

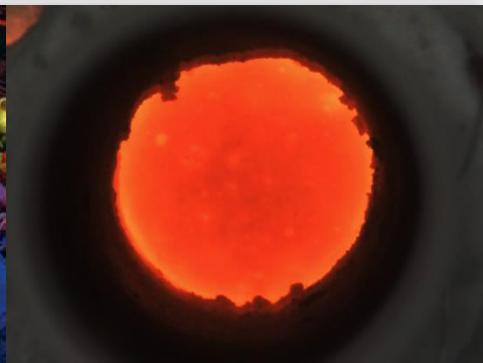
KURION

Isolating Nuclear Waste from the Environment

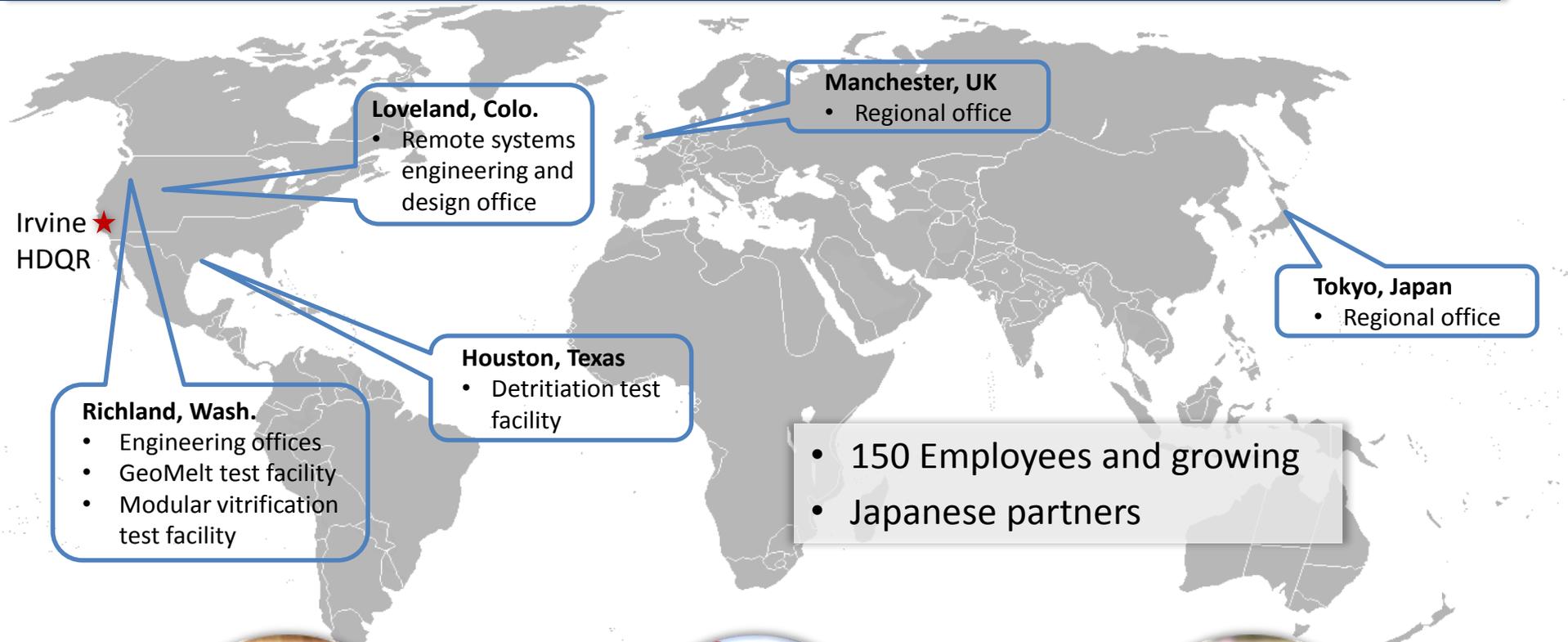
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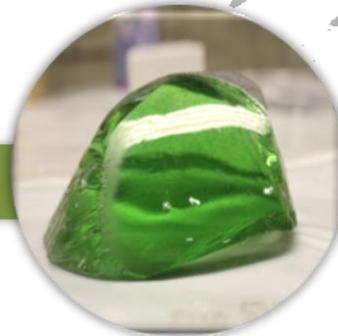
Kurion Key Facts



