
Spray irrigation	• Construction - Holding cell - Spray field • Electricity - Pumping	• Diesel fuel • Soil	• Carbon dioxide (fuel less fixation) • Mobile-source construction equipment pollutants • Fixed-source (electricity) pollutants

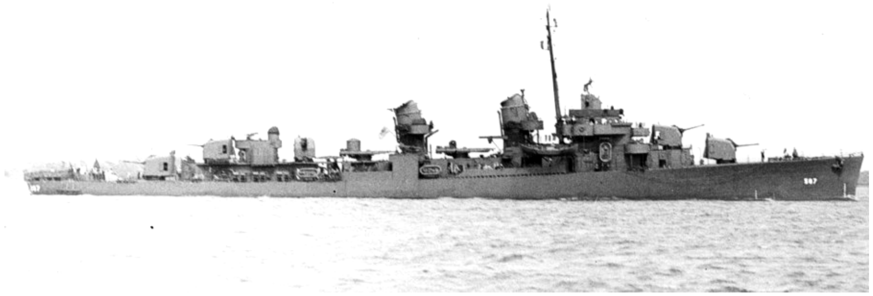
Landfill Sustainability Metrics

Sustainability Metric	Offsite GW Disposal	Wetland	Spray Irrigation
Energy			
Fuel (GJ)	(46,222)	(439)	(439)
Resources			
H_2O (cubic meters)	(5,734)	0	0
Land (hectare)	0	0	0
Releases			
CO_2 (ton)	610	(2,859)	(2,826)
NOx (ton)	97.3	1.6	1.7
SOx (ton)	8.4	0.1	0.1
VOCs (ton)	0.0	0.4	0.4
PM-10 Fugitive (ton)	748	0.4	0.4
PM-10 Combustion (ton)	7	0.1	0.1
Sludge (ton)	(0.1)	0.0	0.0
Exposure Hours	25000	2300	2300

Equivalents of the Landfill CO_2 Reduction

2,500 round trips to Europe

5,827,000 miles in Dave'sZ4



Smelt 2,800 tons of Steel for a WW II Destroyer

Assessing Sustainability – Hypothetical Site X

Site Characteristics

- 0.5 Acre of BETX - 10 ft deep
- Groundwater elevation 2 ft BGS
- Soil hydraulic conductivity = 10^{-3} cm/sec
- GW Disposal – 1 well - 500 gpd
- BETX: 500 mg/kg treat to 50 mg/kg
- Transportation: Landfill and GW disposal, 100 mile RT
- Treatment: 0.5 lb/lb of BETX via geoprobe every other year for 5 years
- Source Biotreatment with geoprobe injection (4 per treatment)

Technologies

- Offsite Groundwater Disposal
- Source Removal
- Source Biotreatment

Offsite Groundwater Disposal

Natural Resources

- Energy
  - Install Wells
  - Pump GW
  - Disposal GW
- Water

Pollutants

- CO_2 (Fuel and degradation)
- NOx, SOx, VOCs, PM-10

Exposure Hours

- Contractors
- Oversight

Source Removal

Natural Resources

- Energy
  - Excavation
  - Hauling (Disposal and Backfill)
  - Support Equipment

Pollutants

- CO_2 (Fuel)
- NOx, SOx, VOCs, PM-10
- Non-Hazardous Waste

Exposure Hours

- Contractors
- Oversight

Source Biotreatment

Natural Resources

- Energy
  - Mob/demob (People, equipment, treatment materials)
  - Inject Treatment Materials
- Water

