

# ***NY/NJ Harbor Sediment Decontamination Program***

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New York , New York**

**Healthy Communities, Clean River Workshop  
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Portland, Oregon**




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# Sediments are Complicated as a Media

- Pathways
  - Assessment
    - Testing (Biological/Chemical)
    - Risk Assessment
  - Sediment Flux Modeling
  - Sediment Management
  - Public Perception / Political
  - Agency Cross-Program
    - Dredged Material / Contaminated Sediments
    - Remediation – Superfund, Urban Rivers
  - Beneficial Use
- 

# Integrated Approach Contaminated Sediment Management Remediation/Restoration

*Multi complex contaminants*  
(TCDD, PAHs, Pb, Hg, Cr)

- **Materials Handling**
  - dewatering, pumping, drying
- **Environmental Precision Dredging +**
- **Capping + Reactive CAPS**
- **Stabilization/Solidification + (ox)**
- **In-Situ Stabilization**

- **CDFs/CAD Management**
    - Storage, immobilization
  - **Innovative Sediment Decontamination Technologies**
    - Thermal/non-thermals
    - Treatment Train/Systems Approach
  - **In-Situ Bioremediation**
    - Mudflats
  - **Monitored Natural Attenuation**
    - CADs / hot spots – is it bioavailable?
    - Leave in place?
- 

- Develop Long-term Self Sustaining Enterprises in the Environmental **Management/Manufacturing** of Beneficial Use Products from Contaminated Sediments
  - It's a business.....

- Sediments are a Resource
- Beneficial Use Applications



# Dredging in NY/NJ Harbor

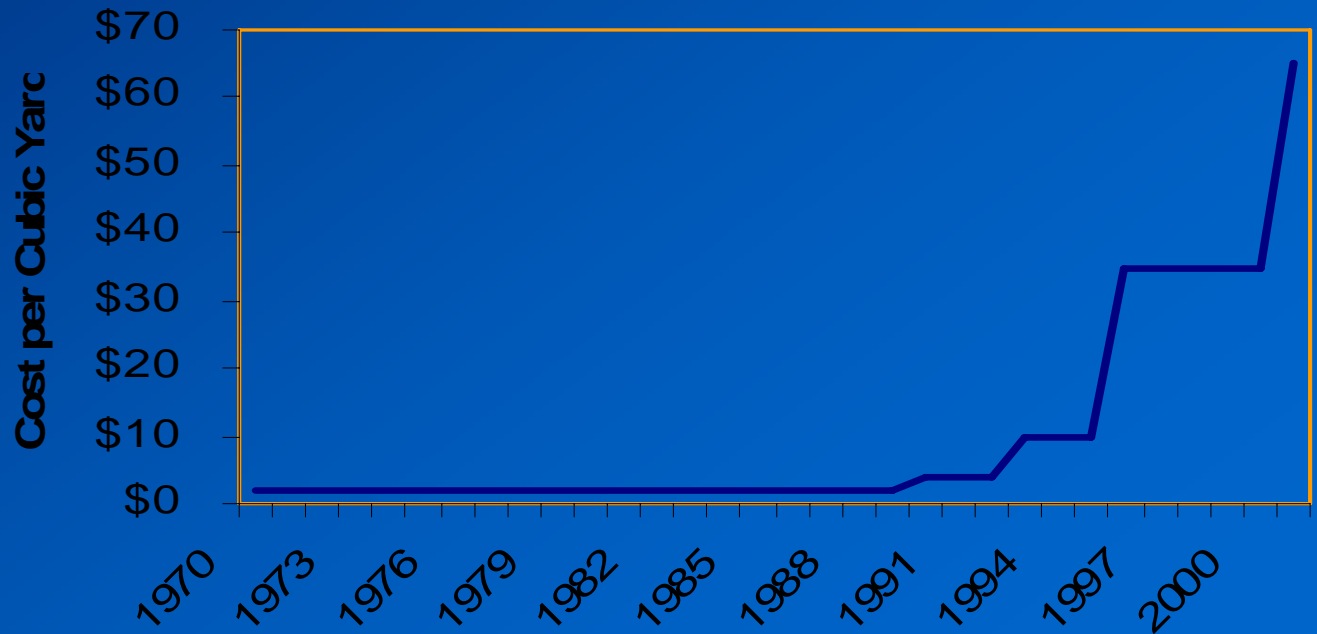
- Naturally 6m deep. Authorized to 15m MLW in many areas
- Dredge approximately 3-5 million m<sup>3</sup> per year. 385 km of channels.
- **Historically most dredged material ocean disposed. This changed as more current science was considered and new testing was implemented**
- Dredged material mostly fine-grained containing PCB, DDT, PAHs, and dioxins.



# Dredging & Placement Costs

## Environmental Regulation

- 1991 Green Book Update
- 1993 Regional Implementation Plan
- 1996 Magnusen Stevens Act
- 1997 Mud Dump site closed
- 1998 More stringent permit requirements imposed
- 1999 NMFS institutes EFH and Fish Windows
- 2001 Air conformity concerns





# New York/New Jersey Sediment Decontamination Technologies Demonstration Program

- Program initiated in 1992 under the Water Resources Development Act
- Partners: US EPA Region 2, Brookhaven National Laboratory, and New Jersey (NJ) Department of Transportation Office of Maritime Resources
- Develop and demonstrate technologies from bench-, pilot-, to full-commercial scale
  - Meet desired treatment efficiencies
  - **Cost-effective compared to other placement options (S/S)**
  - (~\$35-70/yd<sup>3</sup>)
  - Process or store 1500 yd<sup>3</sup>/d and achieve commercial-scale capacity of 500,000 yd<sup>3</sup>/yr
  - Saleable beneficial use product from post-treated material
- In 1998, NJ provided further funding to the program (\$20M)
- \$42 million in Federal and State resources, combined with private investment

