WORLD FEDERATION OF ENGINEERING ORGANIZATIONS

- Committee on Capacity Building
- Committee on Energy
- Committee on Engineering and Environment

ICSU

Summary Report

United Nations Commission on Sustainable Development Meeting No. 19

New York, New York May 2-13, 2011

May 6, 2011 UN-CSD 19 Side Event

Organized by the Scientific and Technological Major Group

Title: Capacity Building: Words Into Action 2010

'State of the Art Innovative and Sustainable Technologies in Waste Management, Mining, Transport and Chemicals'

Introduction

This 90 minute event, which was jointly organized by the World Federation of Engineering Organizations (WFEO) and the International Council for Science (acronym ICSU), consisted of three excellent presentations from three prominent speakers, followed by questions and answers and a general discussion. There were over 30 participants from several countries and included government officials as well as representatives from non-government organizations, either at national or international levels.

This event is part of a continuing strategy of the Scientific and Technological Major Group to build awareness and understanding of current United Nations Commission on Sustainable Development (UN-CSD) themes from a scientific, engineering and technology perspective. The Scientific and Technological Major Group intends to continue these workshops and interventions on the subject agendas of the Un-CSD at the international and where feasible, regional meetings.

In the context of this work, WFEO defines capacity building as:

"The building of human, institutional and infrastructure capacity to help societies develop secure, stable and sustainable economies, governments and other institutions through mentoring, training, education, physical projects, the infusion of financial and other resources, and most importantly, the motivation and inspiration of people to improve their lives."

The workshop was facilitated by Mr. Darrel Danyluk, P.Eng., who chairs the Committee on Engineering and the Environment within the World Federation of Engineering Organizations, one of three committees that support the World Federation of Engineering Organizations involvement in the UN-CSD process through the Scientific and Technological Major Group.

The session was opened by Maria-Jesus PRIETO Laffargue, WFEO President from Spain and attended by President Elect Adel Al-Kharafi WFEO President Elect Kuwait. Other key WFEO leadership included Jorge Spitalnik, Vice President WFEO Energy Committee and Chair of the WFEO UN-CSD Taskforce

from Brazil, Dan Clinton, WFEO Capacity Building Committee, USA and Kate Johnson, a member of the WFEO Younger Engineers/Future Leaders Task Group also from the United States.

Additionally, American Association of Engineering Societies (AAES) representatives Jessica Vogel, President, Society of Mining Engineers (SME), Deborah Shields speaker and a member of SME and Michael Sanio, American Society of Civil Engineers, Director Sustainability and International Alliances, AAES International Activities Committee Staff contact and Chris Scarpino, a member of AAES.

This side event focused on new and emerging technologies and technological approaches within the waste management, mining, transport and chemical sectors – the current focus of the United Nations Commission on Sustainable Development. The focus of these technologies is to minimize impacts and increase sustainability.

The educational objectives of the event were:

- Increased awareness of innovative technologies and their application towards meeting the world's sustainability needs in these sectors
- Identification of opportunities to apply these technologies at a regional, country or local level to show how words can be put into action

The objective of the side event was to contribute to the current agenda of CSD-19 by presenting some of the technologies and trends in current subject areas of concern in the context of sustainable development and the reduction of waste.

The three presentations covered solid waste, mining and chemicals. Copies of the presentations are available as electronic files in pdf format (by permission of the presenters) and are included as Appendix A to this report. The organizers wish to thank the presenters for making these available.

The three presenters and their organizations were:

Mr. Keith Watson - Manager, Screening and Evaluation (Soil and Water)

Sustainable Technologies Development Canada

Ms. Deborah Shields – Department of Economics, Colorado State University

Ms. Martina Bianchini - Vice-President EU Government Affairs and Public Policy

Dow Chemical

Summary of Presentations

K. Watson: "Sustainable Solid Waste Management Through Innovative Technologies"

The presentation opened with the following quote:

"Up to 1,000 million tonnes of waste per year are completely unmanaged, wasting resources, jeopardizing public health and harming the environment. Global wastes are predicted by some to

double in the next twenty years. Industrialized nations spend up to US$270 billion per year managing waste, and it is important that these costs are incorporated into the supply chain…"

Governments should create effective solutions to waste management through research, knowledge transfer, valorisation and dissemination.

The mission and mandate of Sustainable Development Technologies Canada (SDTC) was reviewed. SDTC is a policy delivery instrument of the Government of Canada to deliver environmental and economic benefits to Canadians through fostering the development and demonstration of innovative technological solutions that address clean air, water land and climate change.

With respect to solid waste the agency is focusing its efforts to:

- Take effective actions to clear away plastics from the oceans.
- Treat waste as close to the source as possible
- Close materials and nutrient cycles
- Foster methods that encompass environmental sustainability, animal welfare, and food security in partnership with farmers.

The presentation included and introduction to the technologies and strategies the agency is pursuing within these efforts.

D. Shields: Linking Technological Advances in Mining Environmental Management to Sustainability Performance

The presentation began with a discussion of definitions around sustainability and sustainable development. The goal of sustainability with respect to minerals is to maintain the stream of benefits that minerals provide in such a manner that the contribution of the resource is a net positive over the life cycle of mine or field, and product.

The challenge to the mining industry is how to be sustainable material service providers to society, while contributing to sustainable development at all spatial and temporal scales. Innovative and existing technologies and best practices can be applied at each stage to minimize or eliminate negative environmental and social impacts, and increase worker health and safety, helping to ensure that the benefits of mineral production exceed the costs.

The presentation included a review of the environmental issues in the gold mining industry which include acid drainage from mines and heap/tailings and issues and methods to treat these wastes.

