
TYNE
USA, INC.
30+ Years of Tritium Handling
Tritium Detection
Safe Storage
***Unless otherwise specified, all equipment shown in this presentation was designed and built by Tyne Engineering, Inc.

TYNE USA, INC.

9111 Beauclerc Cir. E, Jacksonville FL 32257

TYNE engineering inc. Turnkey Supplier of Tritium Systems

Tritium Separation – Tritium Storage - Tritium Measurement
Design – Build – Assemble –Test – Qualify

Turnkey systems with all mechanical and instrumentation under full Nuclear Quality Program or augmented with Commercial Grade Dedication

Inquiries: kim.kershner@tyneusa.com

877.969.8963 info@tyneusa.com 877.715.5508 http://www.tyneusa.com

FULL NUCLEAR QUALITY ASSURANCE

- ISO9001:2015
- 10CFR50AppB, NQA-1
- EPRI-NP-5625 Commercial Grade Dedication
- CSA-N285.0 (ASME III, Nuclear Class Pressure Boundary)
- CSA-B51 (ASME B31.3 / Sec VIII div 1)
- **CSA N286.7-16 QA of Safety-Related Computer Software
- CSA-N299.1, Nuclear Quality Program

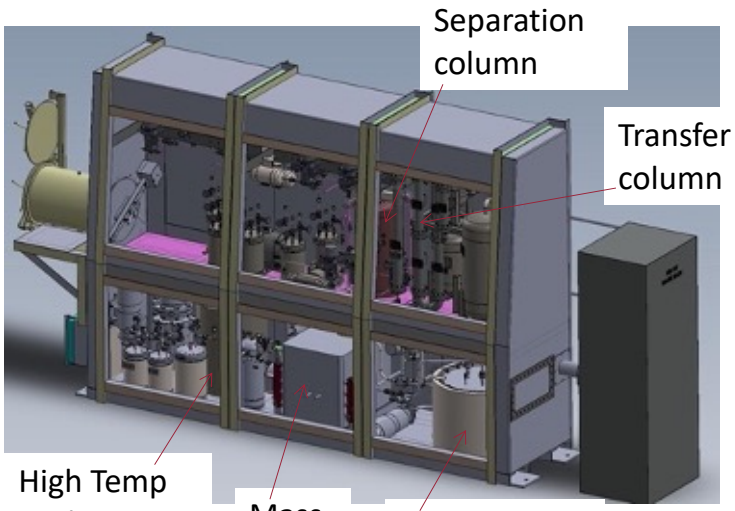
Hydrogen Isotope Separation System (ISS)

Hydrogen Isotopic Separation System (ISS)

- Tyne has experience in various methods to separate tritium from deuterium and hydrogen.
- Gas Chromatograph, Cryogenic Distillation, Thermal Cycling Absorption

Tritium Recovery System (ISS-TCAP)

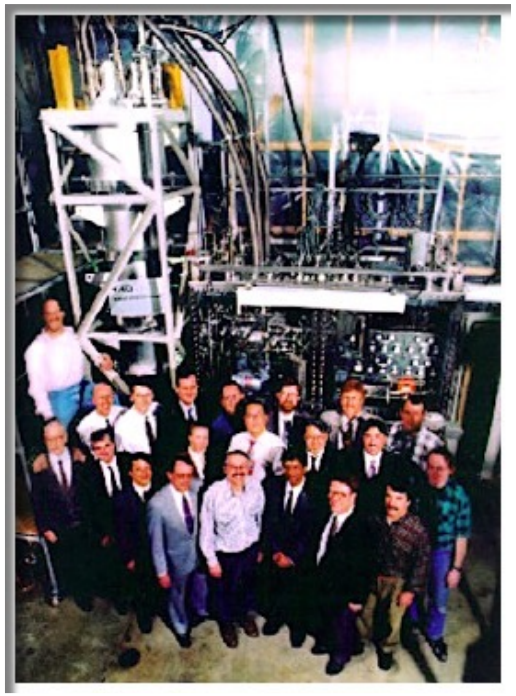
Nuclear-qualified system / Seismically qualified



Process validated in D-H Test System

Tyne, in collaboration with CNL, is currently building a cost-optimized, tritium-compatible unit for delivery in early 2023

Princeton University Cryogenic Distillation System



Tritium Extraction
- from Air and Exhaust Gases -

Exhaust Detritiation System for Fusion Machine - designed, built and delivered by Tyne in under 14 months

Tritium Wet Scrubber

Removes Tritium from Oxygen Exhaust Stream in CECE Process - Prototype Tests at Tyne to validate deuterium scrubbing efficiency.