# EPA/NJDOT Program

- Logistical - Economic

- Moderate to high capacity  
500Kcy/yr
- Accept 3-6000 cy/day
  - Storage
- Produce a value added product (\$35-40 cy)
- Practically unlimited market for product

- Environmental

- Final product meets applicable criteria for proposed end use
- Destroy or capture and account for all COC's
- Safe for human health and the environment
- Able to be sited or permitted in a location suitable for processing harbor material (PPF)

**Common goals to both EPA and NJDOT dcon programs**



# Collaborations

- EPA Region 2
  - EPA SITE Program
    - TetraTech
  - EPA ORD ERL-N
    - TIE's
    - USGS Columbia. MO
  - USACE NYD
  - WES
  - Port Authority NY/NJ
  - NJDOT/OMR
  - NJDEP
  - GLNPO
  - Michigan DEQ
  - NJIT, Stevens, RPI, Rutgers, MSU, UNH
  - Port of Baltimore
  - Department of Ecology –WA
    - MUDS
  - USACE Seattle District
  - EPA Region 10
  - USACE New England
  - CTDEP
  - Hart Crowser
  - Weston Solutions
  - Montgomery Watson Harza
  - Malcolm Pirnie
  - Battelle
  - Port Authority of Venice, Italy
  - EU SedNet
- 

- **Developed a program:**
  - USACE, Brookhaven National Laboratory, Stevens Institute, NJIT, RPI, Rutgers (public outreach)
  - RFP Process (BNL)
    - Complete treatment train
    - Proof of concept – Bench – Pilot – Full scale – Commercial.
    - RFP Process (all in one contract modification)
    - Dcon techniques need not to be pre-proven in terms of likely success (wrda)

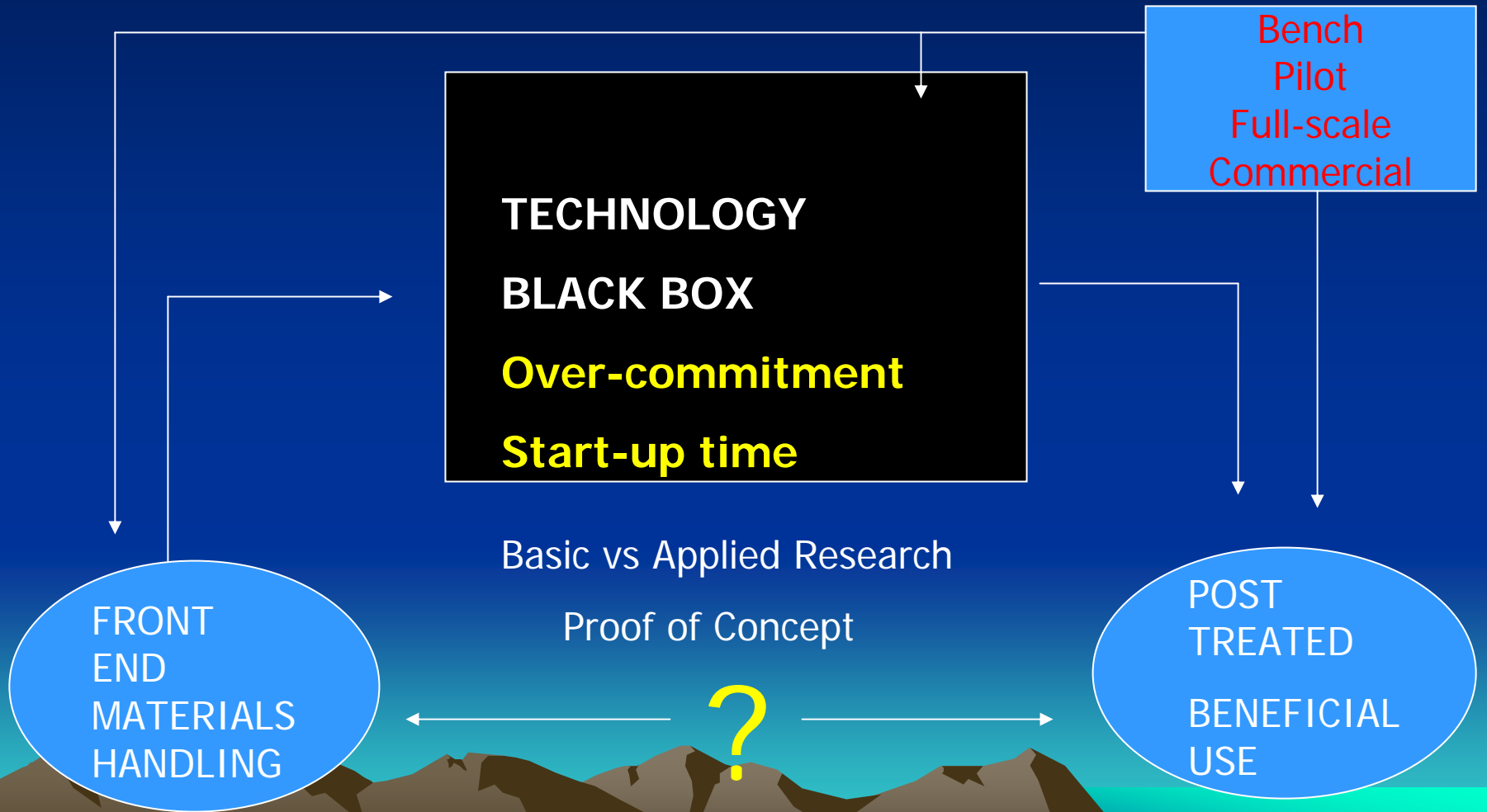


# General Components of the Program

- Program / Project Management (EPA)
- BNL-DoE Procurement
  - RFP development/award
    - Move from bench-commercial in performance stages
    - Treatment train (materials handling / black box / beneficial use)
    - Environmental
    - Basic – Applied Research (ego's)
    - Economics
    - Beneficial use
      - Permitting
      - Siting
      - Public outreach
      - Analytical testing program
      - EPA SITE Program
- **\$22M Obligated (1994-2003) – Incremental Funding**



# Innovative Technology Development



**3<sup>rd</sup> International SedNet Conference**  
**25-26 November, 2004 – Venice, Italy**  
**Contaminated Sediments - European River Basin *Final***  
***Draft: Recommendations***

- Stimulate innovation to more efficient treatment technologies:
  - To date treatment technologies are too costly
    - Large amounts of sediments
    - Dredging and processing rates can't keep up
  - **Technology itself is not the problem**
    - Diversity of technologies are available
      - It's everything else...