Then presentation concluded that integrating and using sustainability as a platform and within the actual planning process for mines was a good practice. As engineers we are evaluating our technology against sustainability development principles. We need to do this before the mining begins, and as part of the mine planning process. Thus our mine planning process comes from a sustainable development platform.

There is also a need to develop a process for the implementation of a new technology to confirm that it will contribute to sustainable development.

M. Bianchini - New Advances in Sound Chemicals Management along the Supply Chain

Sound Management of chemicals is a high priority in global chemical industry. Chemicals have played a central role in the evolution of the concept of sustainable development. Sustainable Chemistry and LCA concepts contribute in this regard.

Chemicals are an important aspect of sustainability

- Chemistry contributes to human development
- Huge volume + inherent toxicity+ exposure = potentially significant environmental and health footprint
- Chemicals and chemistry are embedded in all major industrial processes
- Comprehensive effort by international community since UNCED to address chemical risks

Green chemistry is key enabler to drive sustainable development – and sustainable consumption and production (SCP)

- Process improvements to reduce material and energy intensity
- Product improvements to reduce footprint
- Process and product innovation is already hard wired in chemical industry

The presentation included brief descriptions of a number of technologies developed by Dow Chemicals for water purification as well as addressing energy and climate change:

- Hydrogen flare technology
- Solar power
- The Passive House
- Photovoltaics
- Diesel particulate filters
- CO2 capture
- Innovative propylene oxide process

The presentation concluded with reference to DowProductSafety.com. The company has implemented a policy to identify and manage chemical risks to ensure product safety.

<u>Summary of Questions and Discussion</u>

Following the three presentations there were a number of questions that opened the discussion:

- What waste management technologies exist for those living on less than $2/year?
- How can wastes be used safely as an energy source for the poor?
- The ethics of managing mining sites, the legacy of the past, following closure, what is the responsibility of mine owners?
- How are national governments engaged in Rio+20?
- What is the definition of sustainability, sustainable development?

- How can the Science and Technology Major Group work effectively with member states/national governments meet the challenges of Rio+20 effectively?

The following is a summary of the ensuing discussion.

Eduardo Orteu, Mission of Spain to UN, following CSD and Rio preparations: How can we make many technologies affordable for developing countries? Developed countries want the best technologies for the future, but for less developed countries this is a matter of survival. Affordable technology for people on '2 dollars a day' will be crucial. How can we address the issue of energy requirements for technology in developing countries? I have experiences of bad mining activities, especially with companies leaving problems behind when they finish. How do we address the ethics of mining activities? Also how do the science and technological community perceive the way governments and politicians are dealing with this sustainable development agenda in the lead up to Rio+20? We would like view from non-governmental entities on this.

Martina Bianchini: Dow partners with big NGOs, one on one, but what is needed for Rio+20 is transformative partnerships, which can be replicated, scaled up and scaled down. We have set up a Green Economy task force, which has looked at the Green Economy report, particularly chapters on manufacturing and waste. Keith gave a good overview of what technologies are available. What is lacking in the developing world is infrastructure. Scaling down is therefore particularly important, and is a model suitable for replication. We need to find more ways to have UNEP or governments involved so that we can build transformative partnerships. Opportunities can be hidden. Examination of the whole product life cycle is important - only then can you see all the opportunities. For example, Biolia (?) (waste treatment company) say they can look at the composition of waste, which is different for different countries. These are resources that can be used, but the enabling conditions are not there. It is also important to give attention to social dimensions, for example the working conditions for waste workers, and to all 3 pillars of sustainable development in replicating technologies to places on under 2 dollars a day.

Keith Watson: There is not much energy available in some developing countries. However, for example, the small gasifier unit is self sustaining: the gas produced fuels it, and it perpetuates itself once started. Dealing with waste at location also becomes very important. The same company is looking at the localised treatment of waste water. Dealing with waste products at location, and technology that reuses energy and is self-sustaining is important in isolated locations. Note that this can include ships and islands – as the same principles of isolation are there.

Deborah Shields: We recognise more and more the need for culturally appropriate engineering solutions. What works in Canada may not work in Malawi. It is essential that engineering designs are low energy and low maintenance. Young engineers in academia are very interested in ideas of designing culturally appropriate solutions. This can be promoted and encouraged. In relation to the arc of mining over time, yes, Spain has long legacy of mining, which is not all pretty. The oldest mercury mine in Europe is in Spain, and it is problematic. Older mines were built with a different mindset of how society and natural resources are related. In the past, resources were there to be used. This has evolved to a different understanding, more and more, and certainly in responsible mining companies, they are trying to implement the best technologies to minimise environmental damages and human health. Responsible mining firms are taking a leadership role in educating firms

that do not have as good an understanding of the need for innovative technologies and best practice. In relation to mining legacy sites: many legacy sites were created 100s of years ago. They still need to be cleaned up, but one aspect is that when those sites were originally mined, it was with primitive technologies, so not all resource was extracted, and these can still exist in remaining materials. With thin film technologies, we now have needs for rare earth minerals. Back when lead silver ores were being processed we did not know of the existence, let alone the market for, these materials. They are still there in the smelting and mining waste, so governments are encouraging firms to go back into legacy sites, and they are creating a legal framework in which forms can reprocess ores and do site remediation as part of their contract. The firms make money by gaining ore, and the country gains a clean and regenerated site. This needs changes in legal frameworks, but this is coming, and with new technologies coming forward, we will see significant progress in this.

JingJing Chen: Question on waste management: In the CSD negotiations, some member states tried to insert 'materials management' with 'waste management'. What would you see as a consequence of this, if we really have enlargement of the definition from 'waste management' to include 'materials management'? Also, are technological and scientific mechanisms ready for this enlargement of definition?

