J. Bradley Mason, P.E.

Mr. Mason is a licensed chemical engineer with over 40 years engineering and project management experience. Commercialized several chemical and thermal treatment processes from conceptualizing and patenting process technology, developing process flowsheets, planning and executing process scale-up from pilot plant test programs, supervising detailed process design and engineering of full-scale production facilities, and providing oversight of plant construction and technical support for plant start-up and operations. US DOE and international companies have invested more than US$800 million in design, construction and operation of technologies and processes developed by Mr. Mason. Holder of over 30 US and international patents.

Key Experience

- Process development
- Pilot plant testing and process optimization
- Radioactive waste processing facility design and operations
- Modular transportable system design
- Pressure vessel and process equipment design
- Control systems, instrumentation, piping, and integrated systems design
- Remote maintenance and shielding design
- Pyrolysis, steam reforming and mineralization reactions and operations
- High temperature filtration
- Solids transfer system design and operations
- Procedure development
- HAZOP studies
- Explosion protection

Qualifications

BSc

Chemical Engineering

Professional Engineer

Chemical Engineering

Relevant Experience

Director, Technology and Founder - CEtech LLC

- Developed ScrollTherm thermal treatment process for treatment of hazardous and radioactive wastes, patents pending. Process suitable for safely and reliably thermally treating most radioactive and hazardous liquids, solutions, slurries, pastes, wet cakes and solids including the following radioactive and/or hazardous wastes: ion exchange resins, solvents, oils, decontamination solutions, plastics of all kinds, cellulose, cardboard, bitumen, sludges, acids and bases.

Process can also safely and efficiently thermally treat and stabilize radioactive and/or hazardous waste streams including alkali metal compounds, tetraphenyl borate, nitrates, nitrites, nitric acid, hydroxides, phosphates, sulfates, chlorides, fluorides, compounds that melt, biomass, etc. Nitrates, nitrites and nitric acid are destroyed with very low resultant NOx in process gas.

Figure 1 Water insoluble alumino-silicate minerals produced from simulated alkali-nitrate based tank waste mixed with clay and thermally treated at 500C in pilot ScrollTherm unit.

Figure 1 Ion Exchange Resins thermally treated at 360 to 445C in pilot Scrolltherm unit to produce volume reduced non-organic residual solids.

- Designed and operated the ScrollTherm pilot test system. Verified process operating characteristics and design specifications. Prepared test report and technology report. Commercialization of ScrollTherm process in progress.

Vice President and Chief Engineer -THOR Treatment Technologies LLC

- Developed process flowsheets and process design for utilizing the THOR fluidized bed steam reforming (FBSR) system for immobilization of numerous US Department of Energy (DOE) radioactive wastes including; US DOE Savannah River Site (SRS) Tank 48H High Level Waste (HLW) consisting of hydroxide-based nitrate tank waste with benzene; US DOE Idaho National Laboratory (INL) Sodium Bearing Waste (SBW) tank waste consisting of nitric acid and nitrates; and US DOE Hanford nuclear reservation site Low-Activity Waste (LAW) tank waste and secondary waste (SW). Process converts wastes into immobilized, water insoluble sodium-alumino-silicate (NAS) mineralized final waste form while simultaneously destroying nitric acid, nitrates and nitrites.

US DOE Hanford Tank Farm Waste
(Source: energyinfo.oregon.org)

- Supervised numerous large-scale test programs for demonstration of FBSR mineralization of US DOE tank wastes with concurrent destruction of nitric acid, nitrates, and nitrites in waste streams. Supervised performance of seven extensive test programs for demonstration of FBSR mineralization of US DOE tank wastes including two test programs for converting SBW to a sodium carbonate product, three test programs for converting SBW to water-insoluble sodium alumino-silicate (NAS) immobilized mineral form, and two test programs for converting Hanford Low-Activity Waste (LAW) and secondary waste to immobilized water insoluble NAS mineral.

Hazen Research FBSR
Pilot Plant #1 of 5

The immobilized FBSR mineral waste form was demonstrated to have long-term leach and disposal assessment performance that exceeds performance of borosilicate glasses in the Hanford Intermediate Level Waste (ILAW) disposal facility, as determined by Battelle Pacific Northwest National Laboratory (PNNL) and Savannah River National Laboratory (SRNL).

- Developed FBSR process for conversion of US DOE INL Sodium Bearing Waste (SBW) HLW solution that consists mainly of nitric acid and sodium and aluminum nitrates into dry granular carbonate product. US DOE awarded contact for design, construction, and operation of the Integrated Waste Treatment Unit (IWTU) at the INL site for treatment of 900,000 gal of SBW.