Pollutants

- CO_2 (Fuel and Degradation)
- NOx, SOx, VOCs, PM-10

Exposure Hour

- Contractors
- Oversight

Microsoft Excel - Site X_Demo_2006_10_29_v2.xls

Sustainability Measures	Offsite GW Disposal	Source Removal	Source Biotreatment
Net			
CO_2 (ton)	0	0	0
H_2O (ac-ft)	0.00	0.00	0.00
Land (ac)	0.00	0.00	0.00
Sludge (ton)	0.00	0.00	0.00
NOx (ton)	0.00	0.00	0.00
SOx (ton)	0.00	0.00	0.00
VOCs (ton)	0.00	0.00	0.00
PM-10 (ton)	0.00	0.00	0.00
Fuel (MMbtu)	0	0	0
Non-Hazardous Waste (ton)	0	0	0
Treatment Materials (gal)	0	0	0
Pollutant Remediation (lb/yr)	0	0	0
Exposure Hour (hr)	0	0	0
Credit			
CO_2 (ton)	0	0	0
H_2O (ac-ft)	0.00	0.00	0.00
Land (ac)	0.00	0.00	0.00
Debit			
CO_2 (ton)	0	0	0
NOx (ton)	0.00	0.00	0.00
SOx (ton)	0.00	0.00	0.00
VOCs (ton)	0.00	0.00	0.00
PM-10 Fugitive Particulates (ton)	0.00	0.00	0.00
PM-10 Combustion Particulates (ton)	0.00	0.00	0.00
H_2O (ac-ft)	0.00	0.00	0.00
Land (ac)	0.00	0.00	0.00
Non-Hazardous Waste (ton)	0.00	0	0.00
Other Factor			
Sludge (ton)	0	0	0
Fuel (MMbtu)	0	0	0
Treatment Materials (gal)	0	0	0
Pollutant Remediation (lb/yr)	0	0	0
Exposure Hour (hr)	0	0	0
Backfill Soil (cy)	0	0	0

Site X / Offsite GW Disposal / Source Removal / Source Biotreatment

Microsoft Excel - Site X_Demo_2006_10_29_v2.xls

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Remediation Specifics

Row	Site (ac)	Lifetime (yr)	Transportation (mi)	Transport (MPG)	GW Volume (ac-ft/yr)	Travel Time (hr/lifetime)
2	**0.50**	30.00	100.00	4.00	0.56	3650.00

Row	Disposal (trip/yr)	Speed (MPH)	Wells (#)	Well Installation (hr/well)	Fuel Consumption Rate for Drill (GPH)	GW Volume (gal/day)
4	36.50	30.00	**1.00**	10.00	7.93	**500.00**