Deborah Shields: In discussion, the broadening of the topic from a focus on waste to materials is a shift to a focus on viewing everything in the context of how we can continue to reuse it. This is because we live in a world of finite resources. We no longer have the luxury of throwing things away. Key terminology would be 'life cycle thinking'. Resources and materials are viewed in terms of provision and use, reuse, reprocessing and remanufacturing to bring them back into the system. This signifies a need for changes in legal language about waste. It's a delicate issue in the negotiations, but it is essential to move from talking about 'waste' to talking about 'materials in different stages'.

Keith Watson: The term 'waste' has a connotation that things no longer have a purpose, so a move to a definition of 'materials still with use' is useful. And the technology is ready to welcome this change. My group pick up technology once it comes out of the science community: we take it from the science bench to society as a useful product. We find ways to fund it, and move it into society's general use. This can be done on a policy basis by committing to funding demonstration and development phases.

Darrel Danyluk: Are there technologies that can be used to really improve the system? For climate change and reducing GHGs, 11 country studies were done, and by using technologies you can reduce significantly the emissions. The technology is there, but implementation is not there yet.

Karen Laughlin, US Government Delegation, with US Environmental Protection Agency: Some technologies are available, but the market demand is not there yet. The private sector has learnt a lot about how to help drive demand when a product or technology is available. How has the private sector created a role for itself on driving the uptake of green technologies?

Martina Bianchini: We talk about sustainable production and consumption. My sector focuses on production. In the question of how to influence consumption, where should the influence come from? From business? From governments creating enabling conditions? From educators creating the right public mindset? The challenge is that most consumers still buy on price. They demand better products, but are not prepared to pay more.

Karen Laughlin: If a company has a technology they think they can get consumers to buy, they have a motivation to try to change consumer patterns.

Martina Bianchini: Our business is B to B, we sell building blocks to other sectors. The final products are owned by other sectors. So we cannot go into those sectors and advertise their products, so we need to find new collaborations to generate more awareness of technologies and their use.

Darrel Danyluk: How can scientific and technological community engage for Rio+20? We would love to sit down with member states, and give best available advice one on one and answer specific questions. We have access to worldwide expertise. But in these processes, with 3 minute statements etc, there is not enough time. We need governments to open up the dialogue for us. If you want us to bring together expertise on a subject, we can bring together that expertise. We want to do it, but at present we have to force our information through a small window. Other Major Groups would say the same thing.

Eduardo Orteu: The system does not work, major groups can not engage. We are looking forward to a new procedure for engagement.

Darrel Danyluk: The key message from this session is that key knowledge and technologies exist. They are available. We don't need to do additional research. Dissemination is the key issue.

World Federation of Engineering Organizations - UN-CSD 19 Side Event Delegation

Prepared: May 20, 2011

APPENDIX A

COPIES OF PRESENTATIONS

New Advances in Sound Chemicals Management Along the Supply Chain

Martina Bianchini (mbianchini@dow.com)
Vice President EU Government Affairs and Public Policy
Dow (www.dow.com)

CSD-19 Science and technology Major Group Side Event
New York; May 6, 2011

Sound Management of Chemicals: Agenda 21

Chapter 19 of Agenda 21 under the title of sound management of chemicals proposes six programme areas for action to drive the chemical safety agenda.

The JPOI set the target date of 2020 for ensuring that 'all chemicals are used and produced in ways that lead to the minimization of significant adverse effects on human health and the environment'.

This commitment has led to the Strategic Approach to International Chemicals Management (SAICM) in 2006 to serve as a voluntary global policy framework and platform to engage stakeholders.

Assessment of CSD Review Report Chemicals

- Much done but production accelerates
- Chemical safety low priority in country development plans
- More active engagement of multiple stakeholders needed
- Chemicals have played a central role in the evolution of the concept of sustainable development

Sound Management of chemicals is a high priority in global chemical industry.

Sustainable Production & Consumption: Agenda 21

Chapter 4 proposes the issue of sustainable consumption and production

At the JPOI, all countries agreed for "…changing unsustainable patterns of production and consumption and protecting and managing the natural resource base of economic and social development…".

This commitment has led to the 10 Year Framework of SCP where all countries should take action.

Assessment of CSD Review Report Chemicals

- Much done but absolute production & consumption has accelerated with population growth
- Development exceeds carrying capacity – by all indicators
- more concerted effort needed to delink economic growth from environmental degradation
- A life cycle approach is valuable to understand the interrelations between SP and SC and unintended consequences for sustainable development
- Particular attention is needed to consumption choices where progress is limited
- Concept of Green Economy is gaining wider currency
- Best practices are emerging on energy efficiency, green buildings
- Less is known about the proper mix of measures

Chemicals have played a central role in the evolution of the concept of sustainable development. Sustainable Chemistry and LCA concepts contribute in this regard.

Chemicals and Sustainability

Global Chemical Sales in 2009 was around 2.6 Trillion US $ with 7 M direct and 20 M indirect jobs

Chemicals are an important aspect of sustainability

- Chemistry contributes to human development
- Huge volume + inherent toxicity+ exposure = potentially significant environmental and health footprint
- Chemicals and chemistry are embedded in all major industrial processes
- Comprehensive effort by international community since UNCED to address chemical risks

Green chemistry is key enabler to drive sustainable development – and SCP

- Process improvements to reduce material and energy intensity
- Product improvements to reduce footprint
- Process and product innovation is already hard wired in chemical industry

What We Do

We connect chemistry and innovation with the principles of sustainability to help provide everything from fresh water, food and pharmaceuticals to paints, packaging and personal care products.

We make innovative products and technologies that reduce energy and resource use in the areas of:

- Water treatment
- Health
- Housing and building insulation
- Solutions for fuel-efficient vehicles
- Technology to enable wind power
- Integrating solar systems into building materials
- Responsible operations (measuring ecosystem services)

Water Purification

Description

Dow's water technologies play a critical role in providing clean, safe drinking water to communities worldwide that are affected by water scarcity or unsanitary water supplies.

