

# Decommissioning and Waste Management

An Integrated Approach



# Delivering Solutions with an Integrated Approach

We work with our clients to deliver safe and cost effective solutions across the Decommissioning & Waste Management project life cycle from concept to site end-state, drawing on the integrated capability and experience of our people, process, technology, nuclear licensed laboratories and large scale facilities.

As the category leader in providing life cycle management services for the electricity industry, we are recognized for delivering integrated solutions to the most difficult problems. Trusted by clients worldwide, our expertise in engineering, testing, inspection, and certification is backed by our independent laboratory and testing facilities, a diverse fleet of field inspection equipment and an award winning team of over 1,000 engineers and technical experts.

To augment the direct project experience across all stages of the Decommissioning & Waste Management process, supporting both Canadian-based and international nuclear sites, Kinectrics is able to use its decades of experience with operational and refurbishment services to develop innovative solutions unique to each nuclear facility it serves.

With over 40,000 square feet of CNSC approved and licensed facilities, and multiple specialized facilities such as the Decontamination & Refurbishment facility, Active Laundry Facility, the Alpha Dosimetry Lab, Tritium Lab and testing facilities to support client needs. Kinectrics has international offices in USA, Romania, UK, and India.

# **Your Partner of Choice**

Kinectrics' key competencies of strategic planning, safety analysis, regulatory support, engineering design, decontamination, waste treatment, dosimetry, active laboratories, licensed facilities and site operations have been demonstrated on operational, refurbishment, and decommissioning nuclear projects.

As a result, Kinectrics has direct project experience across all stages of the Decommissioning & Waste Management life cycle, supporting both Canadian-based and international nuclear sites.

Kinectrics' portfolio of operational experience and team of subject matter experts in these areas enable the **development of innovative solutions on projects such as:** 





### Innovation Hub project examples:

### Management of Problematic D<sub>2</sub>O Drums

Highly alkaline and salty tritiated D<sub>2</sub>O repatriated from Japan processed via suite of unit operations to meet station upgrade requirements.

### Treatment of PCB Contaminated Mixed Waste

Internal R&D investment led to award-winning innovative solution to treat Mixed liquid Waste (often called stranded or orphaned waste) that could not be treated by conventional means.

> Wolsong

Schedule

### New Product Development and KI R&D Program

Example - Patented treatment process for selective removal of C-14 from spent IX resins

> CNL Mixed

Processing

Waste

## Preliminary Design Plan for OPG's Deep Geological Repository

.....

International benchmarking on Decommissioning Strategies  Site Strategic planning, Stabilization planning, and Sustainable
 Operations planning for End of Commercial Operation for Pickering Nuclear

Decommissioning







# **Strategy Planning and Analysis**

Experience with optioneering related projects has helped clients and regulators better understand what routes are most feasible for planned decommissioning projects.

- > Strategy Development
- > Waste Disposal Strategy
- > Waste Process Optioneering
- > Decommissioning Options and Costs
- > Funding Options
- Deterministic and Probabilistic Safety Analysis



# Site/Facility Characterisation

Extensive experience with operational CANDU facilities allows for efficient site scoping and characterisation activities.

- > Historical Site Assessment
- Scoping Surveys
- Survey Design
- Final Release Surveys
- > Environmental Assessment
- > Decommissioning Impact Assessment
- Dose Assessment
- Radionuclide Inventory
- Chemical and Hazard Analysis
- Activation Analysis for Structures and Components







Every country has different political environment which can affect waste management costs and social license. Subject matter experts, with international experience and senior leadership experience, allow Kinectrics to understand these considerations in order to inform business decisions and regulatory proceedings.

- > Waste Strategy Development
- > Volume Reduction Strategies

- > Optioneering
- > Disposal and Cost Analysis
- Treatment and Processing
- > System Decontamination at Shutdown





Kinectrics can apply its expertise from decommissioning strategic planning and past experiences to optimize the development of Decommissioning Cost Estimates for both accelerated or long-term strategies.

- > Modelling
- > Optioneering

- > Site End-State Scenarios
- > Database





With experience in PDP activities for Canadian and international clients, Kinectrics has subject matter experts who can help identify OPEX and provide insight with regards to high-level plans for a decommissioning project.

- > Process Modelling / Simulation
- Application of Standards and Regulatory Guidance
- > End-State Definition
- Cost Estimation
- > PDP Preperation



# <//> Transition Management

Staff training programs, OPEX collection, and Subject Matter Experts with industry management experience and leadership are assets in the development of transition strategies decades in advance of final site turnover.

- > Retention of Institutional Memory
- > Release or Transfer of Staff
- > Commercial Handover
- > License Termination Planning
- > Safe Operation Planning Regulatory
- Stabilization Planning Regulatory and Engineering



# Decommissioning Safety Assessment

Planning and execution experience for operational and decommissioning reactors has developed a large pool of experiences to reference in future projects to minimize dose. Kinectrics is the first and only independent commercial service provider of alpha dosimetry services in Canada licensed by the CNSC.