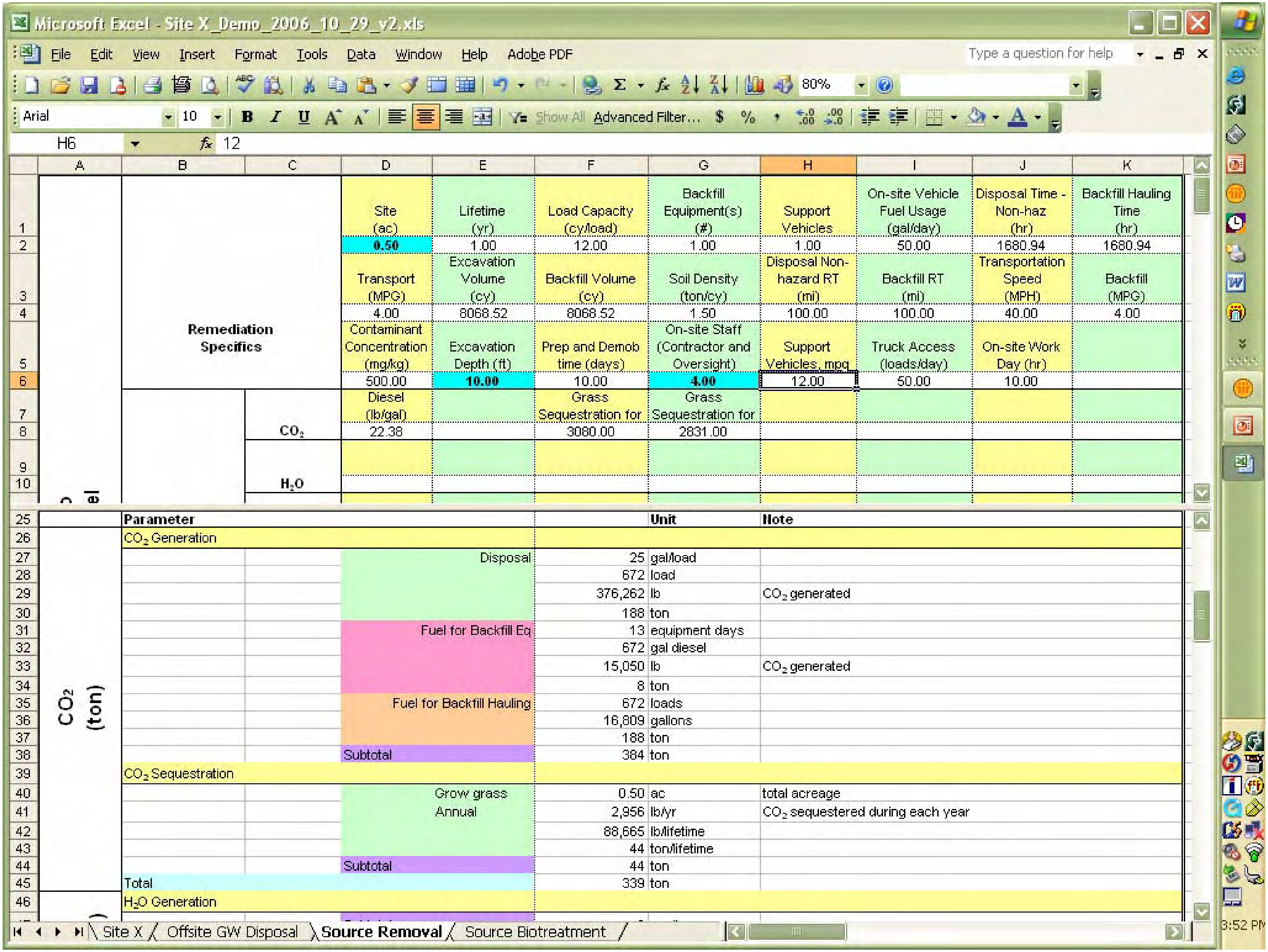
Row	Disposal Volume (gal/ship)	On-site Staff (Contractor and Oversight)	Prep and Demob time (days)	On-site Work Day (hr)	Soil Conc. (mg/kg)	
6	5000.00	**3.00**	1.00	10.00	500.00	

Row		Diesel (lb/gal)	Electricity (lb/kwh)	Grass Sequestration for Growing Season (lb/ac/season)	Grass Sequestration for Dormant Season (lb/ac/season)		
8	**CO_2**	22.38	1.68	3080.00	2831.00		

Row		Parameter			Unit	Note
26	CO_2 (ton)	CO_2 Generation				
27			Disposal	100	mi	
28				3,650	mi/yr	
29				913	gal/yr	
30				20,425	lb/yr	22.384 CO_2 lb/gal for Diesel
31				612,762	lb/lifetime	CO_2 generated for 5 years
32				306	ton/lifetime	
33			Drilling	10	hr	
34				79	gal	http://www.nsf.gov/pubs/stis1993/opp
35				0.9	ton	
36			Pumping	80.4	BTU/day	500 gpd, 15 ft
37				8.6	kwh/yr	
38				0.217	ton/lifetime	
39			Subtotal	307	ton	http://www.eia.doe.gov/oiaf/1605/factc
40		CO_2 Sequestration				
41			Grow grass	0.50	ac	total acreage
42			Annual	2,956	lb/yr	CO_2 sequestered during each year
43				88,665	lb/lifetime	CO_2 sequestered for 5 years
44				44	ton/lifetime	
45			Subtotal	44	ton	
46		Total		263	ton	
47		H_2O Generation				
48			Subtotal	0	ac-ft	
49		H_2O Consumption				