Sustainability Profile

- Removing harmful matter from groundwater and traces of toxic materials from chemical processing applications
- Reducing need for chemical consumption, protecting natural habitats
- Improving space-efficiency components to decrease overall footprint

Dow's technology treats more than nine billion gallons (36 billion liters) of water every day.

Smart Solutions - Innovations for Tomorrow - Responsible Operations - Partners for Change

FILMTEC™ Reverse Osmosis Membranes

Description

Dow's FILMTEC™ Reverse Osmosis technologies provide safe drinking water through desalination in coastal areas that have limited fresh water resources.

Sustainability Profile

- Reverse Osmosis Elements help make desalination more energy-efficient
- Decreases use of chemicals, protecting local marine habitats with high biological or organic fouling
- Reduces use of materials and GHG emissions
- Committed to reducing the cost of desalination and water reuse 35 percent between 2005 and 2015.

2009 AWARD WINNER ACS Heroes of Chemistry "Impact on Society"

Smart Solutions - Innovations for Tomorrow - Responsible Operations - Partners for Change

Household Waste Water Use

Economic, Social & Environmental Benefits

Dow's Terneuzen, The Netherlands, site uses municipal household waste water

- Re-use of water previously discharged directly to the river
- Used twice at Dow

Sustainability Profile

- Almost 10 million liters of water per day
- 65% less energy than desalinating sea water with the same membrane technology
  - Equal to lowering CO2 emissions by 5,000 tons per year
  - Reduced need of chemical cleaning of membranes

Concept/Technology can be leveraged at any location around the world where industrial and urban areas are adjacent

Dow Committed to Access to Clean Water

Economic, Social & Environmental Benefits

Philanthropy and technology address global need

- 1.2 billion people lack access to clean water
- Partnerships with non-profits WaterHealth International and International Aid
- $30 million in loan guarantees to finance water systems for rural Indian villages
- Supply plastic resin for development of 300,000 HydrAid™Bio-Sand Water Filters for Africa, Central America and Caribbean
- FILMTEC™ reverse osmosis membrane technology
- For industrial and drinking water applications globally

Sustainability Profile

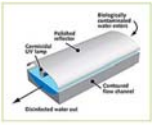
- Financing model brings clean water and economic opportunity to 10 million people without access in rural India
- HydrAid™Bio-Sand Water Filter project gives 2 million people access to clean drinking water in developing areas
- Technology can provide appropriate solutions for specific needs

WaterHealth International

Economic & Social Benefits

Unique Business Model

- Total service, turn key system
- System finance/operation
- Ownership passes to village in 8 years
- Patented, low cost UV technology
- Modular systems serving 2-10 thousand people
- Close working relationship with local NGO & village government



Sustainability Profile

- Affordable water for those earning $2 per day
- Revenue stream sufficient for long term viability
- Innovative use of Dow capital to enable clean drinking water in rural areas

Arsenic Removal

Description

Dow's ADSORBSIA™ titanium-based media removes toxic arsenic from potable water, making it safer to drink.

Sustainability Profile

- Safe and easy waste disposal
- Minimizes chemical storage and usage
- Allows for smaller, less expensive systems and flexible system design
- Handles a wide variety of water conditions
- NSF/ANSI Standard 61 certified
- Meets typical U.S. criteria for disposal in a landfill as non-hazardous waste

Smart Solutions - Innovations for Tomorrow - Responsible Operations - Partners for Change

World Challenge: Energy & Climate Change

CO_2 Capture

ALSTOM

Description

Pilot plant uses proprietary advanced-amine technology jointly developed by Dow and Alstom to capture carbon dioxide from new or existing industrial facilities.

Sustainability Profile

- Carbon capture and sequestration reduces GHG emissions from coal combustion – which represents 40% of world's power generation
- Dow and Alstom's Advanced Amine Process leads the industry in carbon capture
- Pilot plant in West Virginia designed to capture 1,800 tons/year of CO_2
- Large-scale facility in Poland being constructed to capture 1.8 million tons/year of CO_2

Innovative Propylene Oxide Process

Description

Dow and BASF jointly developed the hydrogen peroxide to propylene oxide (HPPO) technology, which significantly reduces waste water, energy and capital over competing technologies.

Sustainability Profile

- Uses hydrogen peroxide and propylene as raw materials
- Produces only propylene oxide and water
- Waste water reduced by 70% to 80%
- Energy use reduced by 35%
- Reduced physical footprint requires up to 25% less capital
- Avoids need for co-product infrastructure and markets

2010 AWARD WINNER U.S. Presidential Green Chemistry Challenge "Greener Synthetic Pathways"

Hydrogen Flare Technology

Description

Patented flare technology saves millions of dollars while reducing greenhouse gas emissions and improving energy efficiency.

Sustainability Profile

- Substitutes hydrogen for more costly methane to eliminate waste gases, reducing costs and GHG emissions.
- Enables Dow to apply for voluntary carbon credits, a driving force for implementing the technology.
- Two sites implementing the technology have combined emissions reduction potential of 27,000 MT/Year and saving more than $10 million over the next 10 years.
- Contributes to 2015 Sustainability Goals of Addressing Climate Change and Energy Efficiency.

Concentrating Solar Power

Description

DOWTHERM™ A heat transfer fluids collect, transport, and store solar heat energy to power electricity-generating turbines.