> Hot Areas Definition

> Operations Planning

> Resource Requirements

- > Virtual Simulations
- Shielding Analysis and Dose Calculations



### Systems and Components Assessment

An understanding of system interoperability and condition assessments helps to develop plans to isolate decommissioning units from the rest of the nuclear facility.

- > Redundant and Retained Systems
- > Life Management for Retained Systems
- New Build Replacement Options
- Infrastructure Support Needs







# **Detailed Decommissioning Plan**

Experience in preparation of PDPs and developing decommissioning strategies can be leveraged to document the final end-state objectives, a waste management plan and potential environmental effects required for the detailed decommissioning plan. The combination of process modelling/simulation and past project experience helps identify and mitigate process bottlenecks in decommissioning schedules.

- > Process Modelling / Simulation
- Schedule and Cost Estimation
- > Engineering Plans and Procedures
- > Waste Stream and Quantity
- Project Organisation and Management

# Engineering Design, Procurement and Manufacture

Machine labs and experienced engineers work closely together to develop and operate inspection and waste retrieval tools.

- > Data Gathering, Sampling and Characterization
- > Optioneering and Concept Development
- Waste Inventory and Storage
- > Waste Acceptance Criteria
- Process Design
- Simulation and Training
- Prep Tender Documentation
- > Tooling Design

- Safety Case Prep
- Planning Cost Estimating
- > Procurement Plan
- > Engineering Design and Substantiation
- Key Items/Long Lead Manufacture and Works
- Design for Decommissioning - New Build
- Shielding Analysis





### Site Assembly, Commissioning and Installation

Extensive experience with asset management, component and temporary structures, and non-destructive testing will be assets for developing effective solutions for the gradual decommissioning and dismantling of entire nuclear facilities. This is de-risked by use of our large mock-up facility and in-house prototype manufacturing capability.

- Civil Works
- Decommissioning and Dismantling of Site Infrastructure
- Maintenance and Upkeep on Retained Assets
- > Strip and Repurpose - e.g. Turbine Hall as a Waste Sorting Area
- > New Build - e.g. Waste Retrieval, Export, **Grouting and Packaging Facilities**
- > Electrical/Mechanical Installations
- Inactive / Active Commissioning Systems and Support Services
- Site Acceptance Testing
- Subcontracting and Oversight
- Process Simulation



# **Decommissioning & Waste Management Services**



### Waste Retrieval and Waste Management

Kinectrics' proprietary waste processing solutions combined with licensed facilities allows for effective and responsive waste processing needs.

- Active and Non Active Waste Used Fuel, Heavy Water, Resins, Hazardous Waste
- Segregation (ILW, LLW, VLLW, Exempt) and Processing
- Award Winning Process for Mixed Liquid Waste Treatment
- > Tritium and C-14 Monitoring and Control
- > Processing of Downgraded Heavy Water
- > Waste Clearance
- > Storage, Short and Long Term

- > Characterisation
- > Post Operational Clean Out
- Processing
- Decontamination
- > Disposal
- Survey and Follow-Up Remediation
- Design and Fabrication of Waste Processing Equipment
- Design and Operation of Modular Waste Treatment Solutions



# Reg

# Regulatory

Kinectrics is widely recognized as the top expert in Canada for licensing consulting services. We have decades of experience working with Canadian and international licensees to deliver successful licensing projects. Strategic regulatory planning ensures projects can meet applicable regulatory requirements as efficiently as possible and provides confidence in scheduling.

- > Licensing Case Development
- Regulatory Compliance Support and Interpretation
- > Environmental Assessment
- Notifications Decommissioning, Mandate, Hold Points





In-house sampling analysis allows for rapid and comprehensive environmental site monitoring programs at the end-state of a decommissioning project.

- > Surveys, Sampling and Analysis
- Regulatory Monitoring

- Regulatory Liaison and Termination of Decommissioning Licence
- Archive



# **Delivering an Integrated Solution to Our Client's Most Difficult Problems**





No task is so important that we cannot make the effort to do it safely.



www.kinectrics.com

#### **Head Office**

800 Kipling Ave., Unit 2 Toronto, ON M8Z 5G5 Canada 416-207-6000

**Canada** 393 University Ave. 4th Floor Toronto, ON M5G 1E6

#### USA

2135 City Gate Lane, Suite 100 Naperville, IL 60563

#### **United Kingdom**

17-18 Frederick Sanger Road Surrey Research Park Guildford, Surrey GU2 7YD

**Germany** Hertha-Lindner-Strasse 10-12 01067 Dresden

#### Denmark

c/o 360 Law Firm Gl.Kongevej 60 DK-18 Frederiksberg C

Romania

59 Grigore Alexandrescu Street., 2nd Floor Bucharest 010623

### India

Sy No. 125, Bandan Mailaram Village Mulugu Mandal, Siddipet District Medchal, Telangana – 502 336

DW052521