# NY/NJ Harbor Sediment Treatment Technologies (full/commercial scale) with Beneficial Use

- **Gas Technology Institute/Endesco**
  - Thermo-chemical rotary kiln (cement and co-gen)
- **BioGenesis Enterprises**
  - Sediment washing (soils, bricks, polymer coating)
- **BayCycle Aggregates**
  - Rotary kiln (light-weight aggregate)
- **Harbor Resource Environmental Group, Inc**
  - Solidification/stabilization/oxidation (structural fill)
- **Westinghouse/The Solena Group**
  - Plasma-arc vitrification (co-generation)



- Work with many technology development firms outside of the sediment decontamination program



**Moved From Bench-scale to  
Pilot-scale (1994-2003) to presently in  
2005-2006  
Full/Commercial Scale  
Demonstrations**



# BioGenesis Bench-Scale 1994



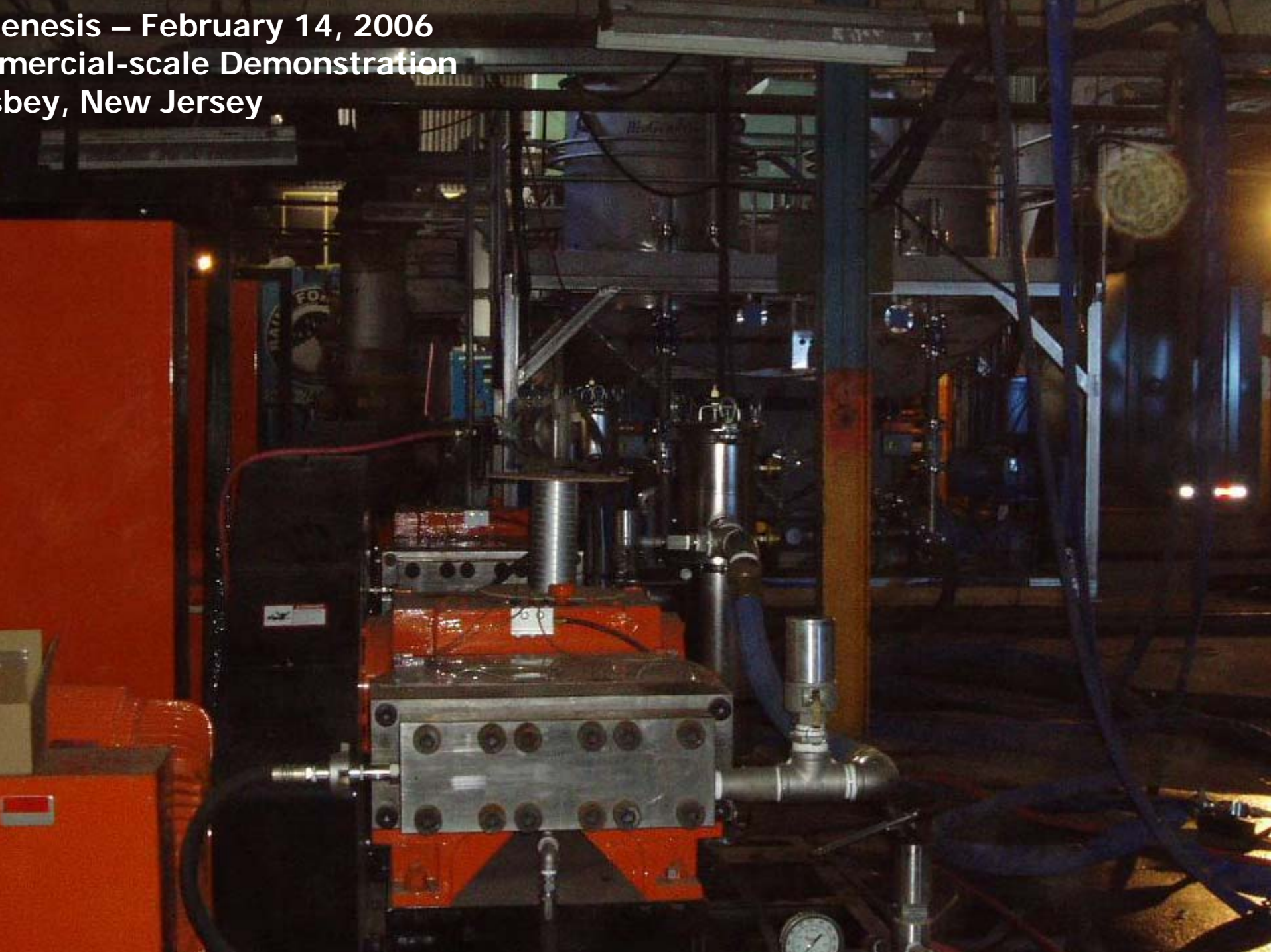
# BioGenesis Sediment Washing Pilot Demonstration – Kearny, NJ 1999