Prepared initial layout of IWTU facility including shielded equipment cells/vaults. Prepared process flow diagram of treatment equipment and systems. Prepared initial design of all thermal process equipment including one FBSR for conversion of SBW into nitrate-free carbonate solid product, one FBSR for combination reducing/oxidizing use as thermal oxidizer, four high-temperature filter vessels, co-reactant and additive granular handling and feed systems, solid product transfer and receiver system including use of erosion resistant piping and fittings, disposal container loading system to fill canisters with high-activity, free-flowing solids. Prepared initial design of mercury adsorber vessel and piping for transferring HLW solutions and metering SBW solution into FBSR for thermal treatment. Performed initial design of solids size reduction unit.

Integrated Waste Treatment Unit (IWTU)
US DOE INL Site

Supervised detailed design of all process and support systems. Served as process and technology consultant to design contractor for design of entire IWTU facility including preparation of detailed process and instrumentation diagrams, safety systems, mass and energy balances, pressure vessel design and stress analyses, piping design and stress analyses, preparation and review of procurement specifications and detailed operating procedures. Interfaced with contractors for design and optimization of maintenance accessibility and remote maintenance features. Provided critical input and served as process consultant during formal HAZOP and process corrosion evaluation.

Process consultant to IWTU management during facility commissioning and initial start-up operations with simulated SBW solutions. Participated during in-depth optimization evaluations and provided evaluations of operations and maintenance work. Designed special test system to provide additional test data for FBSR operations. IWTU is now completing final full-scale simulant operations prior to starting treatment of actual radioactive SBW.

Batch Drum Pyrolysis
System (Full-Scale)

- Developed batch pyrolysis process for removal of prohibited items (sealed containers, liquids, and reactive metals) from US DOE transuranic (TRU) waste and for conversion of uranium metal fuel pieces to stable oxide form. Supervised design, construction, and commissioning of full-scale drum pyrolysis system for thermal treatment of TRU and MLLW. Supervised thermal treatment operations for drums of non-radioactive volatile chlorinated solvents and Dry Active Waste (DAW) including ion exchange resins, plastics, paper, clothing, wood, rags, etc.

Chief Engineer and Founder - Studsvik, Inc

Hazen Research Facility
FBSR Pilot Plant #2 of 5

- Developed Studsvik's pyrolysis and THOR fluidized bed steam reformer (FBSR) thermal treatment processes for radioactive wastes.
- Supervised extensive FBSR pilot-scale test programs for a variety of simulated radioactive and hazardous wastes from commercial nuclear reactor facilities including organic based ion exchange resins, oils, decontamination solvents, and carbons.
- Supervised conceptual and detailed designs and commercial start-up for the turnkey Studsvik Processing Facility (SPF) located in Erwin, Tennessee USA, that was later sold to EnergySolutions. The SPF utilizes the patented THOR pyrolysis/steam reforming process developed by Mr. Mason for volume reduction and stabilization of high-activity, high-organic content ion exchange resins and other LLRW streams.

The SPF has been in commercial operation since mid-1999, processing over 11300 cubic meters (400,000 cubic feet) of LLW, mainly ion exchange resins, with contact dose rate of up to 10 Gy/hr (1000 R/hr).

EnergySolutions Processing Facility - Erwin, TN
(Former Studsvik Processing Facility)

The SPF design and process and system commissioning work included: shielded building, HVAC and ventilation, fire protection, 45-ton bridge crane, truck bays, liquid and solid LLRW handling and transfer stations, fill-ports, storage vessels, size reduction grinders, two scrubber salt solution dryers, two FBSR pyrolysis/steam reformer vessels, three high temperature filter vessels, remote handling, thermal oxidizer, quencher scrubber, demister, offgas control, HEPA filters, blowers, stack, water treatment and ion exchange, and radionuclide and gaseous continuous emissions monitoring systems (CEMS).

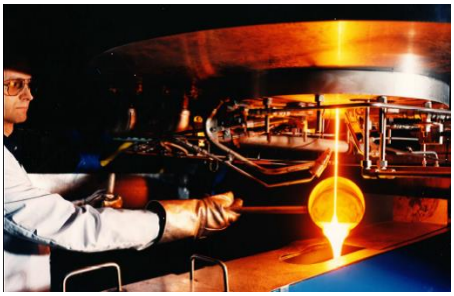
Provided technical input and editing for EPA Air Permit and Radioactive Materials License issued by State of Tennessee for the SPF. Served as member of SPF safety committee for several years. Studsvik sold the SPF to EnergySolutions. The current name of the SPF is EnergySolutions Erwin ResinSolutions processing facility.