Access



Separate



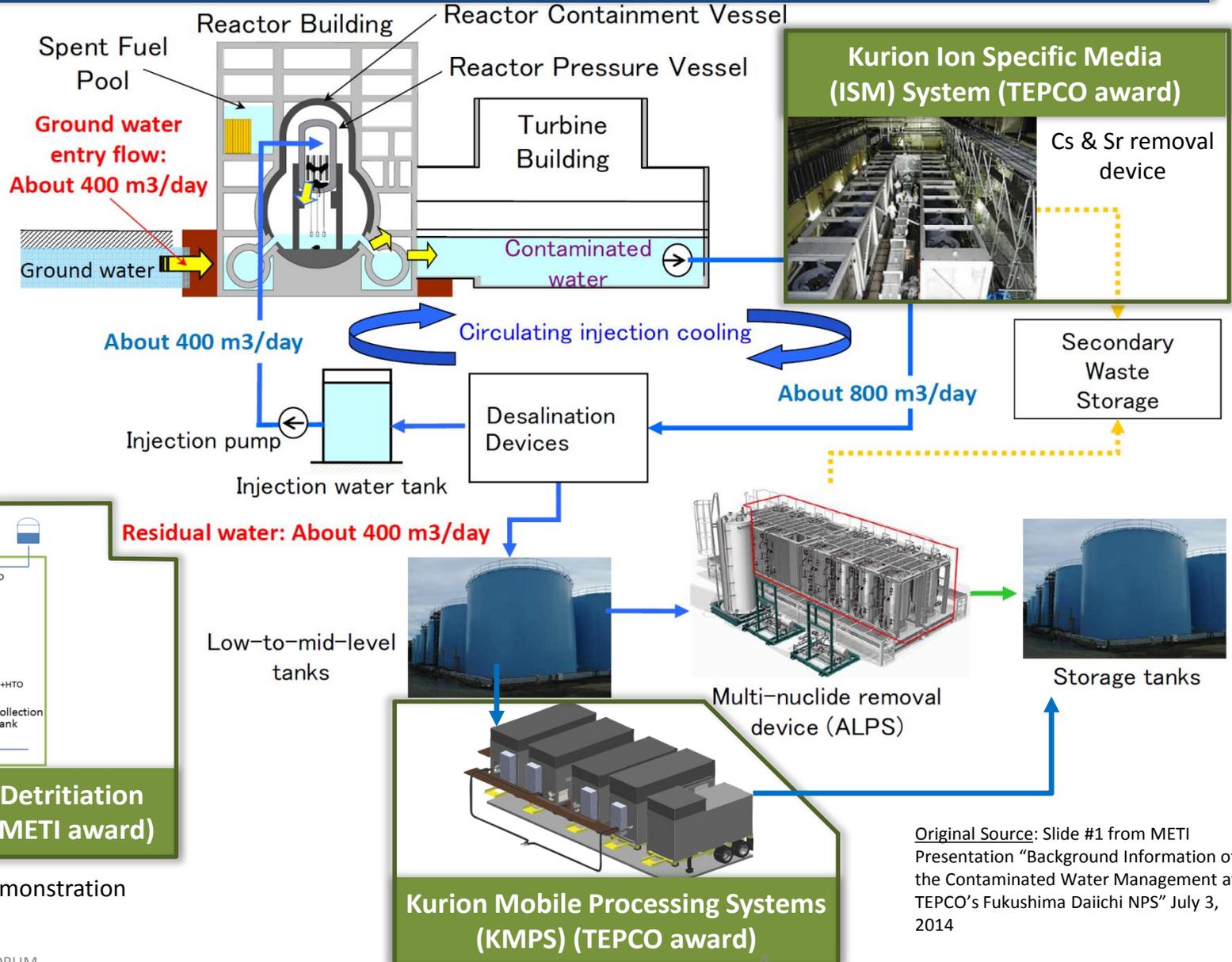
Stabilize

Japan Strategy – Delivering Technologies



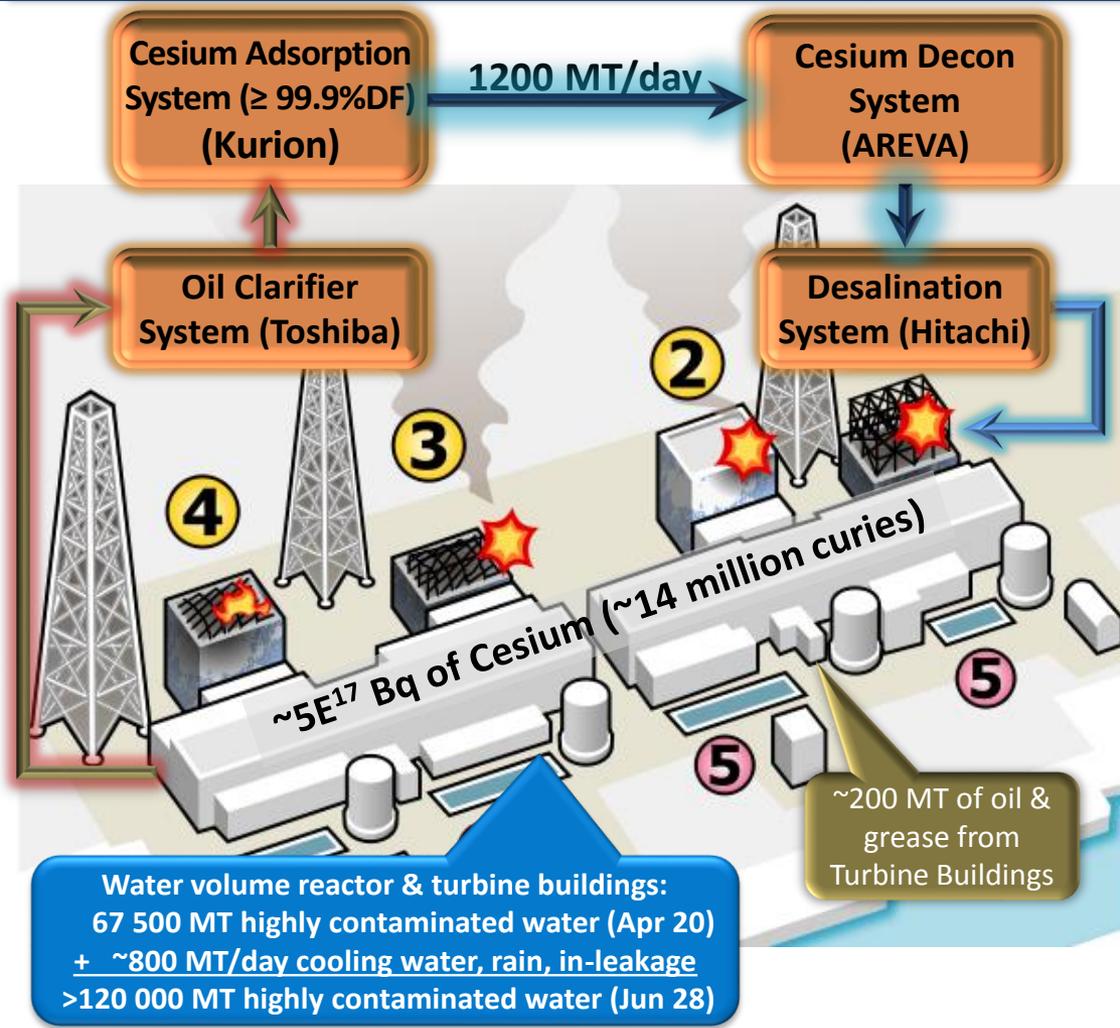
- Strategy**
- Discriminating Technologies
 - Partner with Japanese
 - Look and act Japanese
 - Help rebuild public trust

Overview of Kurion Activities related to Fukushima



Original Source: Slide #1 from METI Presentation "Background Information of the Contaminated Water Management at TEPCO's Fukushima Daiichi NPS" July 3, 2014

Early Responder after 3/11 Accident



- Post Tsunami Challenges:**
- Cs-contaminated, saline, oily water & huge volumes
 - Near continuous aftershocks to > Magnitude 7
 - Summer Rainy Season adds water volume
 - Many unknowns about site conditions
 - Protestors, police, camera crews on streets
 - **Water forecasted to overflow buildings end-June**

Unprecedented External Reactor Water Cooling System in 8-Weeks

Result: Reactor Shutdown Ahead of Schedule



tech talk

BLOGS // TECH TALK
TEPCO Begins Decontaminating Radioactive Water
 POSTED BY: JOHN BOYD / TUE, JUNE 28, 2011

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Kurion Cesium Removal System