# BioGenesis Pilot Demonstration Venice, Italy Port Authority January 2004



genesis – February 14, 2006  
Commercial-scale Demonstration  
Troy, New Jersey



Hazen Research  
Golden, CO - 1996



**Pilot-Scale Unit - GTI Cement-Lock**

**Cement Lock Demo Plant  
Bayonne, NJ - 2005**





2005 - 2006

EPA/NJDOT Integrated Full-Scale  
Decontamination Demonstrations  
BioGenesis / Endesco Cement-Lock



# NJ Treatment Test Processing Facility Keasby, NJ

It's a  
business.....learning  
curve for both



Algocen, Lake Erie 4 / 13 / 01  
Great Lakes Aerial Photos, Don Coles

# NY/NJ Sediment Decontamination Program Cross-Program Demonstration 2006

- **(1) Navigational / Dredged Material**
  - **BioGenesis Sediment Washing Process**
  - Bayshore Recycling Slip Dredging
  - US Army Corps of Engineers
  - Federal Navigational Deepening
    - Arthur Kill
- **Unloading From Scow to Ship Hold**
  - Gross screen / .06cm screen
  - Direct pumping from hold to BioGenesis facility



# NY/NJ Sediment Decontamination Cross-Program Demonstration

- **(2) Contaminated Sediments - Superfund**
- Passaic River, NJ Superfund Restoration Study
  - **BioGenesis** –
  - **Gas Technology Institute / Endesco**
    - Belt-filter press dewatering
    - Transport off site to Endesco processing facility
    - IMTT / Bayonne, NJ



Passaic River Superfund D  
December 2006

5,000 cy dredged for BioG  
Endesco Cement-Lock De

Cable Arm



CARRIER  
GE SHIP

← PUMPED TO SHIP



Shaker Screen









Final mooring at Bayshore

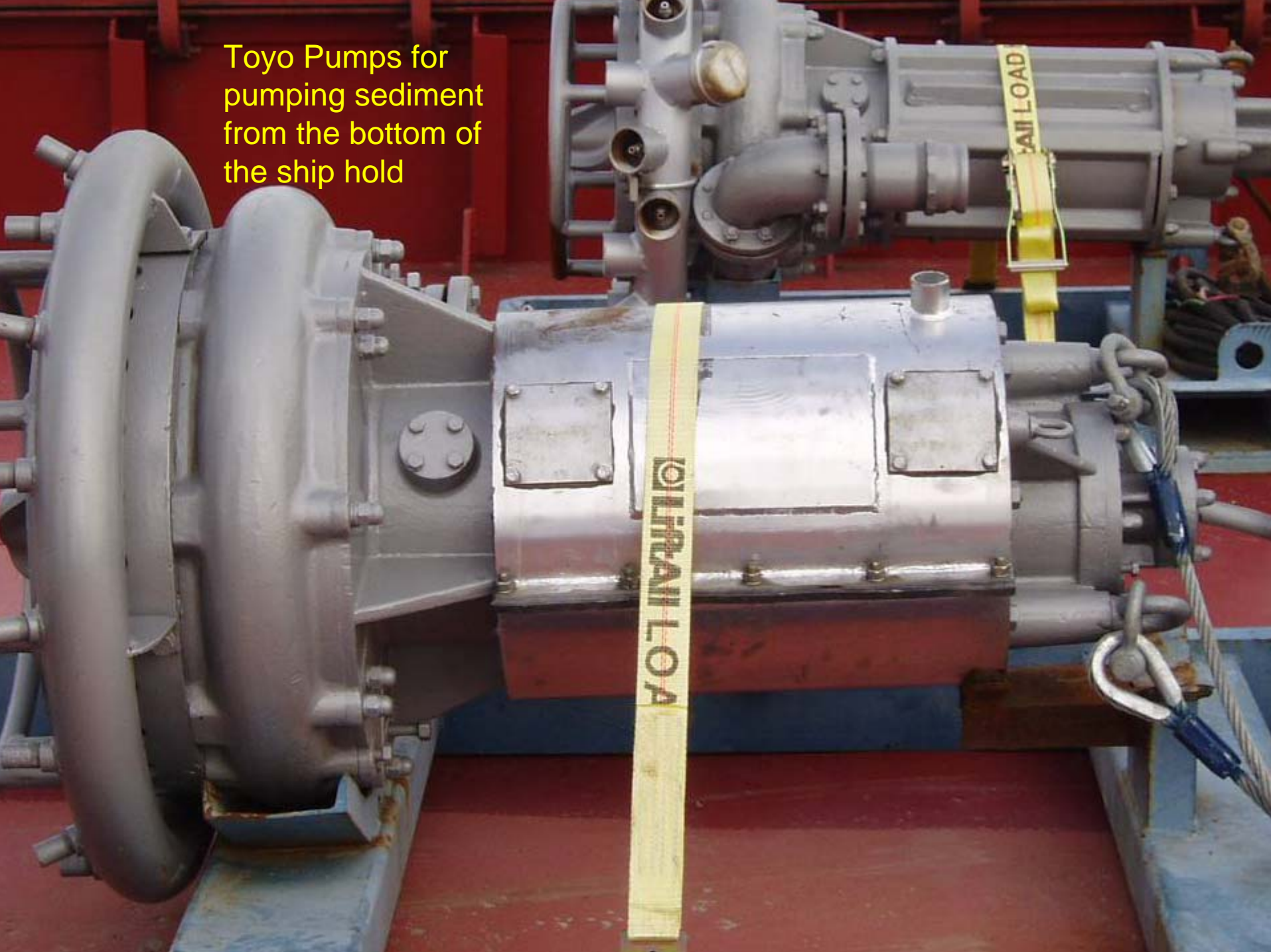








Toyo Pumps for  
pumping sediment  
from the bottom of  
the ship hold





Bayshore landside house sediment demonstrations. sediment will be facility.