- Developed graphite heat treating process for Electricité de France (EDF) for removal of C-14, tritium and Cl-36 from radioactive graphite.
- Developed nitrate treatment process for ORANO (formerly AREVA) for conversion of millions of gallons of Tc-99 contaminated nitrate slurry into stable sodium alumino-silicate and calcium silicate mineralized product. Project is on hold with pilot plant testing and detailed design completed and construction permitting in progress.

Chief Engineer / Director Engineering / Manager, Support Services / Project Manager-Engineer
Vectra Technologies, Inc. (formerly Pacific Nuclear Systems, Inc. / United Nuclear Corp.)

- Developed EnviroGlass and VE-Skull vitrification melter and support systems for thermal treatment of US DOE Hanford LAW nitrate-based tank waste and commercial nuclear power facility Dry Active Wastes (DAW), decontamination solutions, ion exchange resins, etc.
- Performed conceptual design for the modular, transportable EnviroGlass vitrification process. Supervised detailed design and construction for commercial vitrification system including joule-heated melter, stacked bed evaporator/gasifier/pyrolysis vessel, off-gas and air pollution control systems, shielding, remote maintenance devices, modular enclosures, contamination controls, waste feed and storage, shredder and compactor, quencher scrubber, HEPA filtration, Continuous Emissions Monitoring (CEMs), salt handling and solidification, liquid volume reduction, safety systems, and SCADA/PLC controls. Developed process and instrumentation diagrams, mass and energy balances and detailed process operating procedures.

- Performed conceptual and supervised detailed design and construction of the VE-SKULL melter, a vertical electrode, Low-Level Radioactive Waste (LLRW) vitrification melter with cold-wall (skull) lined vessel wall for use in commercial, modular, transportable LLRW vitrification facility. Supervised startup and operation of two ton/day melter for vitrification of high-sodium, high-nitrate, LAW simulant for US DOE Hanford. Supervised conceptual and detailed design of VECTRA cold-wall, induction heated melter for vitrification of HLW.



Vitrification Melter Glass Pour
US DOE Hanford LAW Waste, Richland, WA

- Supervised testing and qualification program for developing borosilicate glass formulations and operational parameters for the EnviroGlass vitrification process and the VE-SKULL melter. Supervised two test programs for denitration of US DOE Hanford LAW tank waste using fluid bed calcination and rotary bed hot-oil heated contactor. Produced denitrated product for vitrification demonstrations.
- Performed conceptual and detailed design and supervised fabrication, startup, and operation of high pressure 40 barg (600 psig) ion exchange (IEX) system for use during first commercial, full-system in-situ chemical decontamination of the reactor and steam generators of a PWR nuclear power station, Consolidated Edison Indian Point Unit 2.

  The process and IEX systems have design flow of 5700 L/min (1500 gpm) with capacity of 69 cubic meters (2400 cubic feet) of IEX resins for removal of over 10,000 curies of radioactivity per week (contact radiation levels of up to 5 Gy/hr [500 Rad/hr]).

  Decontamination and water treatment systems included nine IEX vessels; four spent resin storage tanks; five ANSI B31.1 piping and valve manifolds (over 800 valves); remote resin fill and sluice skids; 1500 kw solution heaters; HVAC chiller; resin slurry vacuum transfer system; integral steel shield walls with 23 cm (9 inch) carbon steel shielding; automatic full-flow, back-washable filtration system; and chemical mix and injection systems designed for full remote operation using a SCADA/PLC control system.

Modular Ion Exchange System, 9 inch steel shielding, 1500 gpm, full remote operation including backwash filtration system

  All systems and equipment were seismically qualified and mounted on a common structural steel skid with an operating weight of 280 tons. Provided separate transportable Transfer Module for waste processing using IEX resin drying system. Transfer Module provides full containment, HEPA ventilation, 50-ton bridge crane for movement of casks and waste containers. Systems built to QA level B/C (NQA-1).
- Performed conceptual design and supervised detailed design, fabrication, start-up and operation of over 50 modular, transportable process equipment skids for use in radioactive service at nuclear power facilities for clients including Westinghouse PN Services, Ontario Hydro Bruce A, KEPCO KORI-1, and Pacific Nuclear/Vectra Technologies.
- Performed conceptual and detailed design and supervised fabrication and operation of the world's largest, commercial, modular, transportable Chemical Process System for radioactive service for use at Ontario Hydro's Bruce Nuclear Power Development. System was designed to US and CSA codes and received Canadian MCCR registration.

  Chemical Process System included; 5 mix and waste vessels (each with a capacity of 136000 L [36,000 gal]), Process Module (72 tons); Bulk Chemical Handling Modules; ANSI B31.1 piping and valve manifolds; underground pipelines; tanker truck loadout station; bulk chemical unloading facility for hazardous, toxic and flammable chemicals from totes and tankers; spill containment dikes; steam and electrical heating; ventilation system; ion exchange and resin transfer systems; liquid filtration;

HVAC heating and cooling systems; and SCADA /PLC automated control system. System designed and built to CSA Z299.3 and QA Level B (NQA-1).

