GeoBrom®

Great Lakes SOLUTIONS
a Chemtura business

Bromine Derivative Benefits for Mercury Emissions Reduction

Chemtura Corporation: World Class, Global Specialty Chemicals Company with Industry Leading Platforms

- Global specialty chemical company listed on the New York Stock Exchange / EURONEXT ("CHMT")
- $2.2 billion in revenues
- More than 4,500 employees worldwide
- Global headquarters in Philadelphia, USA
- Regional headquarters and shared service centers in Sao Paulo, Brazil; Shanghai, China; Middlebury, Connecticut, USA; and Manchester, United Kingdom

Three Reporting Segments

- Industrial Performance Products
- Industrial Engineering Products
- Chemtura AgroSolutions

Chemtura Petroleum Additives

Chemtura Urethanes

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Chemtura Organometallic Specialties

Chemtura AGROSOLUTIONS

Great Lakes Solutions is a business of Chemtura Corporation

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Mercury Control

Mercury Regulatory Drivers

- **United States Regulations**
  - US Federal MATS Rule
  - State Regulations – will have to be at MATS minimums by April 2015
  - Title 26, Section 45 Tax Credit (20% reduction NOx, and 40% SOx or Mercury)
  - Coal Combustion By-product regulations
  - Industrial Boiler MACT
  - Cement Kiln MACT
  - Water regulations
  - Greenhouse Gas emissions
- **International Regulations**
  - United Nations Environment Programme – Minimata Treaty
  - China (12th 5-Year Plan), Europe (regs in place), India (none yet), South Africa (none yet)

Brominated Technology Overview: Most Successful and Widely Used

Technology	Mercury Control%	Preferred Coal Type	Comments
Activated Carbon	Up to 80%	Bituminous	Limited by mercury oxidation; fly ash impacts for resale; particulate control required
Br Activated Carbon	Up to 95%	Sub-bituminous Lignite	Issues with SO_3 impacts; fly ash Impacts for resale; particulate control required
Calcium Bromide Technologies	Up to 95%	Sub-bituminous Lignite	Scrubber or particulate control required
48% HBr	Up to 90%	Sub-bituminous Lignite	Dry sorbent injection; particulate control required
Non-C Br Sorbents	Up to 75%	Bituminous	Particulate control required
Sulfur Technology	Up to 75%	Bituminous	Scrubber technology
Dry Sorbent Injection	Co-benefit	Bituminous	Particulate control required

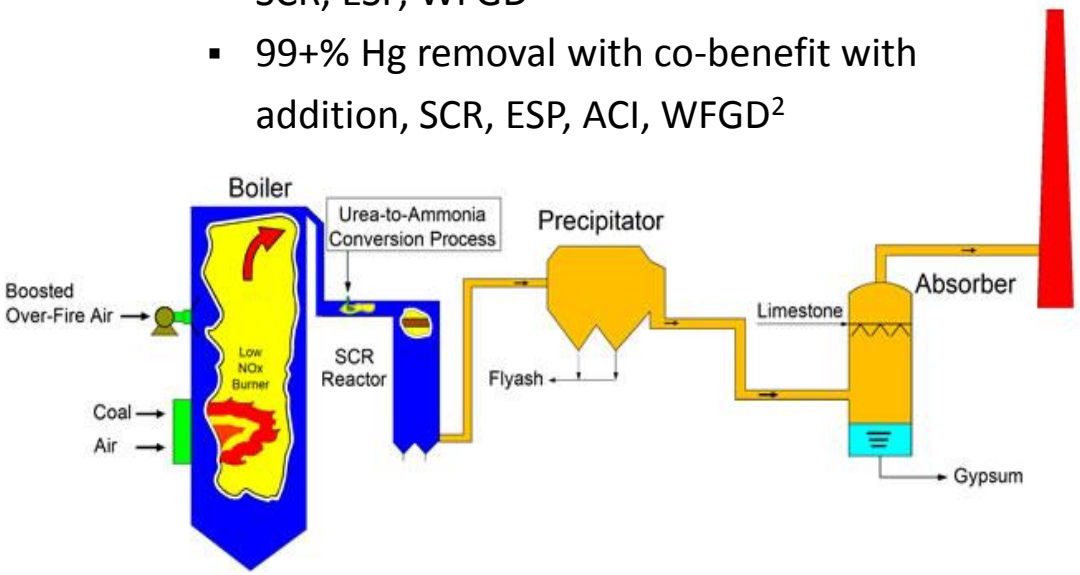
GeoBrom® is intended for general mercury control application. Great Lakes Solutions does not endorse any particular emission control technology. Please consult your technology provider regarding proper application and technology rights.