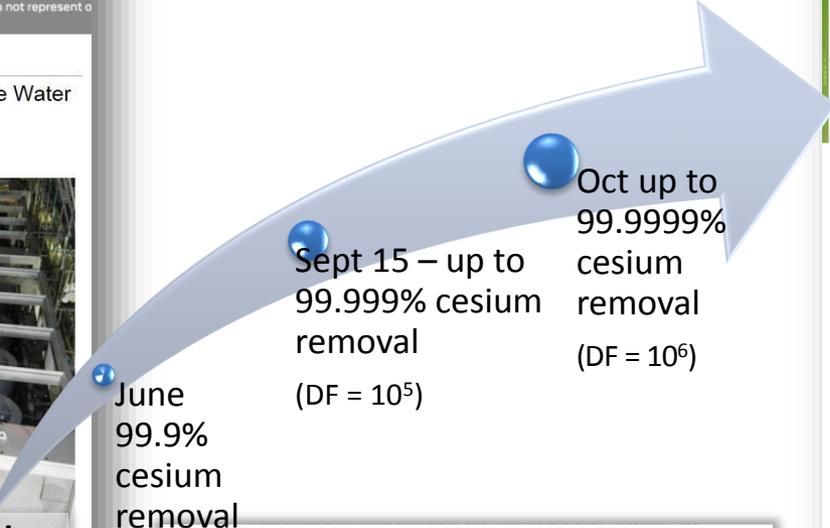
Photo: Workers at Fukushima Dai-ichi's water processing facility

Editor's Note: John Boyd is an IEEE Spectrum contributor reporting from Kawasaki, Japan. This is part of IEEE Spectrum's ongoing coverage of Japan's earthquake and nuclear emergency. For more details on how Fukushima Dai-1's nuclear reactors work and what has gone wrong so far, see our explainer and our timeline.

Coping With Radioactive Water

After a number of frustrating setbacks in testing out the water decontamination system, Tokyo Electric Power Co. (TEPCO) began a series of test runs Monday morning, having treated over 6 000 tons of radioactive water stored in the waste water tanks at Fukushima Dai-ichi. The test runs were the first use of the system, aiming to use the resulting purified water to cool the damaged reactor Units 1,

Improved operations and reduced salinity raised Decontamination Factor



June
 99.9% cesium removal
 (DF = 10³)

Sept 15 – up to 99.999% cesium removal
 (DF = 10⁵)

Oct up to 99.9999% cesium removal
 (DF = 10⁶)

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Press Release
Kurion Announces Fukushima Daiichi Nuclear Plant Contaminated Water Cesium Levels Reduced by More than 40%
 System Achieving Performance Goals for Throughput and Cesium Removal

By mid-Aug Cesium Levels Reduced 40% to 2.4E⁶ Bq/cc

IRVINE, CA—August 16, 2011—Tokyo Electric Power Co. (TEPCO) announced today that the contaminated water treatment facilities at the tsunami-damaged Fukushima Daiichi Nuclear Plant had dropped by more than 40% since startup of the Kurion cesium removal system (see [http://www.kurion.com/press/2011/08/16/110816_01.html](#)). As a member of the site's unprecedented effort to maximize decontamination capability (see Cesium Adsorption Instruments), the design and construction of the Kurion 60 MT/hour (220 gpm) rated system is to remove approximately 99.9999% of radioactivity in the contaminated water. In fact, when originally operated in its design configuration the system was removing cesium by a factor of 70,000 (99.9999% removal).

The reliability, safety, and robustness of the Kurion system was recently confirmed by a 16th analysis of Water Treatment Facility operations that identified several operational missteps regarding incorrect valve settings and incorrect flow rates during the first startup of the system.



ENERGY / NUCLEAR

NEWS

Shutdown of Fukushima Reactors Is Ahead of Schedule

Success in cooling the reactors suggests the plant could be stabilized by year's end
 By JOHN BOYD / NOVEMBER 2011

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Photo: TEPCO
DOUBLE CHECKED: Workers at Fukushima Dai-ichi reactor 1 check a water level indicator. Injected water has cooled the cores, but it has also created contamination at the site.

Editor's Note: This is part of the IEEE Spectrum special report: Fukushima and the Future of Nuclear Power.

This past April, when the Japanese government and Tokyo Electric Power Co. (TEPCO) jointly unveiled their plan to bring the damaged reactors of the Fukushima Dai-ichi nuclear power plant to a controlled shutdown and gain control of the release of radioactive materials, the goal was to reduce cesium levels to 1.3E⁶ Bq/cc by Nov 2011.