Tritium Storage and Transport

Glovebox-Contained Tritium Storage and Delivery System– fully designed, built and fabricated by Tyne to Nuclear Standards

- **Designed and built to Nuclear standards by Tyne for AECL to handle 500,000 Curies Tritium**
- **All getter beds, ion chambers, preamplifiers, controllers, vessels, and glovebox enclosure designed, manufactured, welded, wired, and tested by Tyne**
- **Provided with Full Nuclear documentation, seismically qualified**
- **Glovebox (AGS) Compliant.**

TYNE engineering inc.

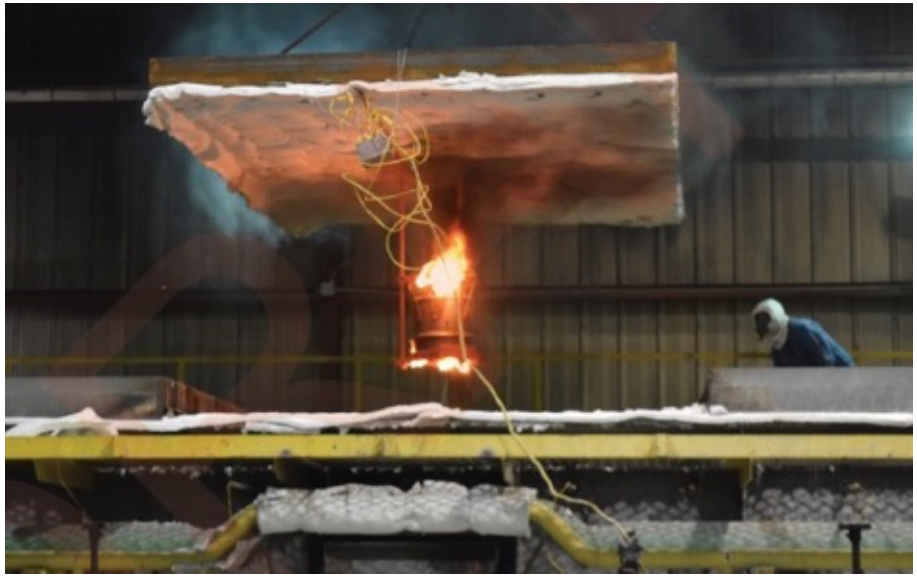
Tritium Storage Getterbeds

- DESIGNED AND BUILT BY TYNE
- DOUBLE CONTAINMENT
- REGISTERED ASME PRESSURE VESSELS
- TRITIUM STORAGE OR SCAVENGING
- URANIUM
- ZIRCONIUM IRON
- NICKEL
- ZIRCONIUM COBALT
- TITANIUM
- MOLECULAR SIEVES

TYNE engineering inc.

Tyne's New International Tritium Transport Container

Tyne's new Type B(U) Nuclear Transport Package for Tritium has just been certified by Canadian Nuclear Safety Commission



Vessel undergoing Fire and Temperature Qualification Testing

Tritium Extraction
- from Light or Heavy Water -

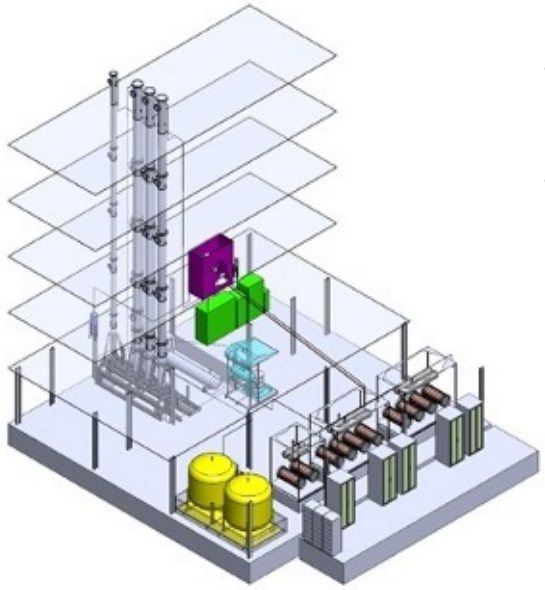
Water Detritiation System – Full Plant Delivery

Combined Electrolysis and Catalytic Exchange Process (CECE)

- Detailed designed, manufactured, installed and commissioned by Tyne for a US waste management facility
- 10m3/h electrolysis
- 4in LPCE columns
- Handles Heavy Water (D2O) or Light Water (H2O)
- All laboratory components designed and built by Tyne, including LPCE columns, Advanced oxidizer skid, Isotopic Separation Skid, electrolyzer Skid, etc.