The GeoBrom® product line has been demonstrated in all major technologies at commercial scale

GeoBrom® HG520 – Effective and Efficient

- Added to coal in the boiler to oxidize mercury in the combustion zone for downstream capture in WFGD or on particulate in ESP, Fabric Filter
  - $Hg^0 \rightarrow Hg^{+2}$
- Technology developed – existing intellectual property
- Survey of 70 Units by EPRI[1]
  - U.S. Section 45 Refined Coal Tax Credit (37)
  - U.S. state regulation compliance (16)
  - Section 45 and U.S. state regulation compliance (3)
  - Parametric testing units (14)
  - Various configurations of air pollution control devices

- Operating and capital cost efficient process
- Typically effective for high mercury, low halogen coals (e.g., U.S. Powder River Basin)
- 94% Hg removal co-benefit with addition, SCR, ESP, WFGD[2]
- 99+% Hg removal with co-benefit with addition, SCR, ESP, ACI, WFGD[2]



[1] Dombrowski, Katherine (URS), Arambasick, Katie (URS), Srinivasan, Nanda, (EPRI). "Bromine Balance of Plant Study." Air Quality Conference IX. Washington, D.C. October 2013.

[2] Van Otten, Brydger, Adams, Bradley (Reaction Engineering International). "Evaluation of Mercury Control Strategies in the Presence of SO^3 Using the MerSim™ Model." McIlvaine Hot Topic Webinar. February 27, 2014.

GeoBrom® HG520 – Benefits

- Longer life of SCR catalyst – provide buffer if SCR used for oxidation (avoid catalyst depletion)
- Reduce requirements for carbon – additional bromide for oxidation
  - Lower operating costs
  - Reduced risk of impact to fly ash for sales
  - Option vs. halogenated carbon – two levers to adjust for operations
  - Reduced cost potential for units with particulate control devices at capacity
- Assist with co-benefit technologies to allow for oxidation
- Allows for adjustment due to fuel blending variations, load adjustments, and other operational variables
- Make use of unburned carbon (LOI) in fly ash that exists for baseline capture
- Provide general buffer for meeting MATS limits in plants that operate close to compliance requirements