Sustainability Profile

- Dow supplies enough fluid globally to generate more than 500 MW of electricity from the sun
- Projects in Spain use more than 5,000 metric tons of DOWTHERM™ A heat transfer fluids
- Energy produced by three plants is enough to power 90,000 homes
- These plants prevent about 350,000 tons of carbon dioxide from releasing into the atmosphere, vs. traditional fuels

The Passive House

Environmental & Social Benefits

Passive House Standards for energy-saving construction

- Concept started in Northern Europe
- Assure comfortable indoor climate in winter without conventional heating system
- Dow products contribute to overall improvements:
  - STYROFOAM™ brand insulation to insulate the housing shell and reduce energy loss at joints, jams and sills
  - ROOFMATE™ VP-N roofing membrane

Sustainability Profile

- An example in Italy resulted in:
  - 92 percent reduction in energy
  - consumption compared to 1970s
  - construction standards
  - Zero carbon emissions

Building Integrated Photovoltaics

Environmental & Social Benefits

DOW™ POWERHOUSE™ roof shingles

- BIPV design combines roofing protection and power generation in one product
- Reduces installation costs by more than 50% compared to conventional solar modules
- Proprietary electrical connections eliminate tedious and costly on-roof wiring

Sustainability Profile

1 micron of CIGS PV semi-conductor material:

- Utilizes1/100 of the material of Si solar cells
- Consumes 1/3 of the energy to produce
- Delivers up to 20% conversion efficiency

Named one of TIME Magazine's "50 Best Inventions of 2009"

Dow Celebrates 25 Years with Habitat for Humanity

Economic &Social Benefits

Dow – Cornerstone Partner of Habitat

- Financial support, product donation and employee volunteer work crews
- Sponsored community builds in nine countries across Asia, North and South America
- Dow employees volunteer for construction in local Dow communities
- Participation in 15 Jimmy Carter Work Projects, including rebuilding Gulf Coast communities in 2007-08 after Hurricane Katrina
- Indonesian communities rebuilt after December 2004 tsunami and May 2006 earthquake
- Official supplier of STYROFOAM™ Brand products for all Habitat for Humanity projects in North America

Sustainability Profile

- Provides sustainable, affordable housing in communities of need.
- Donation of energy efficient products including STYROFOAM™ Insulation , WEATHERMATE™ Housewraps and SAFETOUCH™ Fiberglass-Free Insulation, which, when combined, will reduce natural gas used for heating by more than 23 percent and decrease electricity costs by some 30 percent

Dow Prepares Communities for Transportation Emergency Response

Environmental & Social Benefits

Dow Leads Multi-State Emergency Preparedness Training for Communities

- TRANSCAER® (Transportation Community Awareness and Emergency Response) Training Tours prepare communities to respond in the unlikely event of a chemical transportation incident
- Partnership with Union Pacific in the USA provides free awareness and emergency response training to local and regional responders and community leaders
- Promotes safe transportation and handling of hazardous materials along chemical transportation routes

Sustainability Profile

- Protects human health
- Minimizes damage to local environment

AERIFY™ Diesel Particulate Filters

Description

High-performance filter technology that reduces diesel particulate emissions with little drop in back pressure resulting in optimum engine power and fuel efficiency.

Sustainability Profile

- 30% to 50% lower back pressure than competing filters
- 95% reduction in soot omissions relative to no filter
- Diesel is 25% to 35% more fuel-efficient than gasoline
- Uses fewer raw materials
- Supports smaller packaging
- Recyclable at end of life

Smart Solutions - Innovations for Tomorrow - Responsible Operations - Partners for Change

Freeport Plant saves 1 Billion Gallons

Description

The water conservation and cost-saving of Nalco's 3D TRASAR Cooling Water Technology at Dow's Freeport plant enables the use of seawater for cooling – saving more than one billion gallons of water.

Sustainability Profile

- Dow's Freeport site – Dow's largest production facility – saves enough water to supply 40,000 people with water for one year
- Water savings amounts to $4 million dollars in cost savings
- Dow provides basic building blocks for chemistry in the 3D TRASAR system
- Nalco's Cooling Water Technology received 2010 U.S. Presidential Green Chemistry Challenge Award

Atlantic Forest Restoration

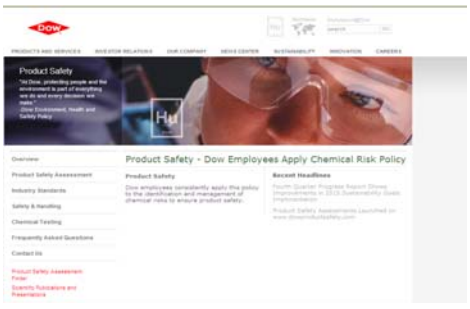
Description

Dow provides exclusive support to The Nature Conservancy's Cachoeira Restoration Project in Brazil's Atlantic Forest, which protects water resources for 9 million people in São Paulo.

Sustainability Profile

- Dow's $1.5 million donation and volunteer employees intend to restore 865 acres
- Projected to sequester over 15 million tons of CO_2 over 30 years
- To date, the project has:
  - Fenced the restoration area
  - Developed partnerships and plans with water supply companies and state and local governments
  - Restored 129 acres
  - Established revolving carbon fund organization structure

DowProductSafety.com



Linking Technological Advances in Mining Environmental Management to Sustainability Performance

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Side Event at UN-CSD 19
State-of-the-Art Innovative and Sustainable Technologies in Waste Management, Mining, Transport and Chemicals
May 6, 2011

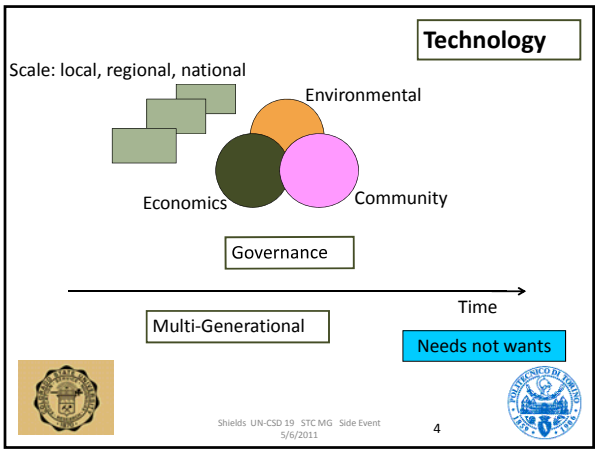
Sustainable Development

"Humanity has the ability to make development sustainable – to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs."