Light Water Detritiation Facility (LWDF)

AECL NRU Rod Bays Water



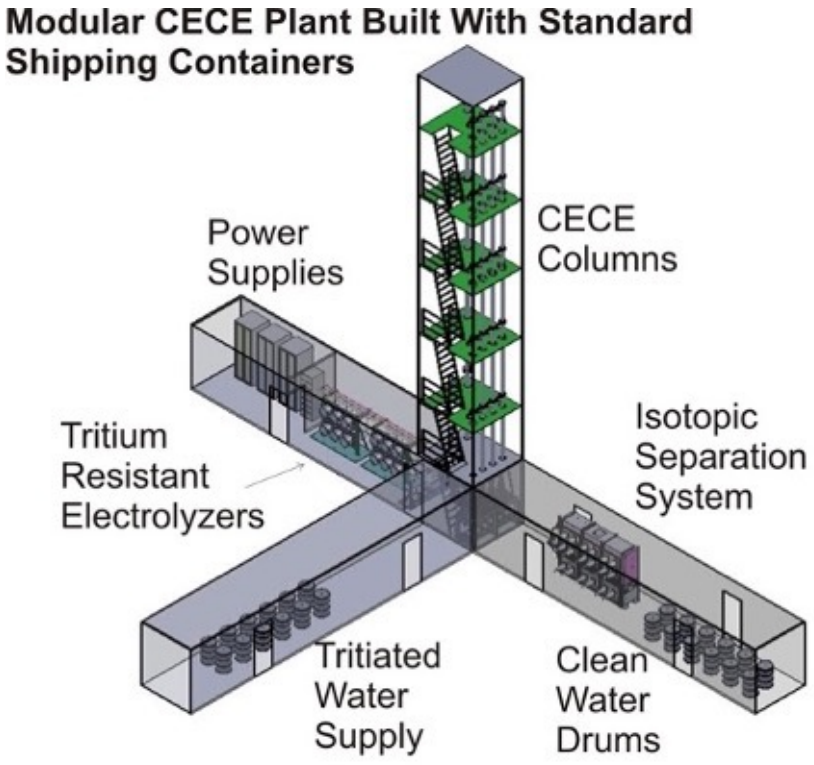
•3D Model of Light Water Detritiation Facility (CECE), designed by Tyne Engineering.
• High Throughput 76kg/h water

• Preliminary Detail Design, including all process, mechanical and I&C, done by Tyne to nuclear design quality standards (CSA-N286.2)

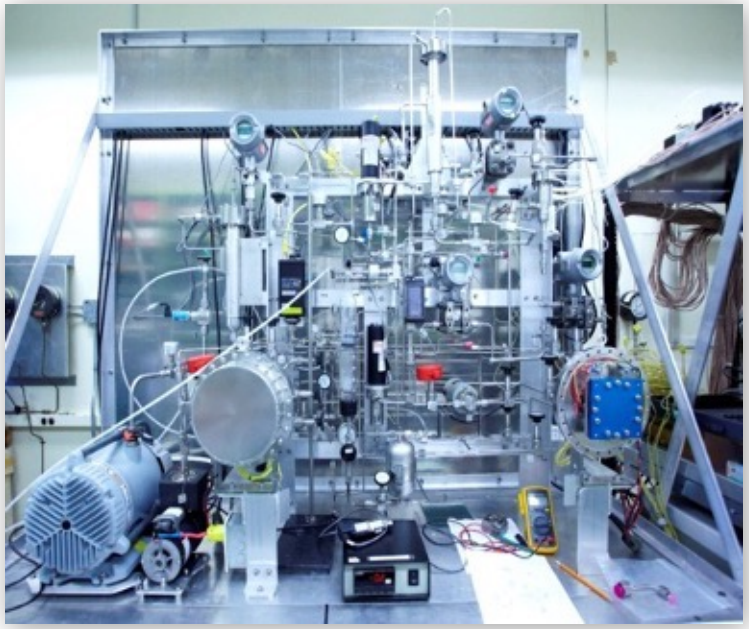
Modularized Construction

Some Advantages of Modularization:

- Parallel Fabrication of Sections (Shorter fabrication time)
- Overlap Schedule
- Cost Sharing (Design is Constant)
- Replication of Modules