United States Logistical Coverage

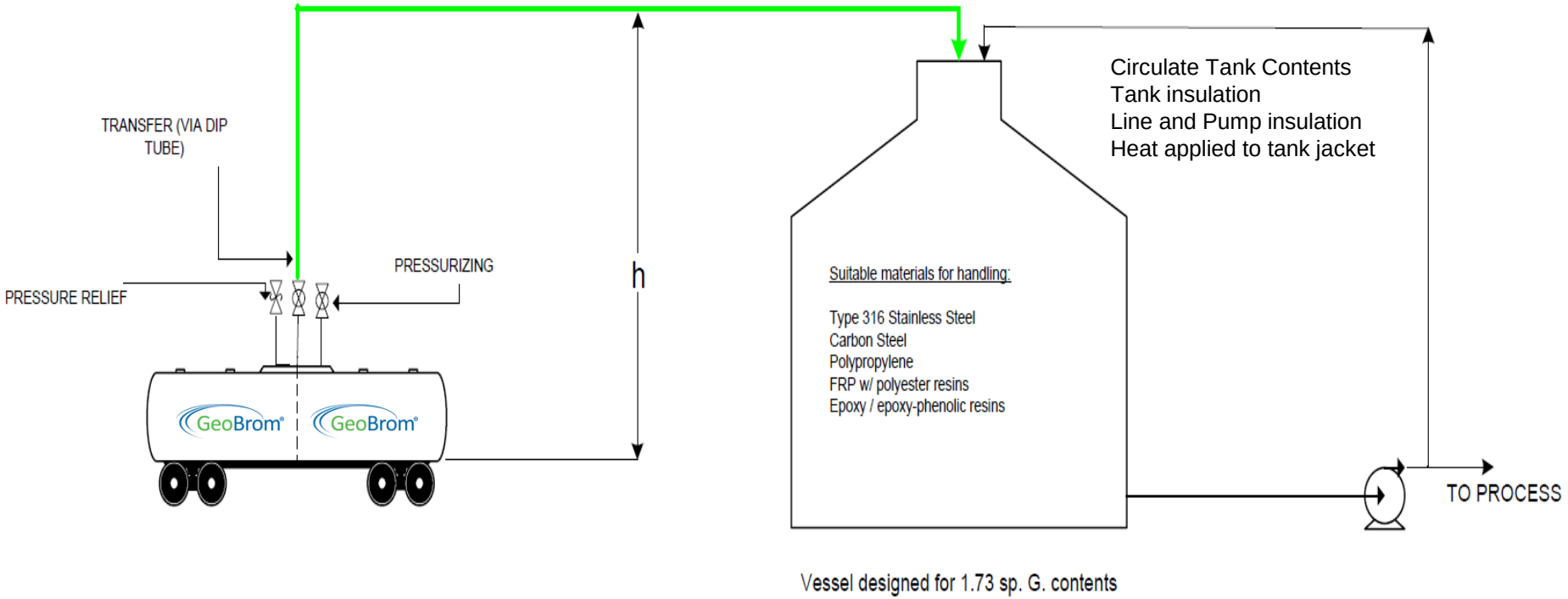
GeoBrom® Calcium Bromide

GeoBrom® Hydrobromic Acid

GeoBrom® Sodium Bromide

24-hour delivery response

GeoBrom® Storage System – Simple and Available



* Pressure relief device setting (75 psig)
  Great Lakes Solutions recommends unloading pressure limit (40 psig)
  Equipped with vacuum relief

*Follow all equipment manufacturer recommendations

Pressure (p) needed to lift product: p = specific weight X height = 106.2 lb_f / cu ft X h
i.e. height of 20ft p = 2,124 lb/ sq ft or 14.8 psig

Main Points of Storage/Transfer System

- Products non-regulated for transport
- Railcar recommended transfer from dip-tube, truckload from bottom valve
- Proper PPE for employees
- Secure connections and monitor transfer
- Density and crystallization temperature – GeoBrom® HG520 (14.2 ppg and est. 10-20 ˚F) and GeoBrom® HG400 (12.5 ppg and est. 27 ˚F)
- Properly insulate and/or circulate the tank in colder regions
- Materials of construction – equipment available off-the-shelf
- Air pressure or pump to lift to desired height
- Adequate back-flow prevention
- Great Lakes Solutions on-site support and expertise available

Corrosion Studies - GeoBrom® HG520

- 90 day tests on coupons of six metals (C-1018, 304W, 316LW, 2205, 304LW, 316) tested with 52% $CaBr_2$ (GeoBrom® HG520)
- Temperatures of 20°C and 50°C – ASTM G1-03 used
- Liquid Submersion
  - All less than 2.0 mpy
  - C-1018 highest rates at 0.32 mpy for 20°C and 1.29 mpy at 50°C
  - All other samples <0.05 mpy
- Vapor Exposure
  - All less than 0.06 mpy
  - C-1018 highest rates at 0.025 mpy for 20°C and 0.053 mpy at 50°C
  - All other samples <0.015 mpy
- Half liquid/ half vapor
  - Liquid immersed typically where corrosion occurred
  - All less than 0.70 mpy
  - C-1018 highest rates at 0.14 mpy for 20°C and 0.65 mpy at 50°C
  - All other samples <0.10 mpy

Good results with Stainless and Duplex alloy performing best. Choice dependent on equipment performance needs, application, cost, and availability. Other materials also satisfactory, i.e. lined FRP, lined-steel, etc.

