

KURION

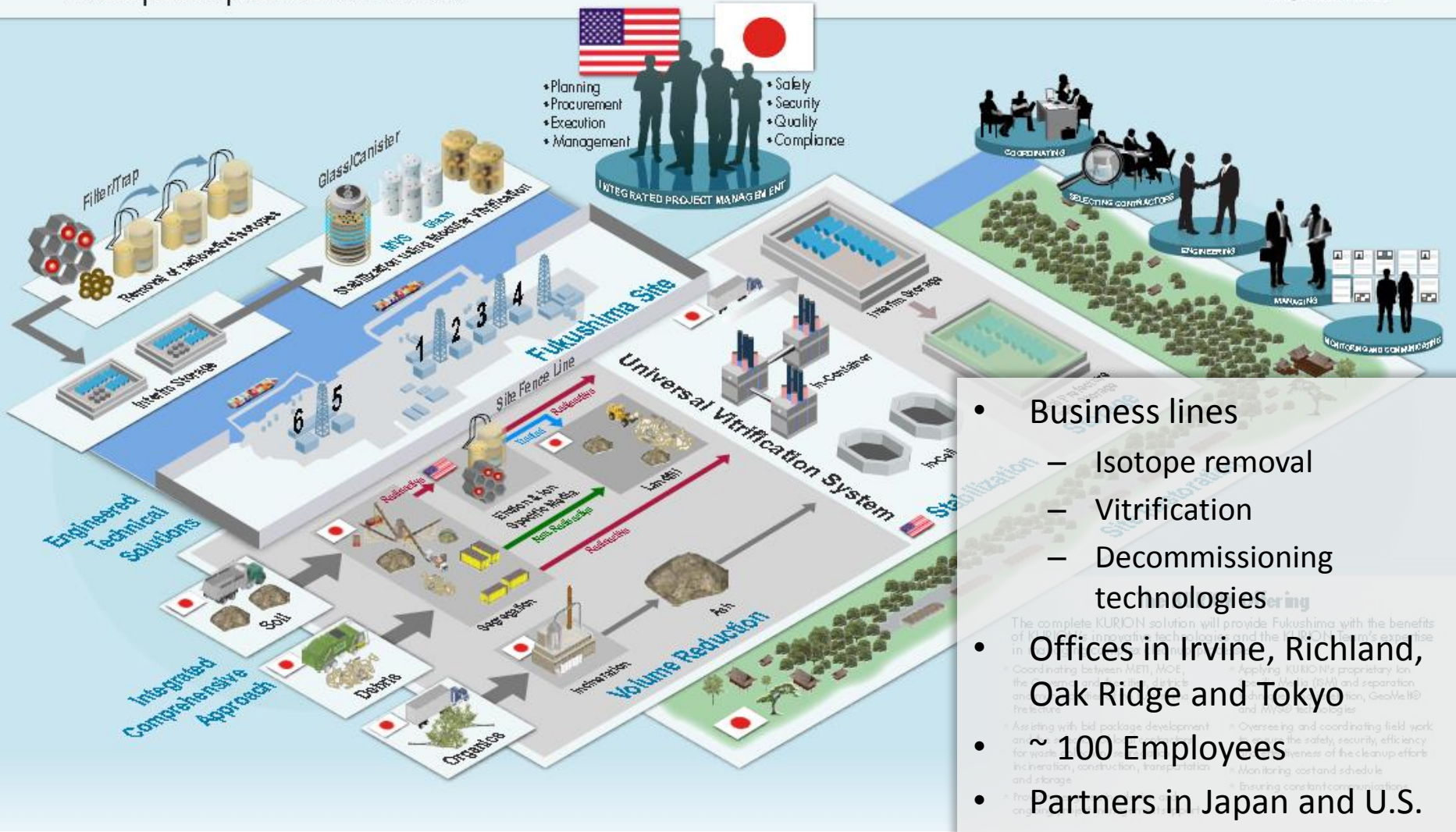
Delivering Timely Solutions under Emergency Conditions