Our Common Future, The World Commission on Environment and Development, Oxford University Press, 1987

Sustainability vs. Sustainable Development

- Sustainability as used in "environmental sustainability', 'economic sustainability', 'social and cultural sustainability' is a one-dimensional concept
- Sustainable development is multi-dimensional as it integrates, it strives to sustain or even enhance all the dimensions



What does Sustainability or Sustainable Development (SD) Mean in Engineering?

- Sustainable forests
- Sustainable construction
- Sustainable engineer???
- Sustainable mining engineer???

Definition of Sustainability in Engineering

- economic, the engineered system is affordable;
- environmental, the external environment is not degraded by the system;
- functional, the system meets users' needs over its life-cycle. This includes users' needs for functionality, health and safety;
- physical, the system endures the forces associated with its use and accidental, willful and natural hazards over its intended service life;
- political, the creation and existence of the system is consistent with public policies; and
- social, the system is and continues to be acceptable to those affected by its existence.

Mining and Sustainable Development

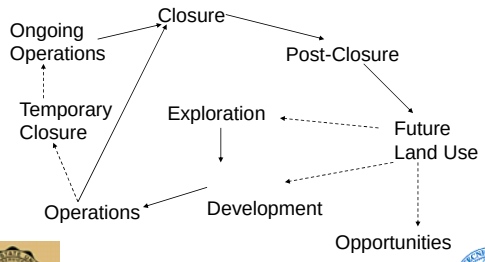
- This does not refer to sustainability of a single company or a mine; clearly an oxymoron if used in that fashion
- It is a culture that addresses in very clear and practical terms how mining can contribute to sustainable development
- It is a concept of needs, an idea of limitations, a future oriented paradigm, and a process of change

The goal of sustainability with respect to minerals is to maintain the stream of benefits that minerals provide in such a manner that the contribution of the resource is a net positive over the life cycle of mine or field, and product.

Thus the challenge to the mining industry:

How to be sustainable material service providers to society, while contributing to sustainable development at all spatial and temporal scales.

Life Cycle (Spiral?)



Innovative and existing technologies and best practices can be applied at each stage to minimize or eliminate negative environmental and social impacts, and increase worker health and safety, helping to ensure that the benefits of mineral production exceed the costs.

Gold Production in the World

- Countries producing large amounts of gold are South Africa, Australia, Peru, Indonesia, Canada, China, Tanzania, Congo, Ghana, Mongolia, Russia, Papua New Guinea, and the United States;
- The climate varies widely;
- The regulatory system ranges from good to poor.

Types of Hard Rock Mines

- Open pit/ open cast
- Underground
- Placer
- Solution
- In situ

Gold Mining- How Is It Done

- Exploration
- Intensive exploration
- Removal of overburden/waste rock
- Ore removal
- Crushing/milling
- Cyanidization
- Precious metals recovery
- Mine waste handling
- Reclamation/closure

Cove Pit Lake

What are the Environmental Issues in the Gold Mining Industry

- Acid Mine Drainage- *in perpetuity* treatment
- Mine Closure- heaps and tailings
- Air Quality- mercury release
- Pit Lakes- water quality/quantity
- Reclamation

Acid Drainage from Mines and Heap/Tailings Drainage

- Both represent long term sources of contaminated water
- Often times, these will exist on the time frame of decades to centuries
- Can contaminate both surface and groundwater
- Serve as a direct source of toxic water to wildlife and livestock

Three Types of Acidic Waters

	Weak	Moderate	Strong
pH	5-7	3-5	<2
Sulfate	<300	300-3000	>3000
Aluminum	<1	1-40	>40
Iron	<5	5-800	>800

Acidic Drainage from Waste Rock Dump in Perry Canyon

Treatment Issues

- The contaminants in the water will not disappear- they will persist on the surface or subsurface
- Any treatment needs to manage those contaminants after removal from the water source
- No walk-away solutions (other than prevention)
- Long term operation and maintenance funds are required.

Acidic Water

- Source: Oxidation of sulfides produces sulfuric acid which dissolves a variety of metals
- Fe, Mn, Al, Cu, Zn, Ni, As, Sb, Cd, Pb, Hg
- The acidity of the drainage and precipitate of these metals on stream bottoms can effectively sterilize a stream
- Once acid generation begins, it is very difficult to stop

Treatment of Acidic Water

- Limestone
- Lime
- Other alkalinity sources
- Passive bioreactors
- Semipassive bioreactors
- Other techniques

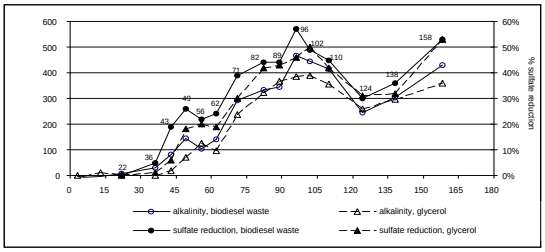
Bioreactors

- Based on the concept that bacteria can reduce sulfuric acid to hydrogen sulfide, followed by precipitation of metal sulfides and an increase in pH
- Requires a reducing (carbon) source such as wood chips, manure, alcohols or sugars
- Biological process can be impacted by nutrient availability and chemical stress
- One of the few technologies that can reduce sulfate concentrations below 2000 mg/L