**LURRY PIC OF COLLISION  
CHAMBER**



# CAVITATION UNIT







# Beneficial Use Products and Markets

## Potential Uses of Modified Final Product

- Top Soil/Potting Soil
- Compost
- Finish Grading Material for Construction
- Cap or cover materials for landfills
- Restoration Material



# New York / New Jersey Harbor Sediment Decontamination & Beneficial Use Demonstration Project Cement-Lock<sup>®</sup> Technology

## Sponsored By:

- Gas Research Institute
- U.S. Environmental Protection Agency Region 2
- U.S. Department of Energy  
Brookhaven National Laboratory
- U.S. Army Corps of Engineers  
(New York District)  
– *funding from the federal  
Water Resources Development  
Act (WRDA)*
- New Jersey Office of Maritime Resources  
– *funding from NJ Environmental  
Bond Issue*



## Technology Developer:

Gas Technology Institute



## Site Host:

International-Matex Tank  
Terminal – Bayonne

IMTT

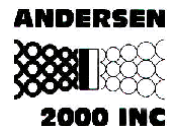
## General Contractor:

RPMS Consulting  
Engineers



## Equipment Manufacturer:

Andersen 2000 Inc.



## Technology Licensor:

Cement-Lock Group, L.L.C.

# Cement-Lock<sup>®</sup> Technology

- A Patented technology (Ecomelt) – not kiln
- An advanced thermo-chemical manufacturing process for decontaminating sediments and other wastes
- Organic contaminants are destroyed with DREs > 99%
- Heavy metals are immobilized in the cement matrix exceeding TCLP and MEP requirements
- Vitrified sediment (EcoMelt) is transformed into construction-grade cement
- Waste heat is transformed into power