Lab-Scale Mini CECE System – for testing PEM Electrolysis Membranes up to 1000Ci / Liter



Specialized Components for Tritium Systems

Hydrogen-Oxygen Recombiners for LPCE and OVS streams in CECE Process

•**Trickle Bed Recombiner**

Recombines Deuterium and Oxygen in CECE Process

•**Gas Phase Recombiner**

Tyne also manufactures and tests process hydrogen recombiner vessels for its systems, including preparation and application of AECL catalyst powder to jelly-roll screens in the recombiners

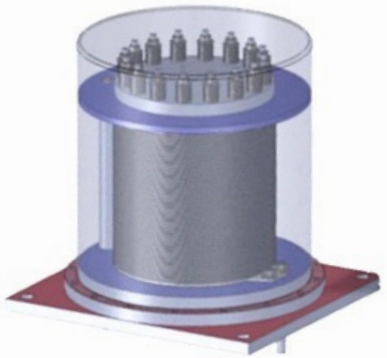
TYNE engineering inc.

Tyne's Recombiner Catalyst Screen Manufacturing Laboratory

Electrolysis of Tritium-Containing Water (for Tritium Removal Plants)

Tritium-Resistant PEM Electrolyzer

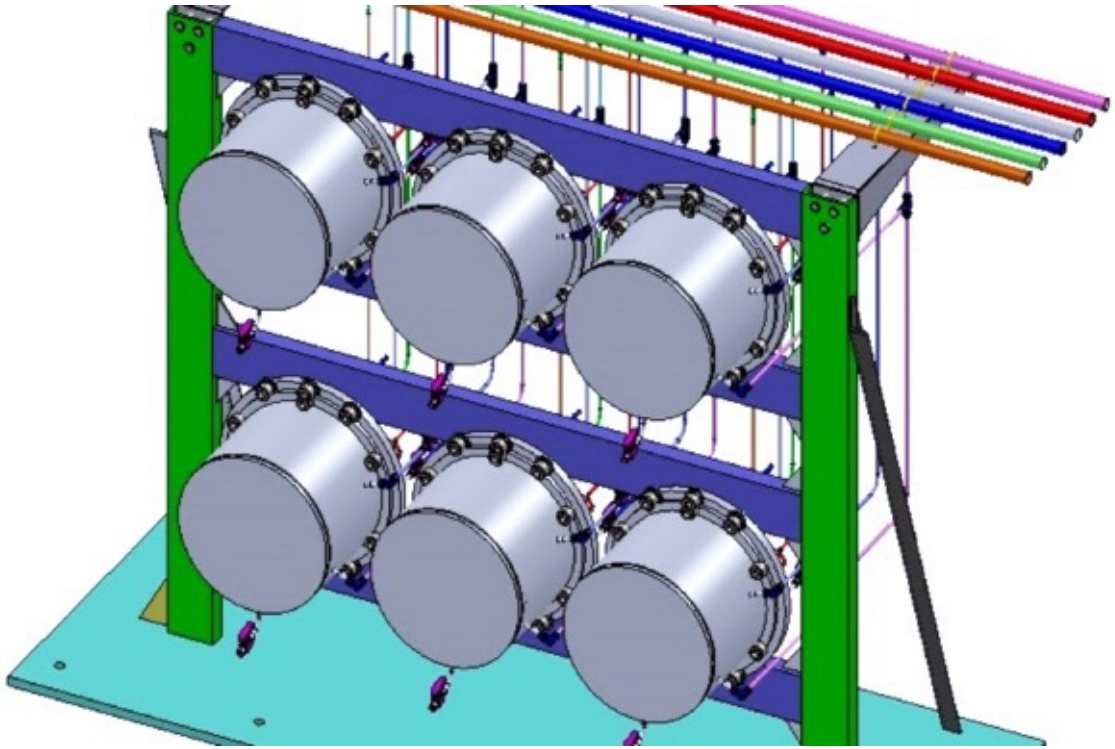
Designed For Use in CECE Process



- ✓ Tritium resistant membrane for long term usage
- ✓ Safety-features specifically for tritium applications
- ✓ Leak-free Design
- ✓ Outer container to monitor for tritiated water or gas.
- ✓ All modules can operate independently and be able to produce 10 Nm^3/hr of H_2

TYNE engineering inc.