Alcohol Sources

- Methanol
- Ethanol
- Biodiesel waste
  - 20-40% glycerin
  - 15-40% methanol
  - Potassium (or sodium) Hydroxide
  - Residual fatty acids

Sulfate removal using biodiesel



Technology and SD

- Historic perspective:
  - Sodium nitrate, or Chile saltpeter mined in Northern Chile until the Haber Process was developed
- Not so recent history:
  - Wide spread application of heap leaching technology for gold/silver and copper recovery since the early 1980's
- Present issue:
  - Hydraulic fracturing in shale formations
    - Extensive environmental and social impacts
    - Currently banned in Quebec, New York, New Jersey and two cities: Pittsburgh and Buffalo
    - Moratorium in France

Incorporating integrating using sustainability as the flatform and actual planning process. As engineers we are evaluating our tech against sd principles and that we are doing before the mining begin, as part of the mine planning process. Our mine planning process comes from a sd flatform. Develop a process for the implementation of a new technology to confirm that it will contribute to sustainable development.

Thank you for your attention!

References available upon request
dshields@ColoState.edu

To Download the slides (long version)
http://www.wfeo.net
then go to Committee on Engineering and the Environment

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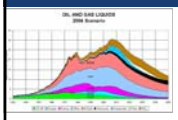
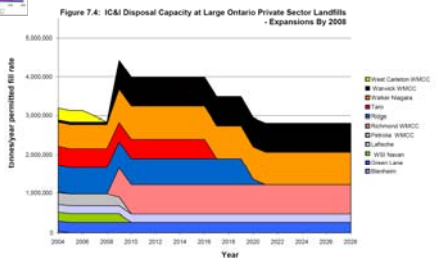
Sustainable Solid Waste Management Through Innovative Technologies

CSD-19 Cluster Thematic - Waste

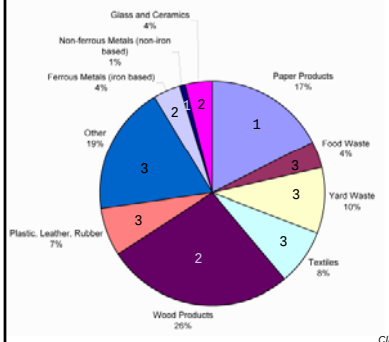
- "Up to 1,000 million tonnes of waste per year are completely unmanaged, wasting resources, jeopardizing public health and harming the environment. Global wastes are predicted by some to double in the next twenty years. Industrialized nations spend up to US$270 billion per year managing waste, and it is important that these costs are incorporated into the supply chain…"

Ontario ICI Landfill Capacity





Average ICI Waste Mix (Canada)



CLASS 1: 19% economically attractive (close to the 21% present average ICI diversion rate)

CLASS 2:34% is marginal

CLASS 3: 47% of ICI waste currently is uneconomic to divert

Source: RIS International, 2005
Class grouping suggestions by SDTC

CSD-19 Waste Focus

Governments should create effective solutions to waste management through research, knowledge transfer, valorisation and dissemination

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SUSTAINABLE DEVELOPMENT TECHNOLOGY CANADA™

Mission and Mandate

- SDTC is a policy delivery instrument of the Government of Canada to deliver environmental and economic benefits to Canadians.
- As a delivery agent, we foster the development and demonstration of technological solutions that address:
  - Clean Air
  - Clean Water
  - Climate Change
  - Clean Land
- Forge innovative partnerships and build a sustainable development technology infrastructure.
- Ensure timely diffusion - increase number and rate of uptake of technologies into the marketplace across Canada, providing national benefits.

SDTC's Mission: "The Foundation will act as the primary catalyst in building a sustainable development technology infrastructure in Canada".

SDTC - Overview

- SDTC began operations in November of 2001
- Registered as a not-for-profit, non-share capital corporation under the Canada Business Corporations Act
- Operates as an arms-length independent organization
- Innovation Funding allocation of $550M for from Government of Canada
- Accountable to Parliament through the Minister of Natural Resources
- 15 Directors on the Board, 7 appointed by Gov. Canada
- Member Council (15) – proxy for shareholders
- International recognition for this Canadian initiative

Scope

- Emphasis on new technologies in the following areas:
  - Waste management
  - Agriculture
  - Forestry
  - Transportation
  - Energy exploration, production, transmission and distribution
  - Power generation
  - Energy utilization (industrial, commercial and residential sectors) - buildings and processes
  - Emission controls and enabling technologies

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Size of Canadian Opportunity

Applications to Date (18 Rounds)

- 1,933 applications (>5300 entities)
- 89% industry-led
- $4.8 Billion in funding requests
- $18.6 Billion in total project value

Strong Demand

Rate of SOIs remains strong
Number of applications constant
over last 4 years (+/-10%)

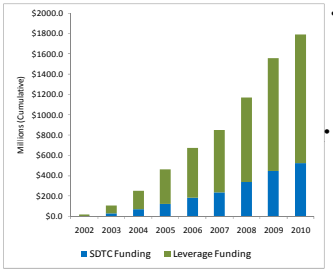
Projects Approved (17 Rounds)

- 210 projects
- $515 Million from SDTC
- $1.8 Billion in total eligible project value

Numbers as of Dec. 2010

There is significant capability to develop clean technologies and a strong demand in Canada for support from SDTC for the associated companies.

Funding & Leverage



- *As of December 2010, on a cumulative basis, SDTC has allocated $515M, for a total leveraged value of $1.8B.*
- *The $550M fund is leveraged 2-3 times with consortia partners.*

SDTC will bring to the cleantech market an investment envelope of over $1.8B by the end of 2010.