Site X | **Offsite GW Disposal** | Source Removal | Source Biotreatment

3:50 PM



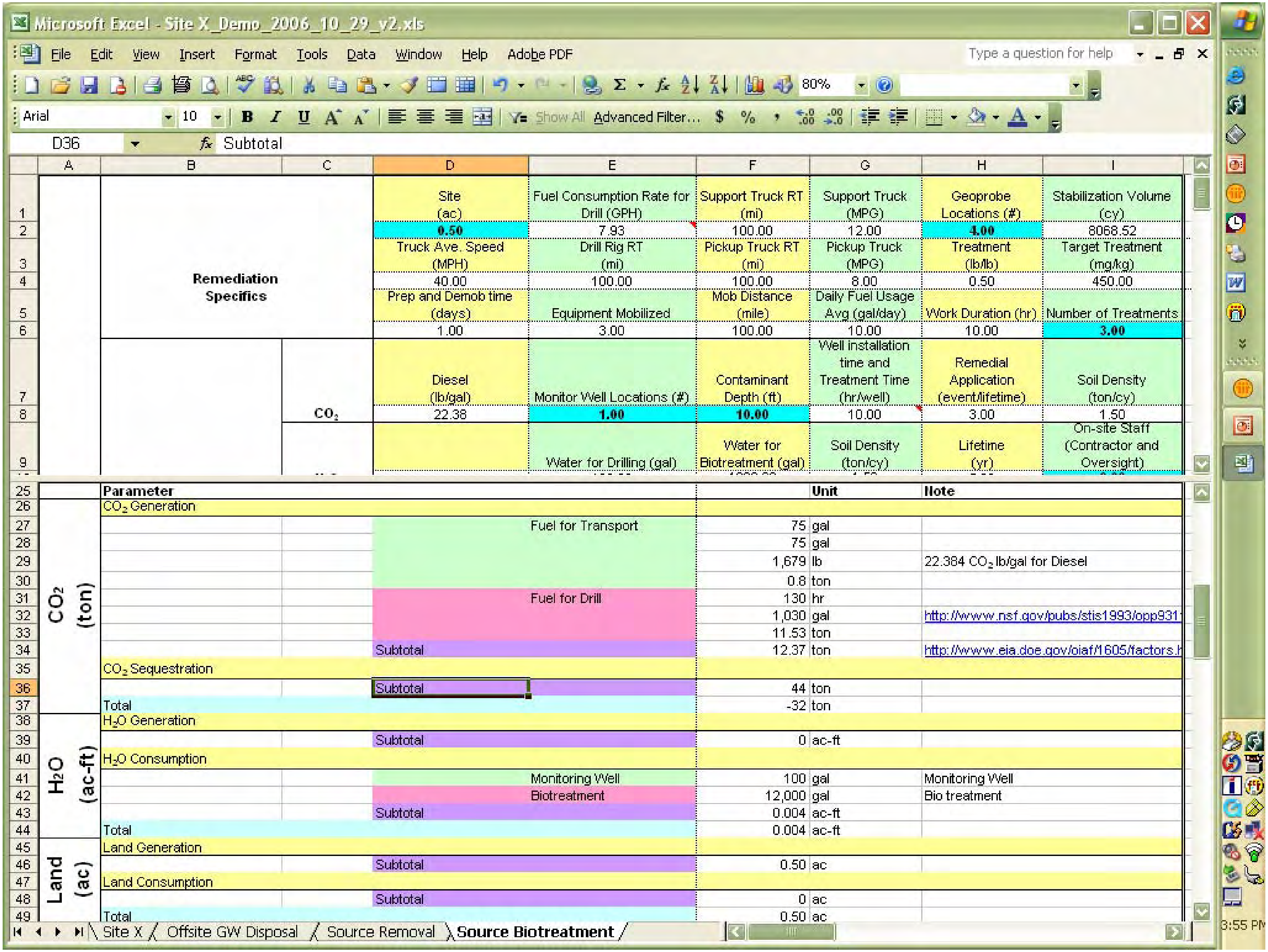
Microsoft Excel - Site X_Demo_2006_10_29_v2.xls