John Raymont, President



Company Overview – Discriminating Technologies

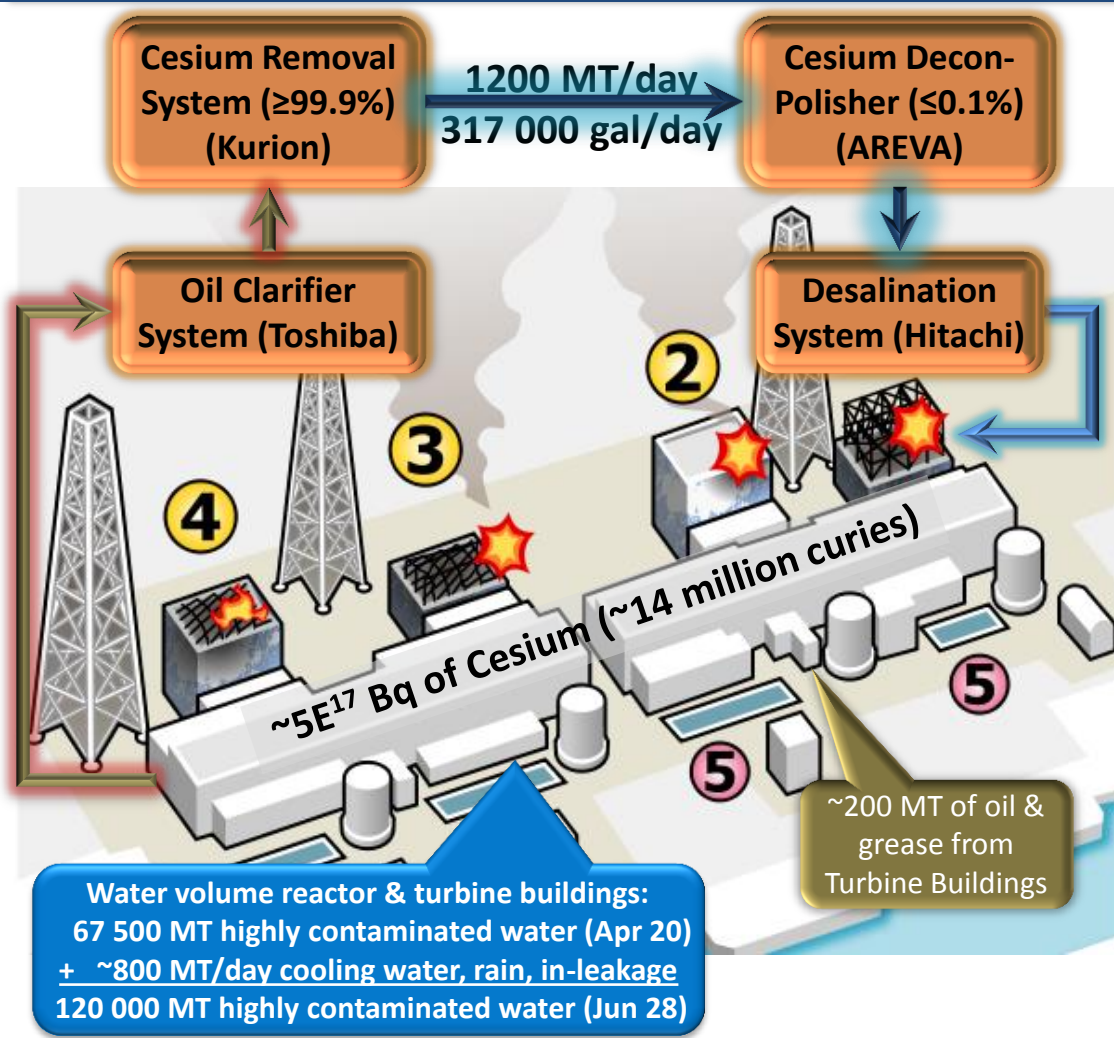
Concept of Operations-Global Solutions



- Business lines
 - Isotope removal
 - Vitrification
 - Decommissioning technologies
- Offices in Irvine, Richland, Oak Ridge and Tokyo
- ~ 100 Employees
- Partners in Japan and U.S.

The complete KURION solution will provide Fukushima with the benefits of...
 • Coordinating with...
 • Assisting with bid package development...
 • Overseeing and coordinating field work...
 • Ensuring constant communication...