ISM System Today (formerly Cs Adsorption System)

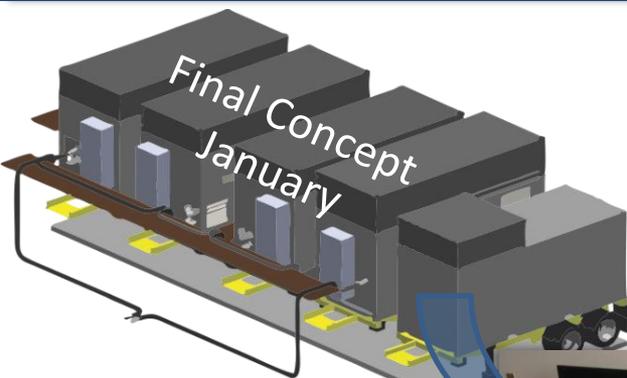


Kurion Project Manager Inspects System

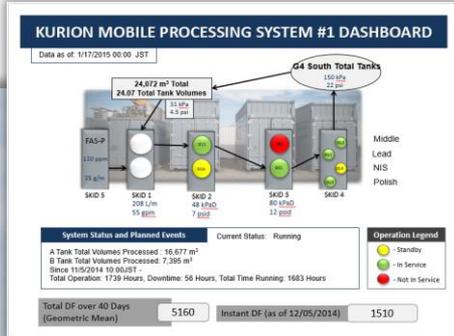
- High reliability is its trademark
 - No single point of failure, no leakage no tripping balance of system
 - Responsible for removing ~70% of all cesium activity to date (source: [IRID](#))
 - ~275,000 m³ (~73M gals) processed (source: [TEPCO](#))
- Upgrades completed end-2014
 - Installed sampling system
 - Option of dual isotope removal or very high DF single isotope (two double length process trains) or original high volume (four single length process trains)
- Dual isotope removal mode initiated Dec; very good DFs for both Cs and Sr removal
 - Cs DF – to 1E⁵ (routinely achieving MDA)
 - Sr DF – approximately 3.5E³
 - Many other Isotopes reduced to MDA or near MDA
- Processing trench and Turbine Building basement water

Continuous operation mode with dual isotope Cs/Sr removal

Delivery: KMPS-1 in 7-Months; KMPS-2 in 13-weeks



Kurion Mobile Processing Systems for Tank Water



- First-of-a-kind at-tank isotope removal system
- Sr reduction goal to support TEPCO's commitment for site safety improvement

Satisfied Rigorous JNRA Requirements, > 90% TOE and Exceeding Contracted DF Goals

Modular Detritiation System (MDS™)

- ALPS can only process 62 of the 63 isotopes, leaving tritium untouched
- ¥1B METI demonstration grant:
 - Won over 182 applicants
 - Alternative to release 800,000 m³ water at 40X annual activity release limit of 1F
 - Process inlet water of low tritium activity (1×10^6 to 5×10^6 Bq/l) to achieve effluent of $\leq 6 \times 10^4$ Bq/l
 - Economical processing
 - TRA approach using external reviewers (e.g. SRNL, METI, SMEs)
 - Demonstration ends March 2016



Help Rebuild Public Trust in Institutions

GeoMelt® Vitrification Mie Prefecture

Production 9.5 MTG Melters



1600°C Melt in Progress



Melter in Preparation

- **ISV Japan Ltd.** – Licensee since 1995
- **Daiei Kankyo** – Site operator, largest municipal waste management company in Japan and shareholder of ISV together with Kurion
- **Iga City Facility** – since 2003 for hazardous wastes plus various engineering scale systems for demos



Pre-Treatment Building

Melt Station

Off-Gas Treatment

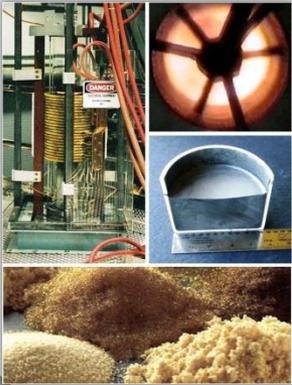
Control Room

Water Treatment Facility

Electrical Equipment and Main Transformer

Discriminating Waste Separation and Stabilization Solutions

Sales of Demos, Studies, & Concepts



Design of Solutions and Systems



Fabrication of Systems and Equipment



Proprietary Ion Specific Media (ISM)



Supply of Proprietary Waste Canisters



*Working with Partners
 To Deliver Success*

Kurion Works with Partners to Isolate Waste from the Environment