Electrolyzer Module

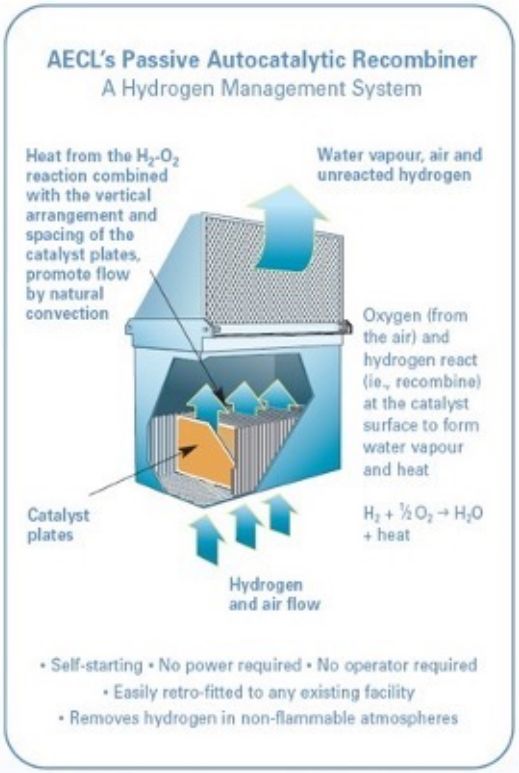


60 Nm^3/hr Electrolyzer Assembly

- 6 units - 60 Nm^3/hr
- Accessible for maintenance
- Individual power source for each stack
- Shut down of the whole system is unnecessary for single unit maintenance
- Continuous monitoring for leakage using Tyne tritium monitor

Hydrogen Safety

Passive Autocatalytic Recombiners (PARS)
- Tyne is the exclusive supplier -



PARs and Test System are Manufactured and Tested by Tyne in its chemistry lab.

Note that Tyne is also fully manufacturing and testing process hydrogen recombiner vessels for its systems, including preparation and application of AECL catalyst powder to jelly-roll screens in the recombiners

TYNE engineering inc.

Tritium in Liquid Waste Collection Container

Cart Monitoring Systems

Monitors hydrogen in helium cover gas of nuclear reactors

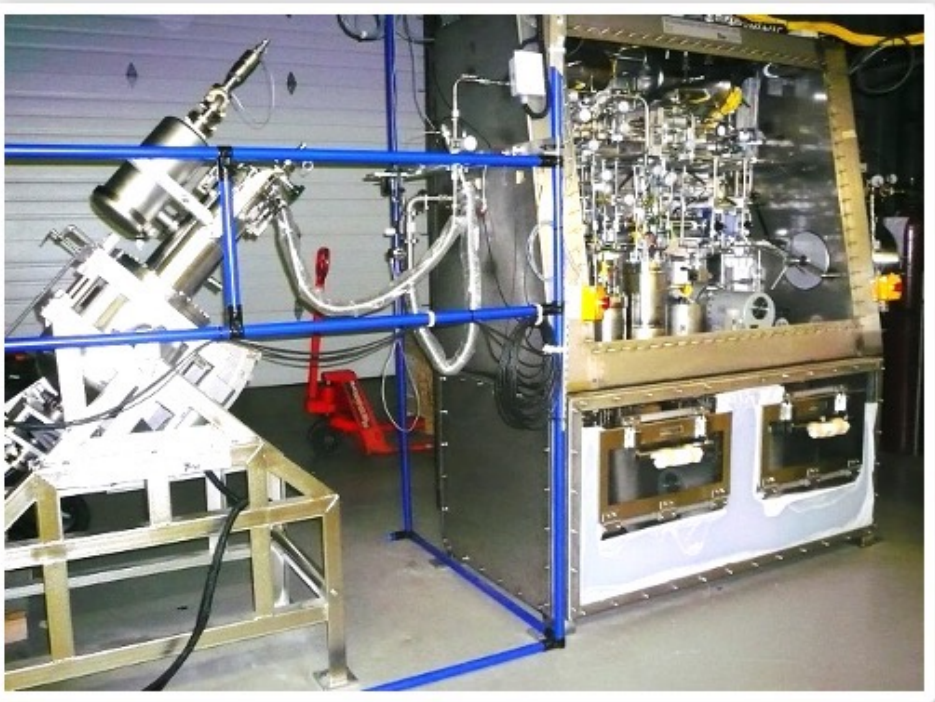
TYNE engineering inc.