Challenges: Contaminated Saline Oily Water, Volume, Schedule, & Mother Nature

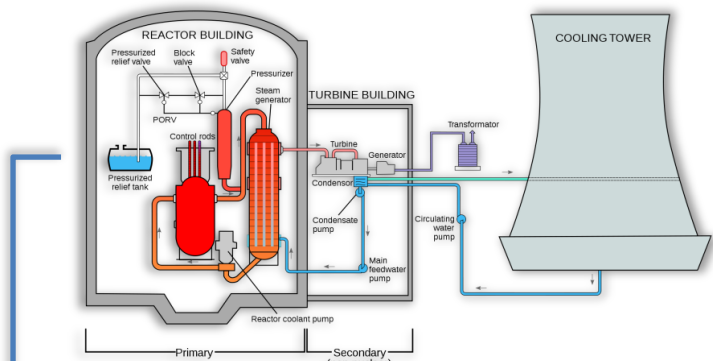


- Challenges:**
- Cs-contaminated, saline, oily water & huge volumes
 - Near continuous aftershocks to > Magnitude 7
 - Summer Rainy Season adds water volume
 - Many unknowns about site conditions
 - Protestors, police, camera crews on streets
 - **Water forecasted to overflow buildings end-June**

Goal: First External Reactor Water Cooling System

Kurion's Recommended Process Followed TMI

Demineralization Filtration Used Inorganic Media for Isotope Separation

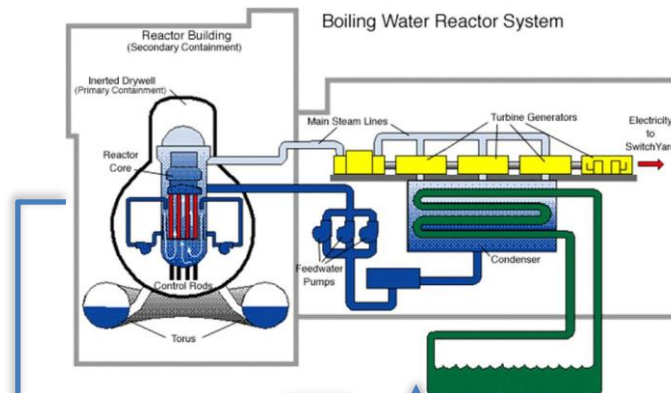


**Inorganic Ion
Specific Media**

Submerged Demin Vessels

Three Mile Island

Kurion Ion Specific Media Used For Removal of Cesium and Other Isotopes

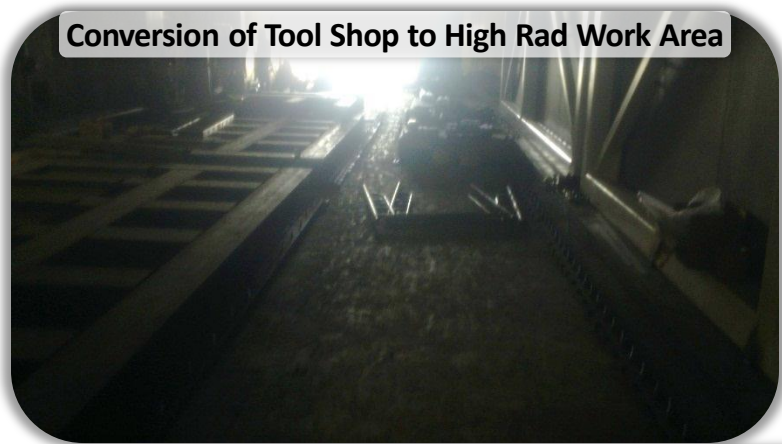


**Kurion Ion
Specific Media**

Fukushima Daiichi NPP

Kurion Had 100 MT of Salt Water Resistant Cesium Removal Media Available

Real Time Balancing Goals w/Site Limitations/Unknowns



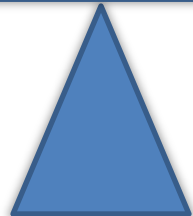
Conversion of Tool Shop to High Rad Work Area



Work Area Limitations Drives Vessels

Site Conditions Media/System Capabilities

- Urgency to implement
- Multiple unknowns
- Tight working conditions
- Overhead crane limitations
- Floor loading limitations
- Lack of facility shielding
- Coordination under high stress