H6 fx 12

	A	B	C	D	E	F	G	H	I	J	K
1		Remediation Specifics		Site (ac)	Lifetime (yr)	Load Capacity (cy/load)	Backfill Equipment(s) (#)	Support Vehicles	On-site Vehicle Fuel Usage (gal/day)	Disposal Time - Non-haz (hr)	Backfill Hauling Time (hr)
2				0.50	1.00	12.00	1.00	1.00	50.00	1680.94	1680.94
3				Transport (MPG)	Excavation Volume (cy)	Backfill Volume (cy)	Soil Density (ton/cy)	Disposal Non-hazard RT (mi)	Backfill RT (mi)	Transportation Speed (MPH)	Backfill (MPG)
4				4.00	8068.52	8068.52	1.50	100.00	100.00	40.00	4.00
5				Contaminant Concentration (mg/kg)	Excavation Depth (ft)	Prep and Demob time (days)	On-site Staff (Contractor and Oversight)	Support Vehicles, mpg	Truck Access (loads/day)	On-site Work Day (hr)	
6				500.00	10.00	10.00	4.00	12.00	50.00	10.00	
7				Diesel (lb/gal)		Grass Sequestration for	Grass Sequestration for				
8			CO_2	22.38		3080.00	2831.00				
9											
10			H_2O								

	A	B	C	D	F	G	H
25		Parameter				Unit	Note
26	CO_2 (ton)	CO_2 Generation					
27				Disposal	25	gal/load	
28					672	load	
29					376,262	lb	CO_2 generated
30					188	ton	
31				Fuel for Backfill Eq	13	equipment days	
32					672	gal diesel	
33					15,050	lb	CO_2 generated
34					8	ton	
35				Fuel for Backfill Hauling	672	loads	
36					16,809	gallons	
37					188	ton	
38				Subtotal	384	ton	
39		CO_2 Sequestration					
40				Grow grass	0.50	ac	total acreage
41				Annual	2,956	lb/yr	CO_2 sequestered during each year
42					88,665	lb/lifetime	
43					44	ton/lifetime	
44				Subtotal	44	ton	
45		Total			339	ton	
46		H_2O Generation					

Site X / Offsite GW Disposal / Source Removal / Source Biotreatment



Microsoft Excel - Site X_Demo_2006_10_29_v2.xls

D36 | Subtotal

Row	B	C	D	E	F	G	H	I
1	Remediation Specifics		Site (ac)	Fuel Consumption Rate for Drill (GPH)	Support Truck RT (mi)	Support Truck (MPG)	Geoprobe Locations (#)	Stabilization Volume (cy)
2			0.50	7.93	100.00	12.00	4.00	8068.52
3			Truck Ave. Speed (MPH)	Drill Rig RT (mi)	Pickup Truck RT (mi)	Pickup Truck (MPG)	Treatment (lb/lb)	Target Treatment (mg/kg)
4			40.00	100.00	100.00	8.00	0.50	450.00
5			Prep and Demob time (days)	Equipment Mobilized	Mob Distance (mile)	Daily Fuel Usage Avg (gal/day)	Work Duration (hr)	Number of Treatments
6			1.00	3.00	100.00	10.00	10.00	3.00
7			Diesel (lb/gal)	Monitor Well Locations (#)	Contaminant Depth (ft)	Well installation time and Treatment Time (hr/well)	Remedial Application (event/lifetime)	Soil Density (ton/cy)
8		CO_2	22.38	1.00	10.00	10.00	3.00	1.50
9				Water for Drilling (gal)	Water for Biotreatment (gal)	Soil Density (ton/cy)	Lifetime (yr)	On-site Staff (Contractor and Oversight)

	A	Parameter			Unit	Note
25		Parameter			Unit	Note
26	CO_2 (ton)	CO_2 Generation				
27			Fuel for Transport	75	gal	
28				75	gal	
29				1,679	lb	22.384 CO_2 lb/gal for Diesel
30				0.8	ton	
31			Fuel for Drill	130	hr	
32				1,030	gal	http://www.nsf.gov/pubs/stis1993/opp931
33				11.53	ton	
34			Subtotal	12.37	ton	http://www.eia.doe.gov/oiaf/1605/factors.h
35		CO_2 Sequestration				
36			Subtotal	44	ton	
37		Total		-32	ton	
38	H_2O (ac-ft)	H_2O Generation				
39			Subtotal	0	ac-ft	
40		H_2O Consumption				
41			Monitoring Well	100	gal	Monitoring Well
42			Biotreatment	12,000	gal	Bio treatment
43			Subtotal	0.004	ac-ft	
44		Total		0.004	ac-ft	
45	Land (ac)	Land Generation				
46			Subtotal	0.50	ac	
47		Land Consumption				
48			Subtotal	0	ac	
49		Total		0.50	ac	