Other Tritium Laboratory Equipment

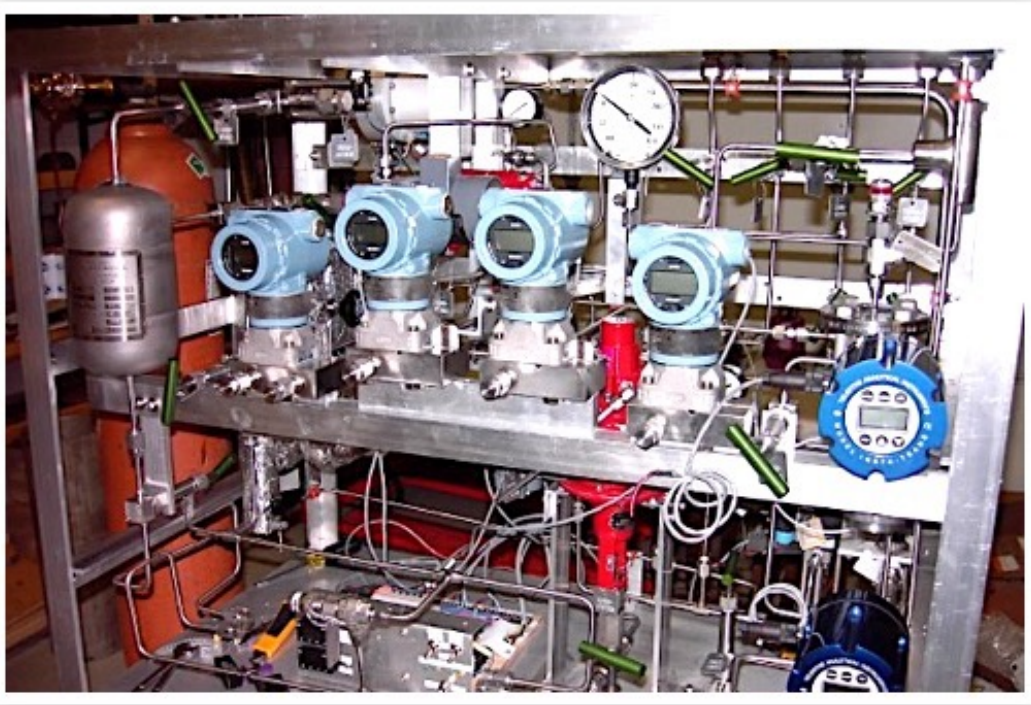
Automated Tritium Lights Laser Cutting, Sealing and Filling System

TYNE engineering inc.

Tritium Lights Glass Crusher



Oxygen Analyzer For Wolsong Tritium Removal Facility



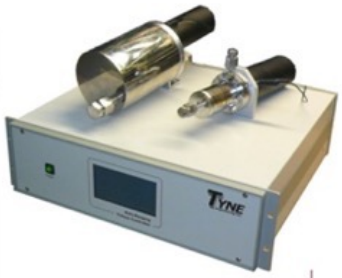
Tritium Monitoring

Tritium and Carbon 14 Monitors

- Portable Tritium and Gamma Monitor

- Tritium On Surface Measurement

- Fixed Air Tritium Monitor



- In Line Tritium Monitor

Tritium-In-Breath Analyzer

- Easy and convenient to use.
- No specialty gases required.
- Quick operation.
- Reports tritium-in-breath results by e-mail to operator and Health Physics simultaneously.
- Auto corrects for all background influences.

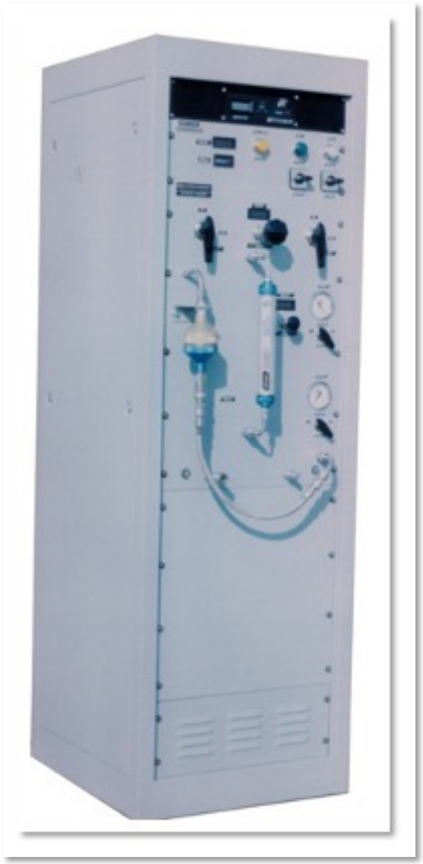
TYNE engineering inc.