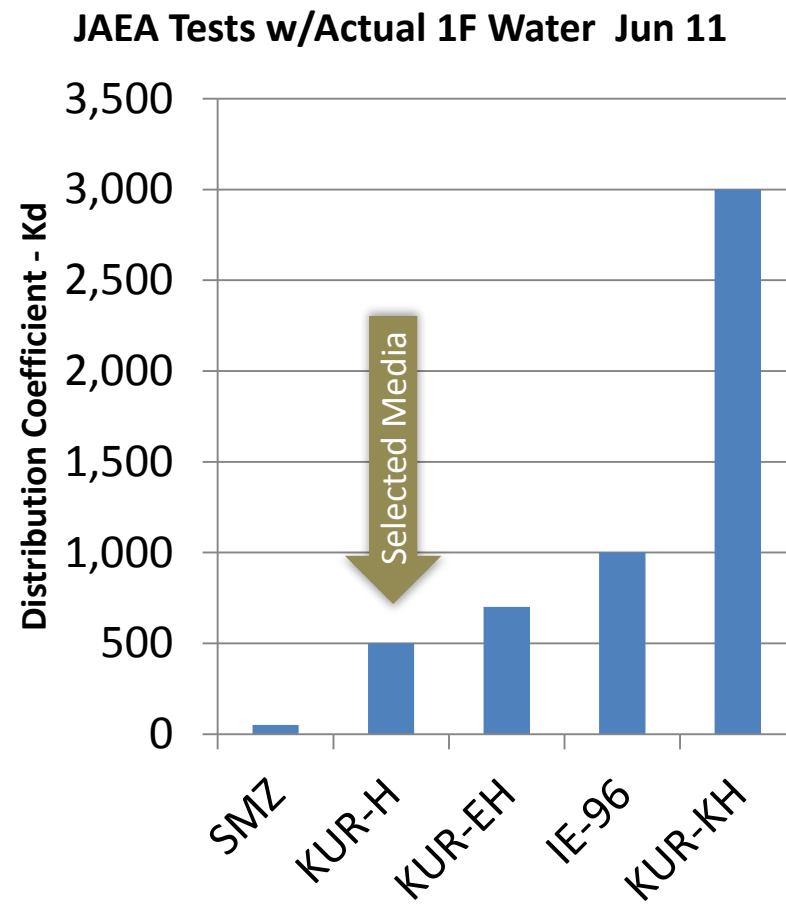


- Redundancy to offset lack of timely nuclear grade components
- Plug-n-Play to speed installation
- Lack of full remote operation
- System Removal Capabilities
- Vessel Loading Limits
- Number of Depleted Vessels