**Cement Lock Demo Plant  
IMTT - Bayonne, NJ - 2005**





EcoMelt



0 INCHES

1

2

3

4

5

6

0 CM

1

2

3

4

5

6

7

8

9

10

12

13

14

15



TIMER

about you™



**Pulverized EcoMelt**

# Beneficial Use

## Construction Grade Cement/Concrete

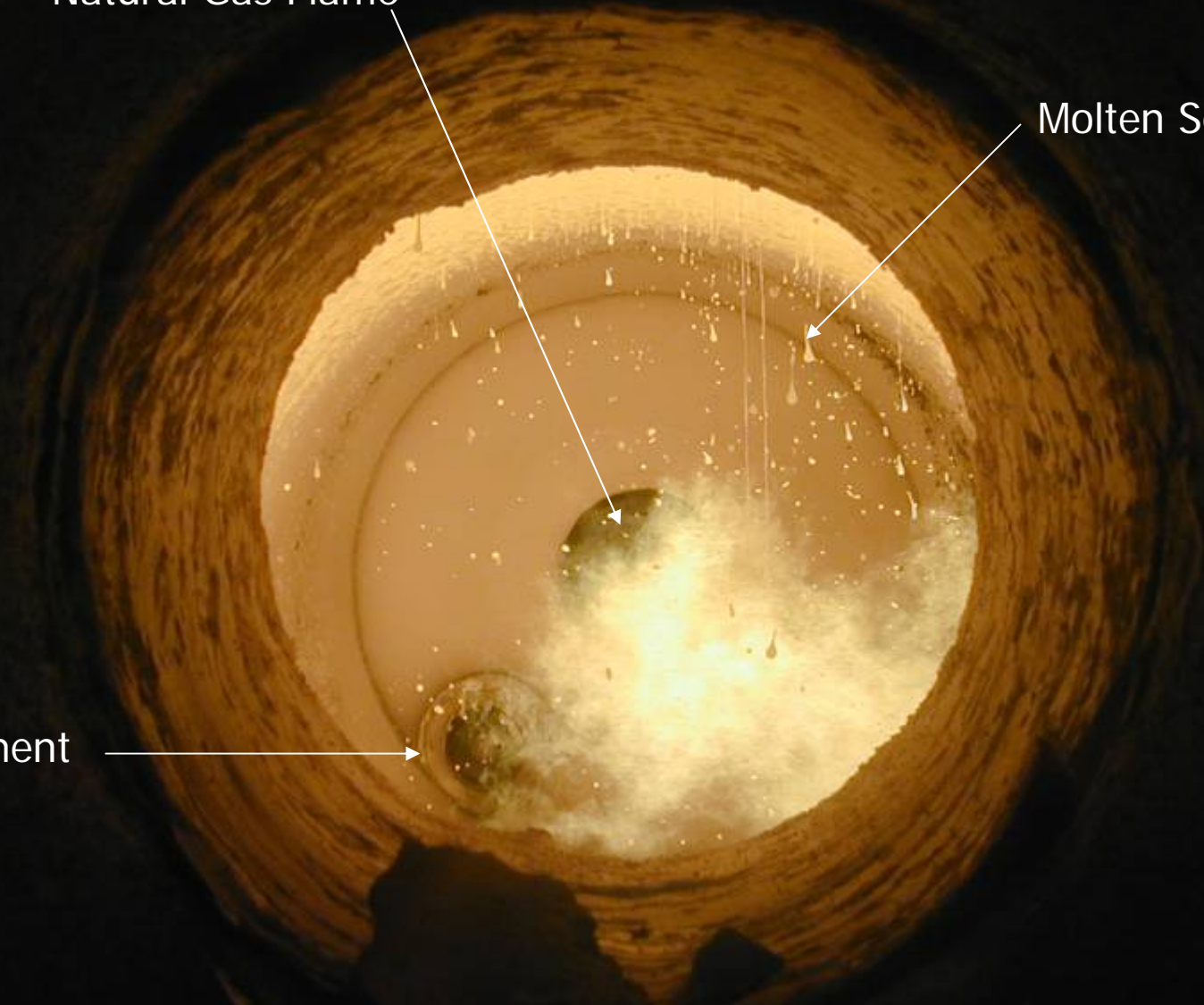


Natural Gas Flame

Molten Sediment

Sediment  
Feed

Interior View of Kiln – 1345 C°



**Flue Gas  
Quencher**

**Lime  
Hopper**

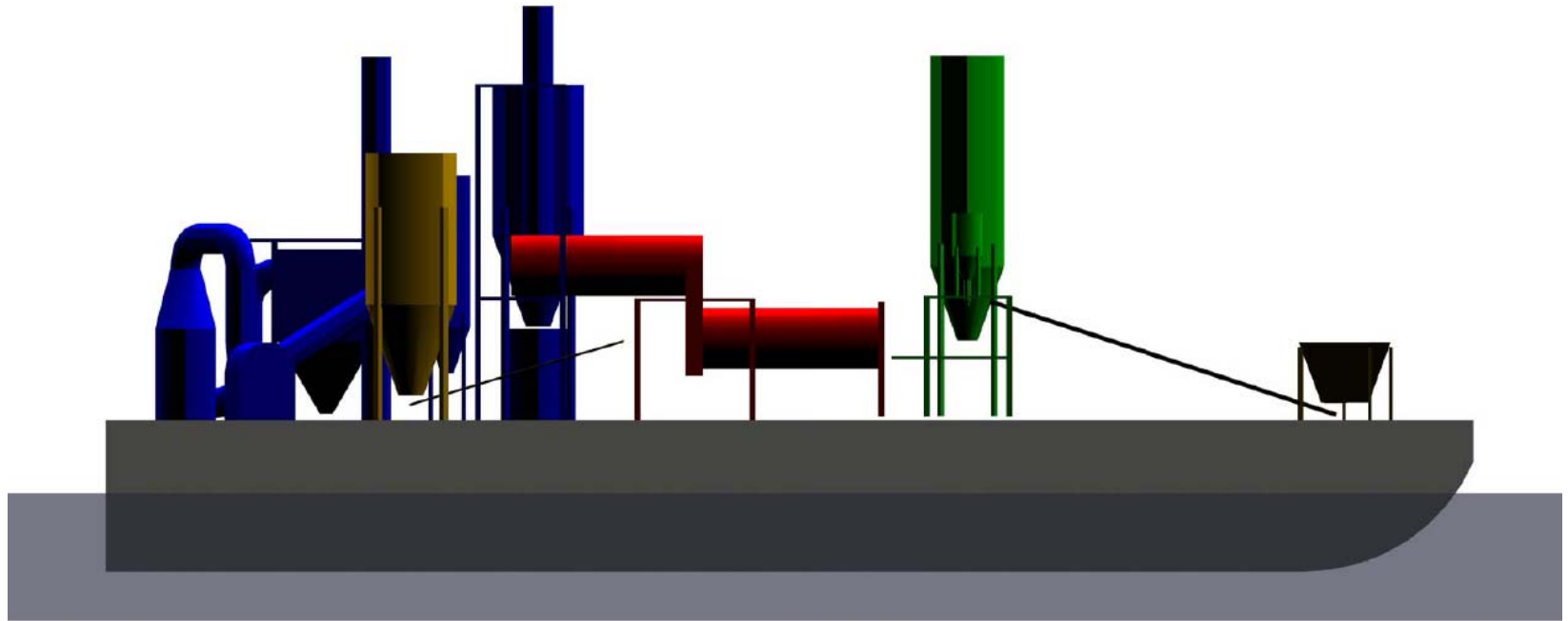
**Baghouse**

**Ecomelt  
Hopper**

**Activated  
Carbon Adsorber**



# BARGE-MOUNTED CEMENT-LOCK® PLANT



Starboard View

- (Brown) Waste Feed System
- (Green) Modifier Feed System
- (Red) Rotary Kiln, Drop-Out Box and Granulator
- (Orange) Ecomelt Product Processing and Storage
- (Blue) Air Pollution Control & Flue Gas Treatment System

**30,000 ton Plant**  
**(225' x 100' Barge)**

# Business Development

## Where are we going?

- Develop Long-term Self Sustaining Enterprises in the Environmental **Management/Manufacturing** of Beneficial Use Products from Contaminated Sediments
  - It's a business..... Venture capital interest
  - Sediments are a Resource
  - Beneficial Use Applications