Site X / Offsite GW Disposal / Source Removal / Source Biotreatment

Microsoft Excel - Site X_Demo_2006_10_29_v2.xls

Sustainability Measures	Offsite GW Disposal	Source Removal	Source Biotreatment
Net			
CO_2 (ton)	263	339	(32)
H_2O (ac-ft)	(16.87)	0.00	0.00
Land (ac)	0.00	0.50	0.50
Sludge (ton)	0.00	0.00	0.00
NOx (ton)	8.41	10.50	0.34
SOx (ton)	0.73	0.91	0.03
VOCs (ton)	0.08	0.70	0.00
PM-10 (ton)	0.59	0.74	0.03
Fuel (MMbtu)	3,797	4,756	153
Non-Hazardous Waste (ton)	0	12,103	0
Treatment Materials (gal)	0	0	5,446
Pollutant Remediation (lb/yr)	458	12,103	2,179
Exposure Hour (hr)	3,710	4,300	0
Credit			
CO_2 (ton)	44	44	44
H_2O (ac-ft)	0.00	0.00	0.00
Land (ac)	0.00	0.50	0.50
Debit			
CO_2 (ton)	307	384	12
NOx (ton)	8.41	10.50	0.34
SOx (ton)	0.73	0.91	0.03
VOCs (ton)	0.08	0.70	0.00
PM-10 Fugitive Particulates (ton)	0.00	0.00	0.00
PM-10 Combustion Particulates (ton)	0.59	0.72	0.03
H_2O (ac-ft)	16.87	0.00	0.00
Land (ac)	0.00	0.00	0.00
Non-Hazardous Waste (ton)	0.00	12,103	0.00
Other Factor			
Sludge (ton)	0	0	0
Fuel (MMbtu)	3,797	4,756	153
Treatment Materials (gal)	0	0	5,446
Pollutant Remediation (lb/yr)	458	12,103	2,179
Exposure Hour (hr)	3,710	4,300	0
Backfill Soil (cy)	0	8,069	0

Site X / Offsite GW Disposal / Source Removal / Source Biotreatment

Path Forward

DuPont's 2007 Plans for Sustainability

Conduct sustainability evaluations as part of every 2007 feasibility study

Track sustainability assessments to understand the level of effort necessary and that the necessary tools are being created and used

Track remedies we select to understand the impact of sustainability analysis

Continually adjust our strategies

Engage the outside world

Making Remediation Decisions

	Safety	Risk Reduction	Regulatory	Public Relations	Business Risks	Technical	Implement-ation Cost	Sustainability
General Objectives:	Minimize H&S exposure	Protect human health and the environment	Control off-site COC migration, plume stability	Maintain positive relationships	Eliminate / minimize	Long-term effectiveness no O&M	Minimize Cost	Net Benefit to the Environment
Option A								
Monitoring	Minimal exposure	Likely not acceptable long-term	Does not control migration or stability	May be viewed as not responsive to problem	No immediate impact, business risk may increase	Not effective in reducing mobility, toxicity or volume		CO_2 emissions minor
Option B								
Downgradient Control	Some exposure during installation and operation	Acceptable at POE short and long-term	Plume migration control, may not control stability	Highly visible, may have postive short-term results	Positive impact, off-site migration is curtailed	Reduces mobility, toxicity, not volume		CO_2 emissions 8,500 tons, minor recycling
Option C								
Source Control	Some exposure during installation and operation	Acceptable throughout long-term	May have longer-term effect on migration and stability	Highly visible, results may be longer-term	Longer-term, positive impact on business risk	Reduces mobility, toxicity and volume		CO_2 emissions 50,000 tons, significant landfilling

What Is DuPont Planning to Do?

Pursue a sustainable remediation program

Develop internal methods and standards

Engage external customers and stakeholders, including regulatory agencies and other companies

Measure our performance

Recycle land

Open Discussion