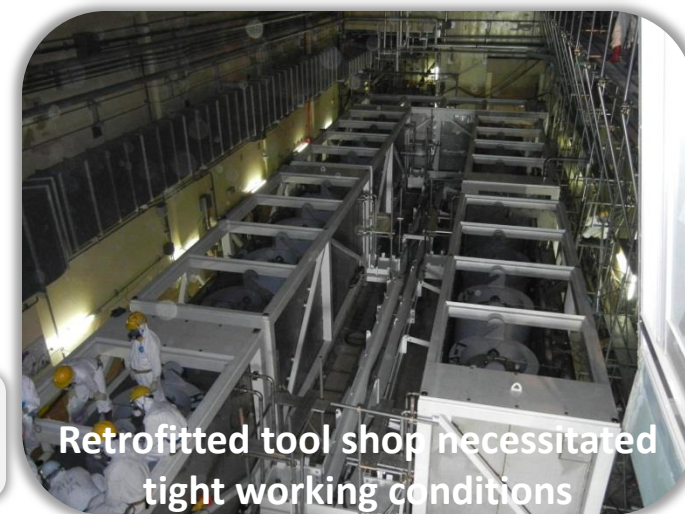
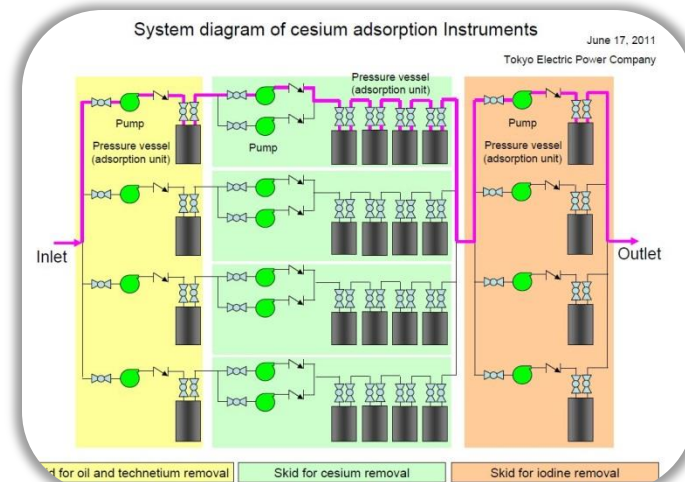
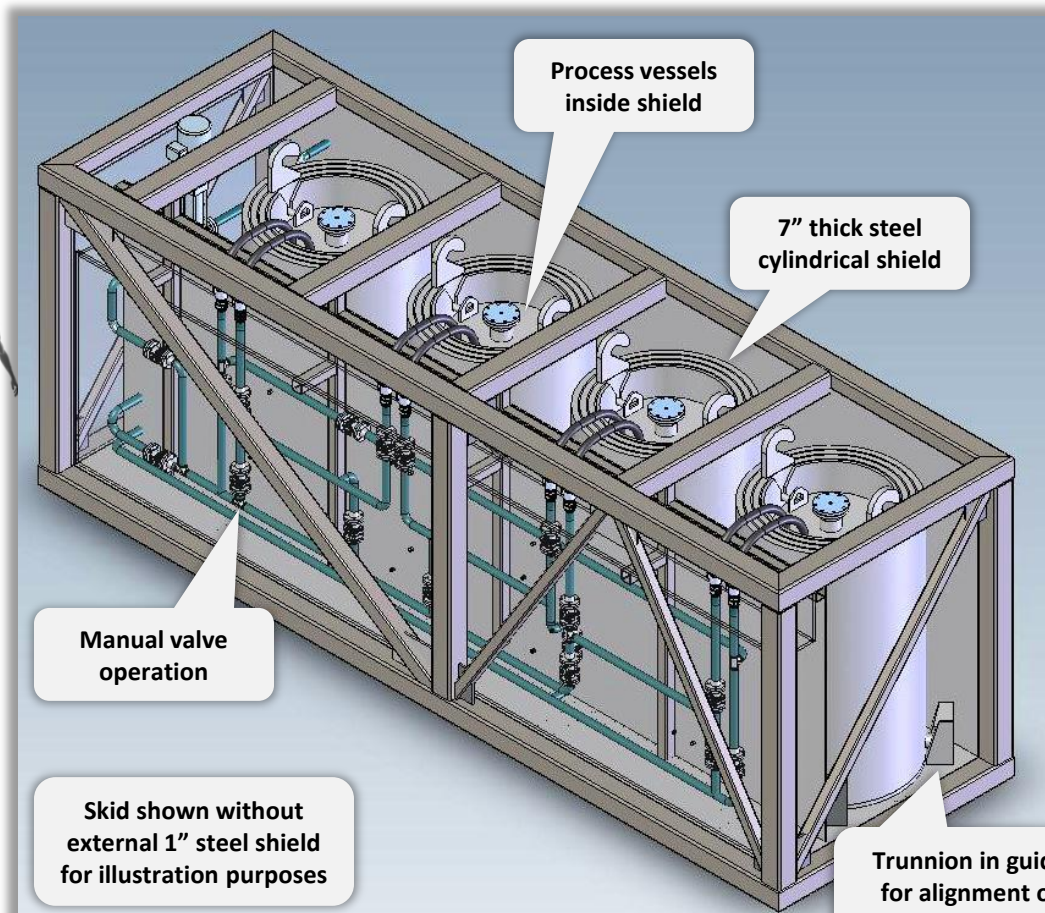
Design, Iteration and Fabrication 24/7 for 5 weeks

Media Selection

- Conversion of Tool Shop to High Rad Work Area for existing crane
- Floor loading limitations limited shielding to 7" steel shield + vessel thickness
- Shielding limitations drove initial media selection