# Uncertainties in Developing Long -Term Enterprises

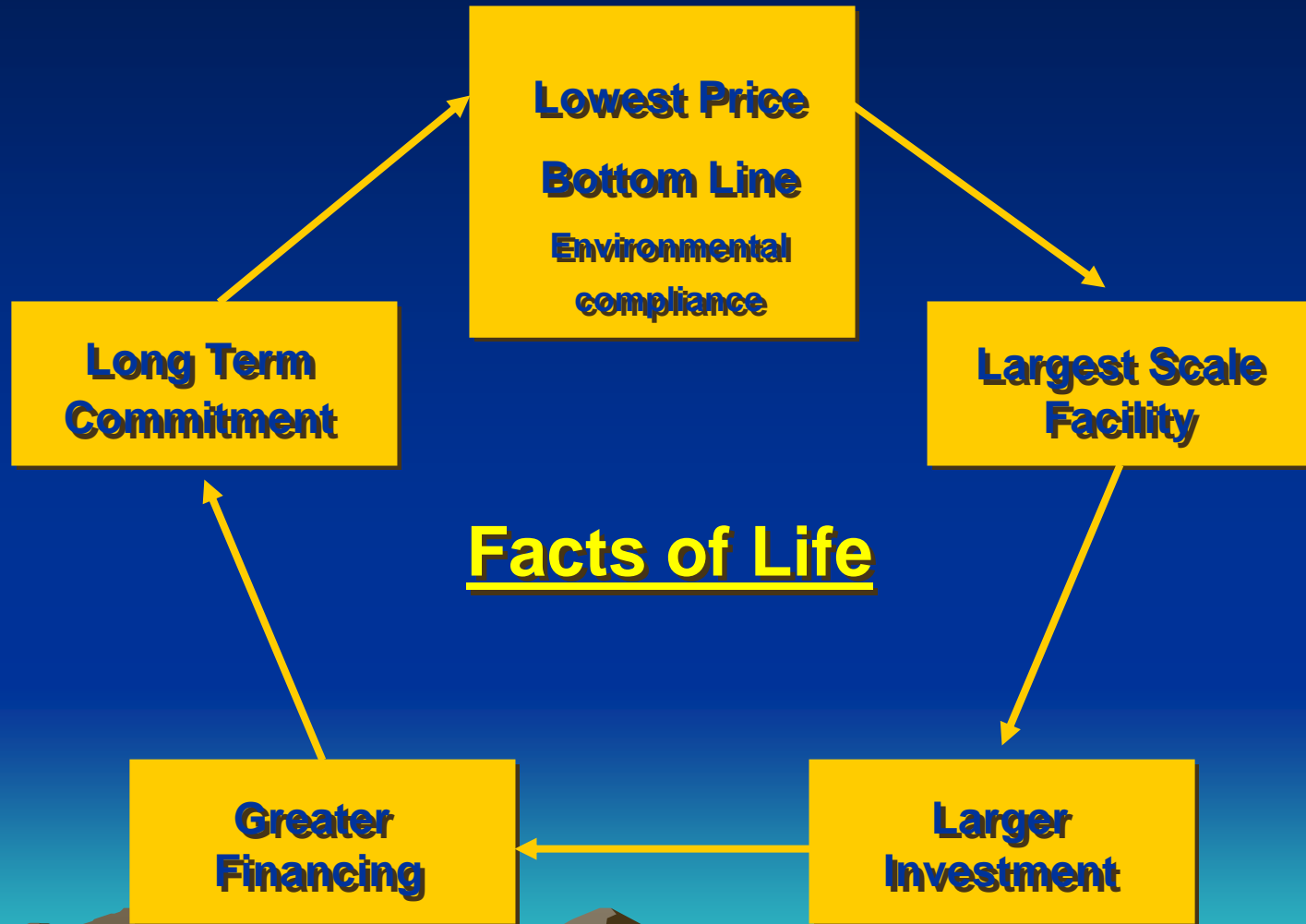
- Unpredictable dredging volume estimates
- Unpredictable dredging cycles
  - Fish migratory windows
- Superfund Construction Schedules
- Litigation
- Long-Term Contracts
- Government Risk Sharing

– Is this a good business?





# Technology Financing Reality



# The Future of Sediment Management

- **Public Education / Outreach**

Without an adequate technical basis for decision making, the special interests that are always present will tend to dominate the process.

There is never enough information or data to answer all questions – hence decision making in the presence of uncertainty.



# The Future of Sediment Management

- **Policy**

- Consistent cross-agency, authorities
- Waste? Resource? Navigation? Remediation
- Dirt is Dirt.....

- ***Administrations come and go***

- Policy decisions are made that will have future implications
- Political short term fix vs. long-term strategy
- Need structures in place to succeed in the long-term.



# The Future of Sediment Management

- **Policy (continued)**
- Throwing \$\$ at problem w/o implementing policy changes that will at least give a program a chance to succeed is wasting \$\$
- Changes in legislation and regulatory requirements



# **Environmental Sustainability Contaminated Sediments**



# They're making people every day, but they ain't making any more dirt – Will Rodgers

- **Topsoil is being depleted avg/yr 18X faster than what is being built up in nature**
  - Takes 2000 yrs to build up 1in of topsoil
- **US/California**
  - CA agriculture depleting as much as 1in TS every 25 years. 80x faster than nature
- **Developing Nations – 36x**
- **China – 54x**
  - C.J. Barrow. Land Degradation, Cambridge U. Press. (1981)
  - National Resources Inventory. Soil Conservation Service. USDA, Washington, DC (1992)

- **Environmental Sustainability of Sediments**
    - Environmental, Economic and Social
  - **Environmental Manufacturing**
    - *Beneficial Use*
      - Environmental Restoration
      - Economic Revitalization
      - Social Consciousness
        - Shrinking Natural (Un-renew) Resources
        - Short vs. Long-term vision
    - Finite capacity, difficulty of siting, changes in public perception
      - Consistent with SedNet
- 

# Positioning for the Future

- **Life Cycle Assessment**
  - What is the cost associated (long-term)?
    - Environmental, economic, social
  - Of not (environmental sustainability)
    - Diminishing natural resources
    - Waste minimization
    - Landfill Closures
    - Lack of real-estate (CAD/CDF)
      - Loss of Benthic Habitat / wetlands
  - **Application of Innovative Decontamination Technologies with Beneficial Use**