Tritium Measurement in Soft Waste

- REDUCE ACTIVE WASTE QUANTITY
- 4-BAGS CAN BE MEASURED SIMULTANEOUSLY
- MASS FLOW METERS
- COMPLIANCE BUBBLERS

TYNE engineering inc.

Stack Monitoring



- **Continuous sampling**
- **Particulates, iodine, tritiated water vapor**

Particulate and Iodine Analyzer

(sample measurement or continuous measurement)

- **Particulate, Iodine, Gas, Liquid Measurement**
- **Beta, Gamma**
- **Static or Moving Filters**
- **Station Discharge Monitoring**
- **Liquid Effluent Monitoring**

TYNE engineering inc.

Carbon 14 Measurement

TYNE BENCH-TOP C-14 OXIDIZER

- Oxidize all CO to CO2
- Collect in absorber for laboratory analysis of ^{14}C content

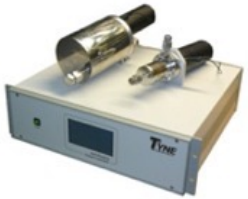
Designing and Manufacturing Instruments and Complex Systems

PROVIDING A COMPLETE SOLUTION

Detect

Tyne devices provide accurate measurement of tritium:

- Air
- Surfaces
- Soft materials
- Process tubing



Locate

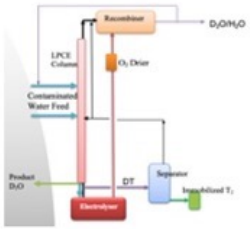
- Distinguish between tritium originating from moderator or PHT systems
- Use of breathalyzer
- Sniffer

Repair

- Immediate repair
- Under certain circumstances, tritium remains in the air
- Capture the leakage from the air

Collect

- Capture and Purify
- Scrubber
- Electrolyzer
- Isotopic separation system



CECE

- Combined electrolysis and catalytic exchange process
- Process for tritium removal and heavy water upgrading

Store

- Getter beds
- Gloveboxes
- Safe storage

TYNE engineering inc.

Commercial Grade Dedication
- saves Nuclear Quality Assurance Costs for Research Reactors -

Commercial Grade Item Dedication (CGD)

Tyne saves cost and time for Clients where possible, by offering CGD options for safety-related items, thus avoiding prohibitive costs of nuclear components.

- To EPRI-NP-5625 Standards
- Audited Nuclear CGD Quality Program
- Select, Purchase, Source Inspection, Special Testing, EMC/Seismic Qualification Testing, History Dockets
- Save costs and time on nuclear component supply

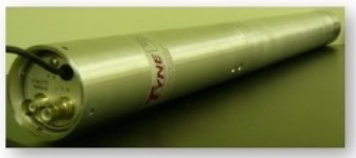
Pumps, Flow Meters, Electronics, Switches, Sensors, Transmitters, Relays, Power Supplies, Pressure Boundary Materials.

TYNE engineering inc.

Instrumentation and Controls

Nuclear PLC and HMI Control Systems

Tyne programs nuclear safety-related software under its Software V&V (Verification and Validation) quality program



Failed Fuel Location System (Delayed Neutron Detection) system Replacement for Embalse Nuclear Plant, shown in Tyne's workshop – designed and built and programmed by Tyne

TYNE engineering inc.

Tyne designs and builds commercial nuclear safety-related components and has an audited Commercial Grade Dedication Program to reduce costs for Fusion Research Reactors

Power Supplies

Safety-Related Relay Boards

Analog Timers

Isolation Amplifiers

In-Core Flux Detector / Amplifier

TYNE engineering inc.

Project Management

Tyne Structured Project Sequence – complies with N299.1 and 10CFR50 AppB

Project Planning
- Contract Review
- Project Plan
- Design Verification Plan
- Document and Drawing List
- Schedule and Workpackages
- Progress Reports

Conceptual Design
- Conceptual Design Description
- Conceptual Design Review

Preliminary Design
- Design Requirements
- Process Flow Diagram
- Piping and Instrumentation Diagram
- Layout Drawings (Mech, I&C/Electrical)
- General Arrangement Drawings (Mech, I&C/Electrical)
- Design Description
- Hazop Report
- Preliminary Design Review