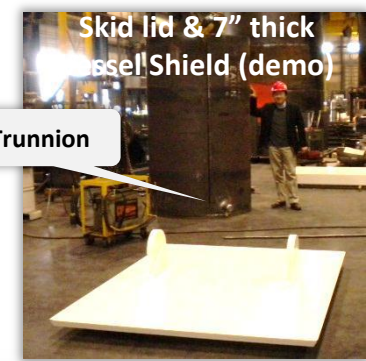


Kurion Processing Skid Design



Each of four fully loaded Cesium Removal Skids weighs 90 MT; other two weigh 65 MT each

Kurion Ships 700 Tons of Equipment & Media 5 Weeks ARO!



Trunnion



Contact: Gaetan Borhomme
Phone: +1 (646) 805-9462
Fax: +1 (646) 725-3309
E-mail: info@kurion.com

2040 Altair Street, Suite 800
Irvine, CA 92614-7216
+1 (949) 398-6330
www.kurion.com

Press Release

Kurion Delivers Equipment and Ion Specific Media to Support Water Cleanup at the Fukushima Daiichi Nuclear Plant
System uses media that can be vitrified into a volume reduced and stabilized glass matrix

Irvine, CA—June 2, 2011: Kurion, Inc., an innovator in nuclear waste management, announced that it completed the initial delivery a week and a half ago of several hundred tons of equipment and its [Ion Specific Media](#) to support its key role to remove radioactivity from contaminated water at the Fukushima Daiichi Nuclear Power Plant. The equipment, including modified repeatable skids, arrived at the Fukushima Daiichi Nuclear Power Plant in the weeks to support system installation, commissioning and startup mid-June. The Kurion system is part of an unprecedented effort to address the water cleanup at the Fukushima Daiichi Nuclear Power Plant. Kurion is the sole American company in this historic water processing effort.