- Performed conceptual and detailed designs and supervised fabrication and operation for the world's first transportable Chemical Cleaning System for removing sludge deposits on steam side of steam generators at nuclear power stations. System included three transportable modules including pumps, piping, valves, filters, IEX polishing system, solution heaters (2700 kw), coolers, cooling tower, MCCs, vent stack, and 15 mix and waste storage tanks (each with capacity of 79000 L [21,000-gal]).
- Performed conceptual and detailed designs and supervised fabrication and operation of over 100 pressure vessels for use in radioactive service. Vessels were built to applicable ASME pressure vessel and/or API tank codes. Pressure vessels ranged in size from 136000 L (36,000 gal) mix tanks to 4-liter reaction flasks. Designed and supervised fabrication and operation of ion exchange vessels for radioactive service with resin capacities of 2.8 to 5380 L (0.1 to 190 cubic feet). Vessels fabricated of alloys from stainless steels to Inconel and Hastelloy.
- Supervised design and fabrication, DOT/IAEA testing and IP-1 and IP-2 qualification for large 20-ft long ISO EnviroVan cargo containers and for snap-on lids for DOT 7A drums.
- Supervised detailed design and fabrication of automated radwaste drumming station including drum storage, fillport, lift table, drum capper, and drum washdown station. Performed conceptual and detailed design of process systems for a Cesium food irradiation facility.
- Supervised acceptance testing for two automated liquid radioactive waste cement solidification systems installed at Energy Northwest Unit 2 and Marble Hill nuclear power stations.
- Project Manager/Engineer for 14 in-situ, chemical decontaminations/cleanings at nuclear power stations including:
  - Millstone Unit 2, 2 SGs: 567 lbs Cu and oxide sludge removed
  - ANO Unit 1, 2 SGs: 10,040 lbs Cu and oxide sludge removed
  - ANO Unit 2, Letdown Heat Exchanger: 16 lbs Cu and oxide sludge removed
  - Bruce A Unit 4, 8 SGs: 14,056 lbs Cu and oxide sludge removed
  - Bruce A Unit 4, 4 Preheaters: 449 lbs Cu and oxide sludge removed
  - Bruce A Unit 3, 4 SGs: 7,000 lbs Cu and oxide sludge removed
  - Kori Unit 1, SG Channel Head (1), REMCON Process: DRF of 7.0
  - Millstone Unit 2, SG Channel Head (2), CITROX Process: DRF of 6.6
  - Brunswick Unit 2, RWCU System, CITROX Process: DF of 13.7
  - Hatch, RWCU System, CITROX Process: DF of 10.0
  - Brunswick Unit 1, RRS System, CITROX Process: DF of 12.0
  - Monticello, RRS System, LOMI Process: DF of 17
  - Monticello, RHR System, LOMI Process: DF of 23
  - Peach Bottom Unit 3, Reactor Recirc Pump, LOMI Process: DF of 8.5
  - Indian Point Unit 2, Full-Reactor System Decon, CanDerem Process: DF of 7.8

Project Engineer – Atlantic Richfield Company (ARCO)

- Supervised concrete placement and testing for 764 cubic meters (27,000 cubic yards) of concrete at the Black Thunder Coal Mine, Wyoming. Supervised erection and monitored startup of two crushers and 5,000 ton/hr solids conveyor handling systems including multi-story structures.
- Supervised fabrication, registration, installation and startup of over 100 pressure vessels for use in off-shore oil production and gas plant facilities in Asia.
- Supervised field construction and monitored startup operations of 10 off-shore oil and gas production platforms. Tasks and structures included: pile driving, anchor systems, undersea pipeline installation DN200 to 800 (8 to 32-inch diameter), modular platform installation, modular vessel and piping system placement (single lifts up to 450 tons), vessels and piping systems installation and hydrotests, control system checkout, startup and turnover to operations staff.

Black Thunder Coal Mine Load-Out Facility,
ARCO Minerals, Gillette, WY

Offshore Gas Plant, Ardjuna Field
ARCO Indonesia

Employment History

- 2020 - Present CEtech LLC
- 2003 - 2017 THOR Treatment Technologies LLC
- 1995 - 2021 Studsvik Inc
- 1980 - 1995 Vectra Technologies, Inc
  (Formerly Pacific Nuclear Systems, Inc. / United Nuclear Corporation)
- 1974 - 1980 Atlantic Richfield Company (ARCO)
  ARCO Indonesia (1978-80)
  ARCO Minerals (1976-78)
  ARCO Indonesia (1975-76)
  ARCO International (1974-75)