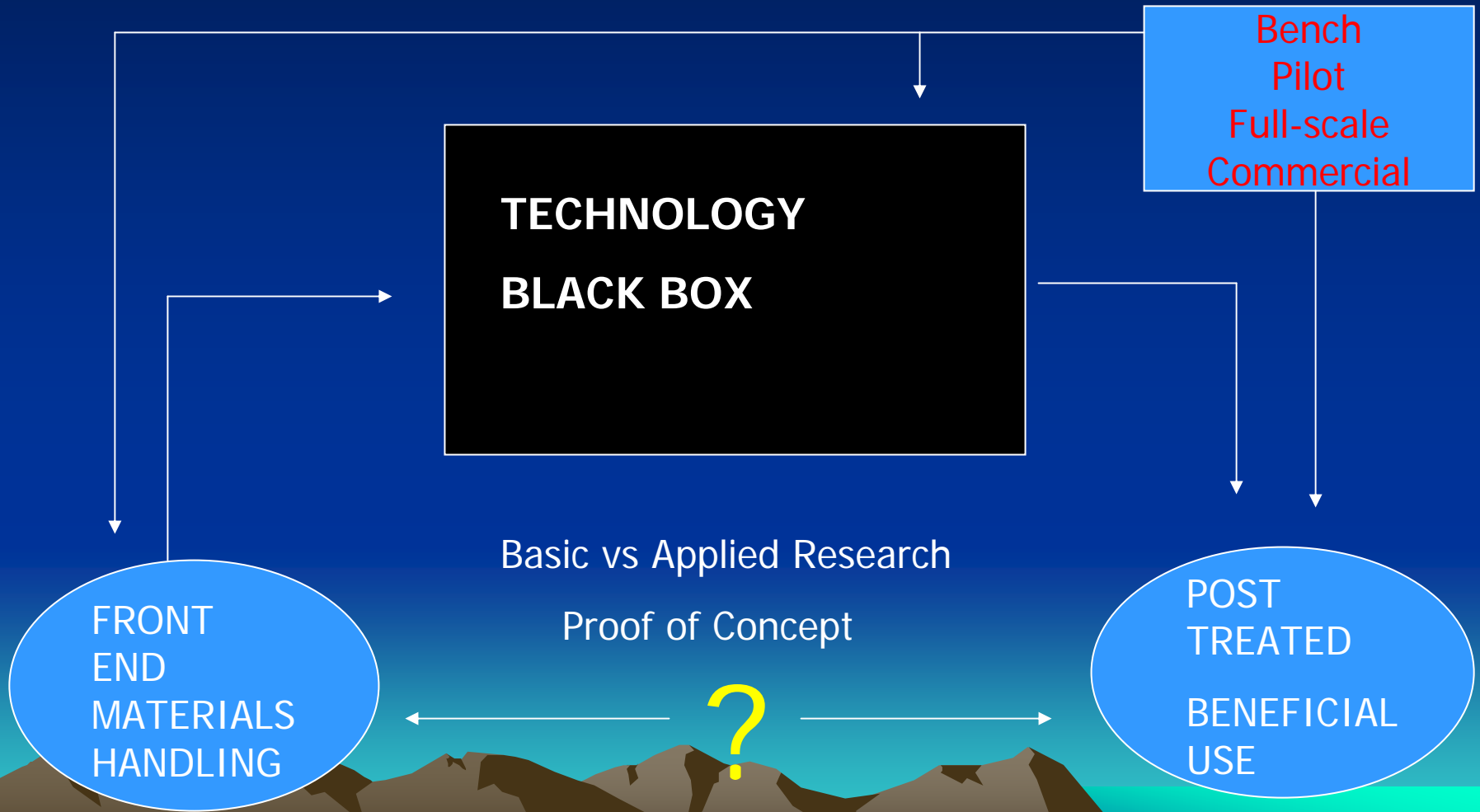




# **Barriers to Innovative Technology Implementation**



# Impediment to Innovative Technology Development



# The Future of Sediment Management

- **Program Integration**
  - *Sediments are cross-program*
    - Dredged Material (Navigation)
    - Superfund (Remediation)
    - Aquatic Brownfields (Superfund)
    - Solid Waste Industrial Sites
    - Remediation/Clean-up
      - *Run for the Hills.....*

**"dirt is dirt" (tech. def.)**



# Dcon Sternism's (#47)

- There is NO ONE WINNER in Technologies
- There is **NO SILVER BULLET**
  - Explore from a technology integration and multiple beneficial use perspective
  - Technology Campus
    - Multiple [contaminant], cross-program
- **Make an informed decision** that at some time, treatment will be a **component** or part of a ***tool box*** for dredged material / contaminated sediments management strategies

# Overcoming Barriers to Innovative Technology Development – 2 Workshops

- **International Navigation Association (PIANC)**
  - Brussels, Belgium
- **U.S. Army Corps of Engineers – Waterways Experiment Station**
  - Oakland, California
  - May 2000
- **Maryland Port Authority**
  - Annapolis, Maryland - USA
  - November 2004
  - <http://www.mpasafepassage.org/forumpresents/index.htm>

• Norman Francingues



# Overcoming the Barriers to Technology Implementation

U.S.PIANC Special Workshop

2 May 2000

- Long-term forecasting of dredging requirements and likelihood of funding
- Public funding of centralized dredged sediment storage and management facilities
- Use of other waste streams to insure continuous feed stream to process

# Overcoming the Barriers to Technology Implementation

## U.S.PIANC Specialty Workshop

### 2 May 2000

- Mandate the use of treated sediment products in public work projects
  - Federal – state – municipal government
- Provide education on the benefits of using treated sediment products as beneficial use
  - Sustainability
    - Un-renewable resources



# Technology Forum on Innovative Reuse of Dredged Materials - Annapolis, Maryland 9 December 2004

- ***Observations – 4 Major Areas***
  - Long-term supplies
  - Permitting process
  - Long-term contracting
  - Siting





Technology Forum on Innovative Reuse of  
Dredged Materials - Annapolis, Maryland  
9 December 2004

- ***Primary challenges to produce marketable products:***
  - Cost
  - Product Acceptance
  - Permitting / Regulatory
  - Safety



# Technology Forum on Innovative Reuse of Dredged Materials - Annapolis, Maryland 9 December 2004

- **Recommendations**

- Provide regional storage sites to ensure a steady source of sediments for potential innovative re-use options
  - *Dredging > than processing rates*
- Support market studies and development of intermediate and end use products including regulatory policy and incentives

# Technology Forum on Innovative Reuse of Dredged Materials - Annapolis, Maryland 9 December 2004

- Establish how much **RISK** the Government, Port Authorities etc. is willing to assume to implement technologies and beneficial use options
- Present a realistic timeframe and schedule to implement re-use based upon potential business models
- Incorporate the continued use of public outreach programs



Sunset over Bayonne, NJ

GTI Cement-Lock Rotary Kiln