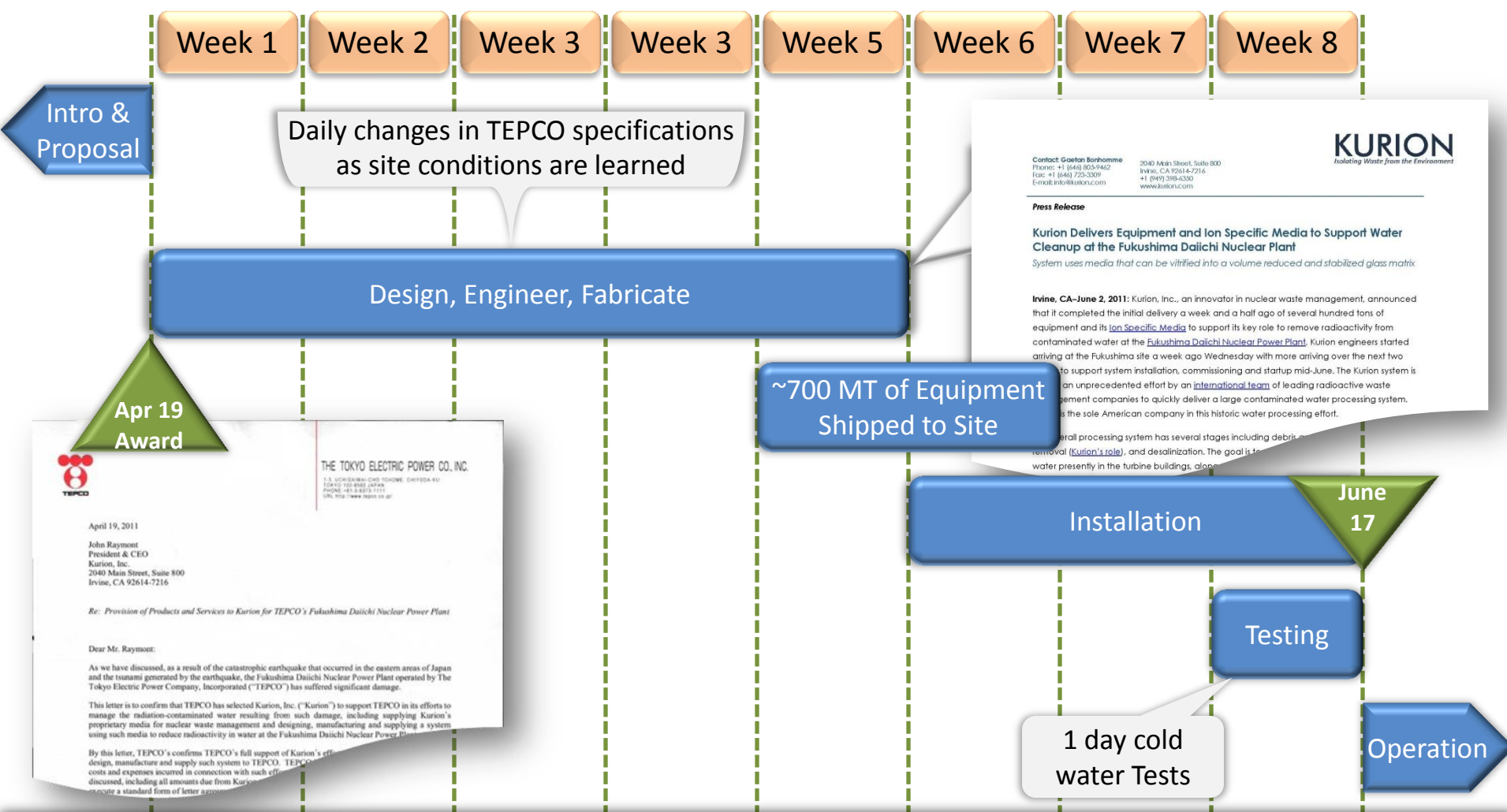
Kurion Ships Equipment & Media May 22

The overall processing...
removal (Kurion's)...
water presently in...
the purified water...
second radioacti...
Kurion CEO John...
hour/day 7 day p...
modified repeate...
evolving specific...
extraordinarily sh...
project and level...
[Mile Island Nuclea...](#)
Indicators should be c...



Russian Antonov Cargo Transport

Project Timeline/Historic Delivery



Intro & Proposal

Week 1

Week 2

Week 3

Week 3

Week 5

Week 6

Week 7

Week 8

Daily changes in TEPCO specifications as site conditions are learned

Design, Engineer, Fabricate

Apr 19 Award



~700 MT of Equipment Shipped to Site



Installation

June 17

Testing

1 day cold water Tests

Operation

5 Weeks From Award to System Shipment/8 Weeks From Award to Startup

Result: Reactor Shutdown Ahead of Schedule



tech talk

The views express and do not represent o

BLOGS // TECH TALK

TEPCO Begins Decontaminating Radioactive Water

POSTED BY: JOHN BOYD / TUE, JUNE 28, 2011

Email Print Share



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-ichi'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,

Mid-June 2011

Cesium levels 4.2E⁶ Bq/cc

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)

Contact: Gordon Benhaim
Phone: +1 (949) 398-4330
Fax: +1 (949) 462-7028
Email: gbenhaim@kurion.com

KURION
Isolating Waste from the Environment

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

Los Angeles, CA—August 16, 2011—Today, Kurion announced that its proprietary cesium removal system, the Kurion 60 MT/hour (220 gpm) rated system is to remove approximately 70% of the cesium from contaminated water. As a member of the site's unprecedented effort to maximize Fukushima Daiichi's safety (see Cesium Adsorption Instruments), the design goal of the Kurion 60 MT/hour (220 gpm) rated system is to remove approximately 70% of the cesium from contaminated water. In fact, when originally operated in its design configuration the system was removing cesium by a factor of 70,000 (99.999% 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 a pipe blockage during the first startup of the system.

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



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

Email Print Share



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.