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Great Lakes Solutions - Bromine Experts

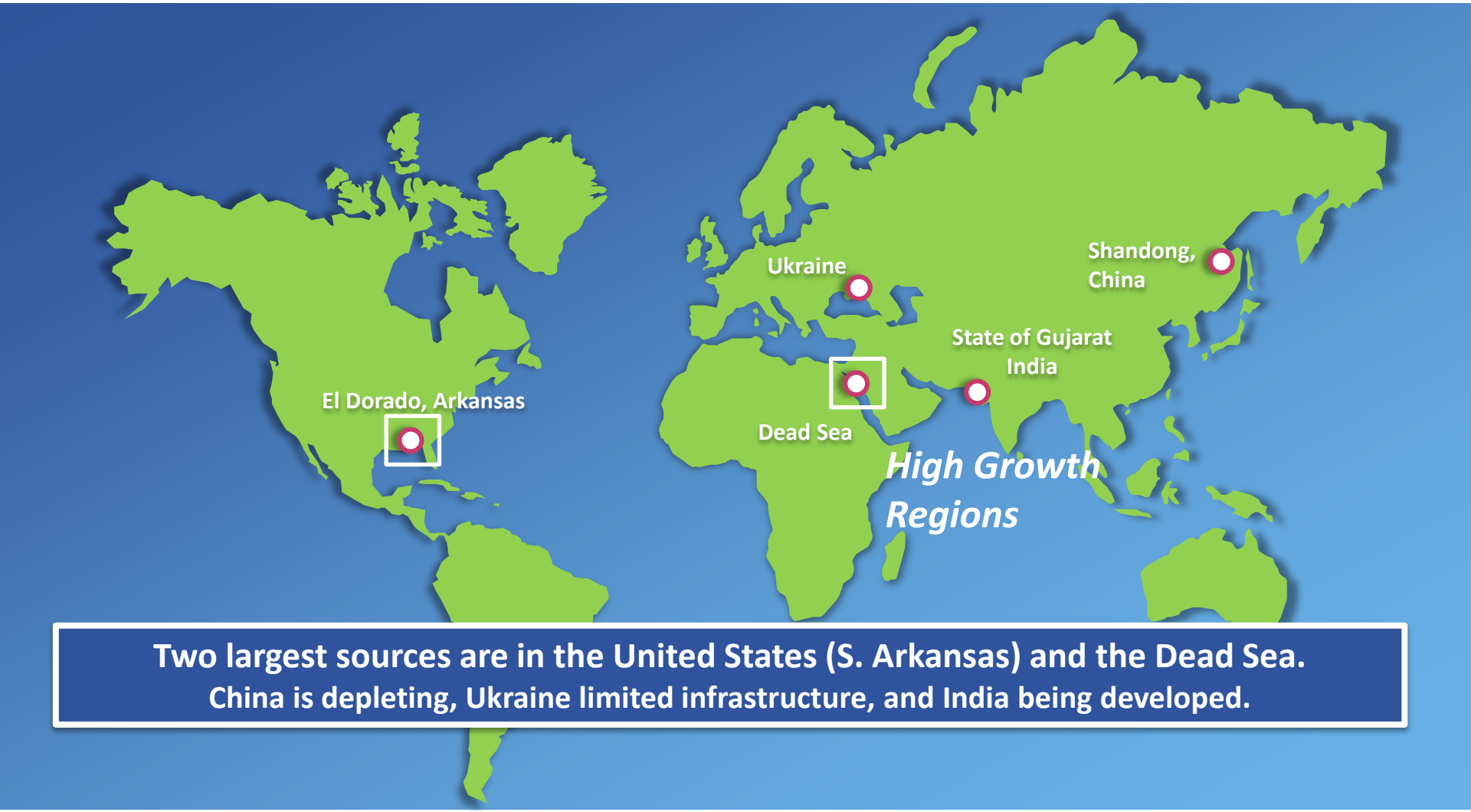
Great Lakes Solutions

We Build Customer/Partner Relationships

- **Domestic Supply**
  - Strongest U.S. bromine position
  - Secure, established U.S. operations - $100M invested 2011-2013, $170M planned 2013 – 2015
  - Strong investment in US facilities, global expansion
- **Supply Security and Sustainability**
  - Multiple carrier options
  - Strategic inventory locations
  - Three U.S. bromine plants + two additional bromine sources
  - Multiple U.S. sources for calcium bromide
  - Estimated reserves - eleven million tons of bromine[1]
- **Expertise with CaBr and NaBr Products**
  - Equipment and training
  - Handling and technical expertise exceeding 30 years
- **Flexibility and Customization of Solutions**
  - Ease of order process/ delivery - customer service
  - Flexible logistics and product support for test trials
  - Facility design assistance
  - Site specific storage and support
  - Broad package range: drums to bulk in trucks and railcars

