CEI OVERVIEW

- **Core Capabilities**
  - Process engineering
  - Mechanical and electrical design / automation
  - Project management
  - Pilot Plants – Design, Build and Operate
  - Skid systems
  - Custom equipment

- Owners have over 150 years of combined experience in the design, construction, and operation of chemical facilities.

- We focus on long term relationships in which we supplement a customer’s engineering staff.
CEI OVERVIEW

- Experience in most unit operations
  - Continuous and batch reactions
  - Distillations
  - Filtrations
  - Powder handling
  - Bulk material handling
  - Liquid and gas handling
  - Hazardous materials
  - Ultra high vacuum
  - High temperature or pressure
  - High purity

- Many project examples available to discuss
CEI STAFF

- Chemical Engineers
- Mechanical Engineers
- Instrumentation/Electrical Engineers
- Technicians
- Administration

- Licensed PEs on staff for multiple states including Texas, Pennsylvania, and Maryland
- PMI accredited project managers

- 15,000 SF Process + Engineering facility opened in 2015
Alkali Metal Experts

- Na
- K
- NaK
- Li
- KO₂
- Na₂O₂

Pilot Plants
- Design
- Build
- Operate

Engineering Services
- Process
- Project
- Mechanical
- Electrical
- Automation
- Controls
ALKALI METALS EXPERTISE

- Engineering Design
  - Na and NaK heat transfer
  - Loading / Unloading
  - Pilot plants & skid systems
  - Storage & transportation
  - Process Safety Analysis

- Alkali metal reactions
- Handling & purification
- Equipment & instrumentation
- Metal Halide reductions (700+ Deg. C)
ALKALI METALS SERVICES

- On-site clean up & removal
  - Na
  - NaK
  - Na$_2$O$_2$ - KO$_2$
  - Li
  - K
- Site inspection
- Hands-on training and demonstrations
- Building, fire code and DOT shipping consulting
Electromagnetic pumps and flow meters for Alkali Metals and other fluids

High temperature NaK filled pressure transmitters

Sodium supply, custom sized sodium ingots
Custom shaped extruded Alkali Metals
Purified Alkali Metals
Sodium Dispersion
Sodium Etchant
Sodium and other Alkali Metals are widely used in the following applications or processes:

- Fluoropolymer Etchant
- Sodium Peroxide
- Reduction of organic esters
- Descale metal
- Purification of molten metals
- Sodium Cyanide
- Sodium Hydride
Sodium Dispersion can be used in a number of ways for the following processes or end uses:

- Organic Synthesis
- Dechlorination of PCBs
- Agrochemicals
- Pharmaceuticals
- Fragrance and Flavors
- Carboxylation
Sodium Dispersion is produced via joint venture.

- Creative Engineers, Inc. + Columbia Sales International joint venture.
- Two production units
- Batch sizes of 75 to 400 gallons
- Made to order
PROCESS ENGINEERING

- Conceptual process design
- Evaluation of alternatives
- Scale-up design
- PFDs - Process Flow Diagrams
- P&IDs - Piping and Instrument Drawings
- MEB - Mass and Energy Balances
- Operating procedures
- Relief valve sizing and PSV/PSE analysis
- PHA - Process Hazard Analysis facilitation and resolution
PROCESS EXAMPLES

- Sodium, water reactive, and other hazardous chemicals
- Alkali, refractory, rare earth, other metals
- Metal halides and hydrides (use & manufacture)
- Sodium Methylate
- Highly exothermic or endothermic reactions
- Photovoltaic silicon
- Solar thermal
- Flammable & toxic materials
# PROCESS MATERIALS

- Specialty Chemicals
- Polymers/Monomers
- Pigments
- Energetic materials
- Pyrophorics
- Powdered Steel
- Zeolites
- PCC/GCC/Minerals
- Zr & Al based Chemicals
- Salts & metals for solar applications

- Cement
- Silica
- Glass
- Hydrides (B and Si)
- Ta, Ti, Si, B, Sn, Pb, Sb, Sc, Nd
- Metal halides
- Oil
- Solvents
- Activated Carbon
- Waste Water
PROJECT MANAGEMENT

- Scope development & control
- PMI methodology
- Project estimates
  - Conceptual
  - Budgetary
  - Construction
- Schedule development
- RFP/RFQ development
- Expediting of long lead or critical path equipment
MECHANICAL ENGINEERING

- Custom machine or equipment design
- Lite custom fabrication
- Materials of construction/material selection
- Utilities (of all types)
- Autodesk Plant Design Suite plus Inventor
- PSV/PSE sizing
- Designing for extremes of temp/press/vac
- ASME/BPE compliance
ELECTRICAL ENGINEERING

- Power distribution
- Motor controls
- Panel design
- Interlock design, implementation and testing
- Wiring details including one-line and three-line diagrams
- Electrical heat trace design
- Load studies
- NEC/NFPA compliance
AUTOMATION & CONTROLS

- Process control strategy
- System-level architecture
- HMI design and implementation
- DCS, PLC, PXI, NI LabVIEW, NI FPGA/cRIO, cDAQ
- Data acquisition and data logging
- Instrument specifications
- Control loops design and implementation
OTHER SKILLS

- IBC – International building codes
- IFC – International fire codes
- Rapid response capability
- Startup support
- Construction management
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- Build
- Operate

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Engineering Services
- Process
- Project
- Mechanical
- Electrical
- Automation
- Controls
PILOT PLANT TYPES

- Pilot plant or R&D Unit
- Bench-top or Lab-scale Set Up
- Demonstration Unit
- Skid mounted Systems

- Proof of Concept
- Technology Evaluation
- Milestone Data for Investors
- Economic Feasibly
- Commercialization
PILOT PLANT BENEFITS

- Complete customization
- Customer-owned equipment
- All IP Developed is customer owned
- Delivery to customer location
  ....or...
- Operated at CEI facility in York, PA
- Experienced pilot plant staff on hand
- Many project examples available to discuss
A UNIQUE SET OF SERVICES

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Engineering Services
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- Mechanical
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CONTACTS

Richard J. VanLieshout
President
(443) 807-1202
rich@ceina.pro

Jay E. Grassel
Business Development & Project Manager
(512) 266-9972
jayg@ceina.pro