Detailed Design
- Technical Specifications
- Test Plans and Procedures (ITP, CGD)
- Detailed Drawings(Mech, I&C/Electrical)
- Piping Isometric Drawings
- Lists (Equipment, Valve, Instrument, Line)
- Control Narratives
- Design Manual and Design Brief
- Calcualations
- Registration Packages (Pressure Boundary)
- Qualification Testing
- Detailed Design Review (at 90% complete)

Tyne Structured Project Sequence – complies with N299.1 and 10CFR50 AppB

Procurement
- Tender, Evaluate, Order per ASL
- Receiving Inspection
- Component Storage

Manufacturing
- Production Plan and Assembly Sequence
- Inspection and Test Plans
- Manufacturing Specifications and Procedures
- Manufacturing Drawings and BOMs
- As-built Drawings
- Operating and Maintenance Manual
- History Docket / Permanent Manufacturing Records

Testing
- Factory Acceptance Test Procedure

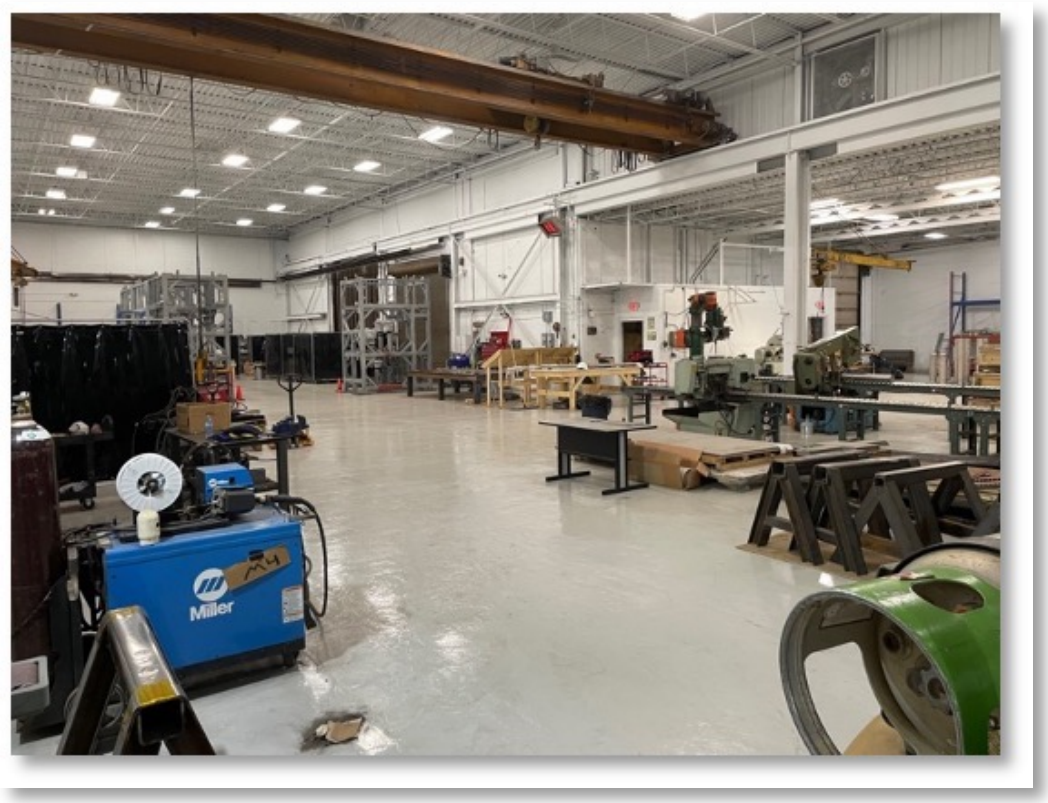
Packaging and Shipping
- Packaging according Packaging Procedure
- Final Inspection Report / QA Release (to ship)
- Certificate of Conformance

Installation
- Installation Drawings and Instructions
- Site acceptance Test Procedure

Commissioning
- Commissioning Procedure
- Commissioning Report

TYNE engineering inc.

Tyne's New Hamilton Facility for Tritium System Manufacturing



Tyne's new Hamilton manufacturing facility has 26ft height, 25,000 sqft assembly and test space with 1200 Volts, 5 cranes to augment Tyne's current headquarters.

PROVIDING A COMPLETE SOLUTION

TYNE USA, INC.

9111 Beauclerc Cir. E, Jacksonville FL 32257

Inquiries: Kim Kershner

Business Development Manager

kim.kershner@tyneusa.com

877.969.8963 info@tyneusa.com 877.715.5508 http://www.tyneusa.com