[1]USGS Mineral Commodity Summaries 2013, January 2013
http://minerals.usgs.gov/minerals/pubs/commodity/bromine/mcs-2013-bromi.pdf

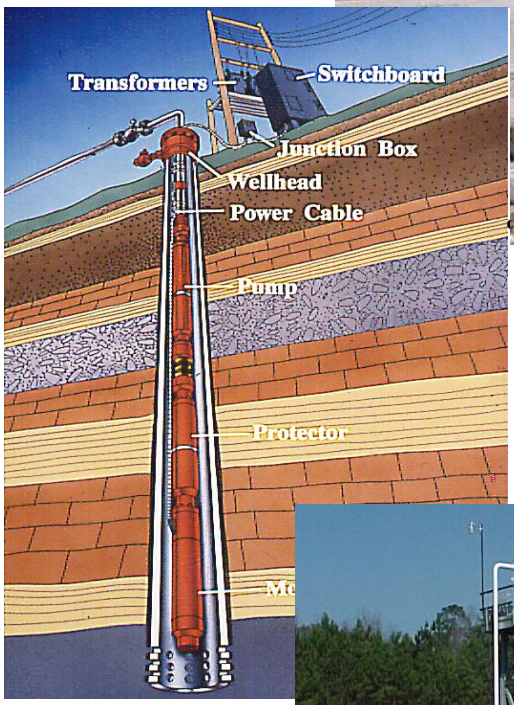
Global Bromine Resources



Two largest sources are in the United States (S. Arkansas) and the Dead Sea.
China is depleting, Ukraine limited infrastructure, and India being developed.

Sources of Brines for Bromine Production

- Deep wells (>5000 ft) – similar to South Arkansas production
- Shallow wells (200-400 ft) – more prevalent in China
- Tail brines from fertilizer potash production
- Salt bitterns from production – China and India
- Evaporation ponds
- Seawater – low concentrations
- Bromine extracted after reaction with chlorine to convert Br^- to elemental bromine (Br_2)



Design Schematic & Brine Well in South Arkansas, USA

Where else is bromine used?

Key Products	Key End-Use Markets
Brominated Performance Products: ♦ Clear Brine Fluids ♦ GeoBrom® Series ♦ Bromine & Bromine Derivatives ♦ Fumigants	♦ Mercury Control ♦ Oil Fields & Gas Exploration ♦ Pharmaceuticals ♦ Agriculture ♦ Transportation
Flame Retardants	♦ Electrical & Electronics: Printed Wiring Boards, Connectors, Enclosures ♦ Building & Construction: Insulation Foams, Furniture Foams

Key Growth Drivers for Bromine:

- Flame retardants for energy efficient thermal insulation
- Mercury control to reduce emissions from coal-fired power stations
- Emerging global fire safety standards
- Fine chemicals growth in fast growing regions
- Electronics market expands as global standard of living grows

The Value of GeoBrom® and Great Lakes Solutions for Mercury Control

GeoBrom® products have been designed for incorporation into new technologies that use bromine or brominated derivatives products for the efficient reduction of toxic mercury emission from coal-fired boilers and power plant installations.

The GeoBrom® product line provides sustainable, secure, U.S. manufactured brominated products for mercury control by a company with proven ability to solve complex customer logistical challenges and requirements.

- **Effective and proven at commercial scale in technologies**
- **Reliable U.S. supply**
- **Cost-effective solutions for mercury control**
- **Flexibility to meet customer needs**
- **Customer support and creativity for all facets of the order and delivery process**

Contact Information

Jon Lehmkuhler, Energy Industry Leader
Great Lakes Solutions
1801 Sagamore Parkway W
West Lafayette, IN 47906

Phone: 765-497-6011
Fax: 765-497-5941
Mobile: 765-427-7384

Email: jon.lehmkuhler@chemtura.com

Connect on LinkedIn with Jon!