Overview of Selected SDTC Waste Management Projects

1. **Alternatives to MSW & ICI Landfill**
   - BIOX – biodiesel from waste greases
   - Enerkem Technologies Inc. – ethanol from MSW gasification
   - Plasco Energy Group Inc. – waste-to-energy using plasma gasification
   - Terragon – Small scale MSW gasification
2. **Industrial Solid Waste Management**
   - Ensyn Technologies Inc. – bio-oil from wood waste
   - Lignol Innovations – ethanol from wood waste
   - Nexterra Energy Corp. – gasification of wood waste
   - Lakeshore – onsite treatment of contaminated soil
   - Deane (Enutech) – contaminated soil treatment
3. **Agricultural Solid Waste**
   - Bio-Terre Systems Inc. – Anaerobic digestion of hog manure
   - Highmark Renewables Inc. – Anaerobic digestion of cattle manure
   - Prairie Pulp & Paper – re-use of straw flax to make tree-free paper
   - Woodland Biofuels Inc. – Wood & crop residue to Ethanol
   - ICUS – Improved fertilizer use
   - Targeted Growth – Non-food drought resistant crop – bio-jetfuel
   - Tekle Technical Services – Particle board from agricultural waste
4. **Enabling Technologies**
   - Atlantic Packaging – biomass drying
   - Mechtronix – Biomass drying
   - Paradigm Enviromental – WWTP sludge pretreatment
   - Synodon – methane emissions detection

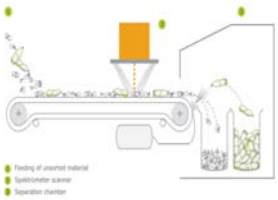
CSD-19 Waste Focus Areas

- Take effective actions to clear away plastics from the oceans.
- Treat waste as close to the source as possible
- Closing materials and nutrient cycles
- Farmers want to be partners for sustainable development. Our goal is to foster methods that encompass environmental sustainability, animal welfare, and food security.

Plastics

- Recycling is dependant on sorting.
- Commonly PET bottle, tubs and lids are easiest to sort
- Remaining plastics are mixed ridge plastics that are difficult to sort.
- No incentive to collect mixed rigid plastic leads to landfill disposal, dumping, littering, etc.
- What is needed is an efficient sorting and processing system that justifies establishment of a plastics collection system.

1640 Entropex – Plastic Sorting Technology



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Treat Close to Source

- Remote locations and isolated communities have difficulty processing waste due to the distance to the markets.
- Resulting in the potential for scattered dumping sites.

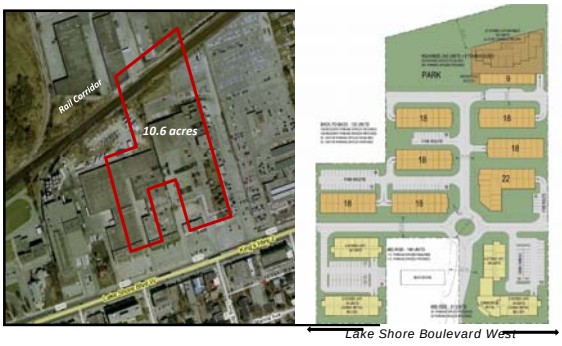
Frequently result in contaminated land that needs remediation to improve usefulness. Frequently this contaminated soil is simply excavated and sent to a landfill.

Terragon Environmental Tech. Inc.
2006B-1097R

*In one day, a **MAGS** unit can treat the waste typically generated by a community of up to 500 persons.*

*In 2 hours, **MAGS** reduces the volume of 40kg of typical waste including plastics by more than 95%.*

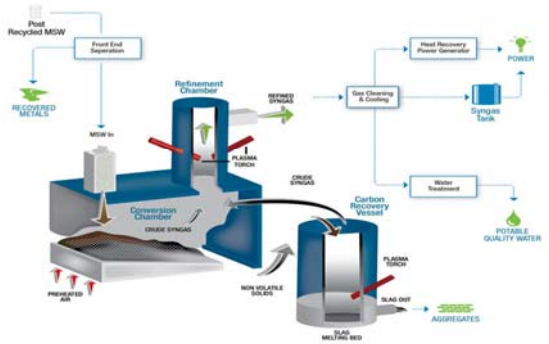
1600R Lakeshore EMPC Two L.P.



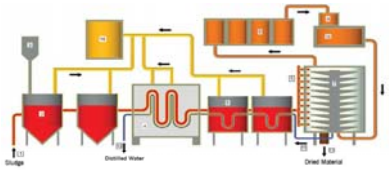
Materials and Nutrient Cycles

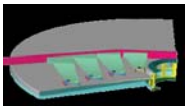
- Making material reusable or closing the material cycle frequently requires a change the qualities or form to suit a new use.
- The most common example is turning discarded material into fuel.
- Some materials simple have too much moisture to be effectively used. Cost effective drying is needed.
- Other materials need be broken down to make processing easier.

Plasco Plasma Arc Gasification



Mechtronix – Biomass Drying





optional)
"Key to Success;
«Thin Layer Drying» via
the CMV™, a Patented
Process"

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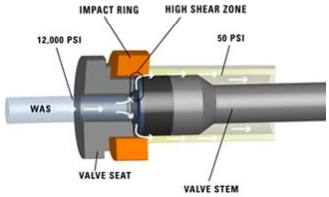
Paradigm - MicroSludge

- Waste activated sludge (WAS). MicroSludge® is a powerful, robust and compact system that liquefies WAS, boosting the speed that anaerobic digesters convert WAS to biogas and reduce residual sludge for disposal.



Summary

Waste is a poorly used resource.

By developing innovative technologies these resources can be optimized.

SDTC has an on-going role in developing innovative sustainable technologies that use science and engineering to achieve sustainable management of resources.

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