

## Elixsys Executive Summary

**Overview:** The Elixsys Group has developed a highly innovative, environmentally friendly process designed to mitigate significant industry challenges with coal fly ash (CFA) and directed toward beneficiation and land reclamation. Known as the Elixsys Process, it is the only known technology that holistically recovers metals and constituents such as aluminum, titanium, iron, silica and gypsum and, perhaps most importantly, rare earth elements (REE) from CFA. By concentrating the REE, the CFA is processed completely so there is no need to store waste or return residuals to storage ponds. The Elixsys Process methods are safe, leave no carbon footprint, will not generate additional waste streams, and all by-products involved in the process are recycled. Additional benefits include remediation of waste coal lands and returning them to productive and safe use.

**The Problem:** For years CFA has presented an enormous environmental problem relating to its harmful constituents and the massive ongoing accumulation of stored CFA. The coal industry has historically viewed CFA as an unavoidable waste product resulting from using coal to generate electricity. The coal industry's solution has been to store the ash as an industrial waste since previously there were no known safe and cost effective ways to make it inert. For decades CFA has been accumulating in landfills and in environmentally unstable ash containment ponds. By 2006, approximately 125 million tons of coal-combustion byproducts, including CFA, were being produced in the U.S. alone.

Through CFA testing and engineering development, the Elixsys Group has discovered that what the coal industry has been categorizing as industrial waste is actually a valuable untapped commodity comprising extractable aluminum, titanium, iron, silica, barium sulfate, and REEs. Essentially, the coal industry has been leaving millions of dollars in revenue piled up in ash containment ponds and landfills. The Elixsys Process will correct this problem and benefit the bottom lines of coal/electric facilities.

**The Fix:** Elixsys' solution to the world's CFA problem is anchored in patent-pending technology in which CFA is almost completely consumed in the recovery of metals such as iron, alumina, titanium, and REEs. When sulfur is present in CFA, it is typically removed in the form of gypsum. The Elixsys Process converts the gypsum into value added products such as barium sulfate and calcium chloride, both of which have value in industrial markets.

**The Technology:** Elixsys' innovative, patent-pending technology is a safe, low temperature hydrometallurgical process utilizing a chloride leach solution to beneficially recover metals and rare earth elements, and to produce commercial products from CFA. The end-result of the Elixsys Process is a concentration of the REEs in our leaching solution.

**Environmental Benefit:** Finally, since the Elixsys Process consumes the CFA, the environmental liabilities of the coal/electric facility for the long term storage of CFA can be significantly reduced if not eliminated, and the recovery of alumina and REE will markedly reduce dependence on foreign sources

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for these scarce products. According to the Department of Energy, the REE industry is a \$329 billion per year industry supporting 618,000 jobs, so the work generated by Elixsys Process will further enhance a growing and viable industry. In addition, large areas of land devoted to waste coal (culm or gob) will now be remediated through the consumption of the waste coal in power plants generating the ash.

**Financial Benefit:** The process has been analyzed on a site by site basis. The attached analysis is for a project which is proceeding with the process and demonstrates a daily base operating revenue of \$387,000 and gross margin of \$217,000 which can be greatly enhanced by the addition of REEs into the calculations.

## Key Players – Elixsys Group

**Dr. Barry Scheetz, Principal Scientist, Retired Professor of Materials and Civil Engineering, Coal Fly Ash Specialist.** [barry.scheetz@elixsysgrp.com](mailto:barry.scheetz@elixsysgrp.com), *phone 814-360-8241*. For the last 30 years of his career, Professor Scheetz has worked directly with industry to develop applications that would utilize industrial “waste” products into useful commodities that focused on environmental restoration of Pennsylvania’s blighted mine lands. Utilizing his knowledge of cementitious behavior of materials he and his students placed in excess of 30 million tons of a fly ash-based cementitious solids into mine voids, thereby reducing the formation of acid mine drainage and improving the public health and safety of local communities. Dr. Scheetz has received numerous national awards for these activities, which has propelled him into national prominence as a leading expert on coal fly ash.

**Leonard H. Passmore, Principal Engineer.** [leonard.passmore@elixsysgrp.com](mailto:leonard.passmore@elixsysgrp.com), *phone 423-676-2069*. Mr. Passmore is responsible for development and implementation of the Elixsys Process. He is a graduate from the US Naval Academy and the Naval Post Graduate Program and was the first in his year group to qualify as a Nuclear Engineer. Following Naval service, Mr. Passmore worked as the Project Manager and later as the Construction Manager for Mega Construction Company specializing in the Boiler, Refractory, Insulation and Linings.

**Bruce Tetkoskie, Director Business Development.** [bruce.tetkoskie@elixsysgrp.com](mailto:bruce.tetkoskie@elixsysgrp.com), *phone 570-590-3078*. Mr. Tetkoskie is a veteran executive supported by over 25 years of project management expertise and operational leadership within the power generating and environmental service industries. Possessing a wide range of experience in a variety of areas including reclamation activities, permits and compliance issues, environmental assessments and audits, as well as multi-site management, Mr. Tetkoskie has gained a strong reputation for utilizing technology innovation to drive results in operations, cost savings, and revenue growth.

**Marsh Passmore, Director Industry Relations.** [marsh.passmore@elixsysgrp.com](mailto:marsh.passmore@elixsysgrp.com), *phone 423-292-5126*. Ms. Passmore holds a BBS from Hawaii Pacific University. Her work experience includes customer

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relations and sales for National Health Laboratories, environmental services, remediation and laboratory construction sales for EcoTek (a subsidiary of Nuclear Fuels), environmental laboratory sales for the Department of Energy sites including Hanford, Fernald and the Nevada Nuclear Depository for Advanced Technologies. She owned Monte Piedras, LLC., a firm specializing in the design and construction of modular environmental laboratories.

**Dan Preston, Chief Executive.** [dan.preston@elixsysgrp.com](mailto:dan.preston@elixsysgrp.com), *phone 206-406-6402*. Mr. Preston is also the Chief Executive of ClaroVia Technologies, LLC; Chairman and Managing Member of Eagle Harbor Holdings, LLC; and President and CEO of MediusTech. Throughout his career Dan has founded and led six technology companies. He was founding Chairman, President, and CEO of Airbiquity and co-inventor, with his son Joseph Preston, of the key technologies that were deployed in GM-OnStar, BMW and Ford's Connected Services for SYNC. Under Dan's Leadership Airbiquity was selected as one of Fortune Magazines "Cool Companies" and later recognized as one of the top 25 companies in the Northwest by the Investment Forum. Dan Preston is a named inventor on more than 100 patents and applications pending.

**Samuel Hemingway, Financial Principal.** [sam.hemingway@elixsysgrp.com](mailto:sam.hemingway@elixsysgrp.com), *phone 971-600-0025*. Mr. Hemingway has over 30 years corporate and investment banking experience. Sam joined Manufacturers Hanover Trust in 1978 as an Assistant to the Chairman and calling officer in the National Division, leaving to go to Wall Street and Barclays Bank including time in Chicago and at Barclays headquarters in London. Following his departure from Barclays in 1992, Mr. Hemingway was a private venture capitalist and served on several public company boards. In 2000, Mr. Hemingway joined Cascadia Capital and served in various capacities including CFO, Controller and Financial Operations Principal.