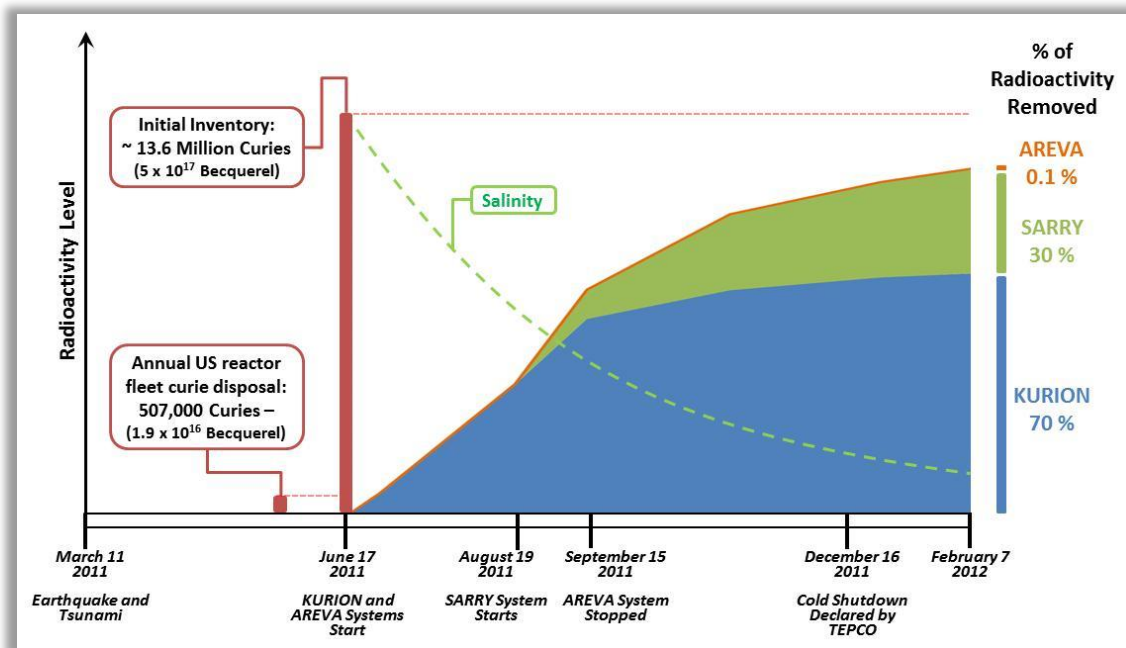
Editor's Note: This is part of the IEEE Spectrum special report: Fukushima and the Future of Nuclear Power.

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 stabilize the plant by the end of 2011.

Nov 2011
Cesium Levels Reduced 70% to 1.3E⁶ Bq/cc

Matching Capabilities to Needs/Timely Solution

- Status as of end-Feb 2012
 - Kurion system inlet cesium level $\sim 3E^5$ Bq/cc, a 90% reduction from mid-June levels with DF $> 1.0E5$
 - Kurion system removed $\sim 70\%$ of the initial inventory of 14 million curies of cesium activity
 - Cold shut down not possible without this success
- Delivered a reliable, proven, and defensible technology roadmap to ensure success
- Delivered quality under high time pressure (media testing + redundancy approach)
- Experienced team delivering technologies for applications at operating and decommissioning sites

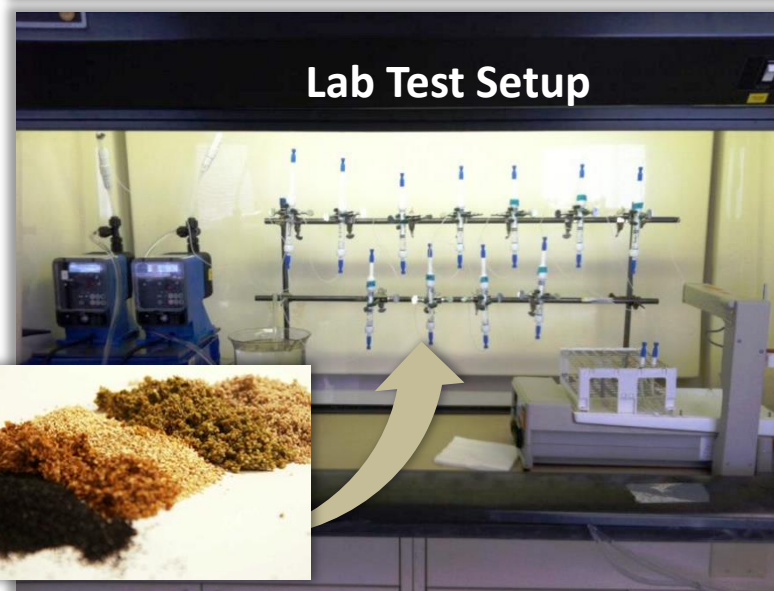
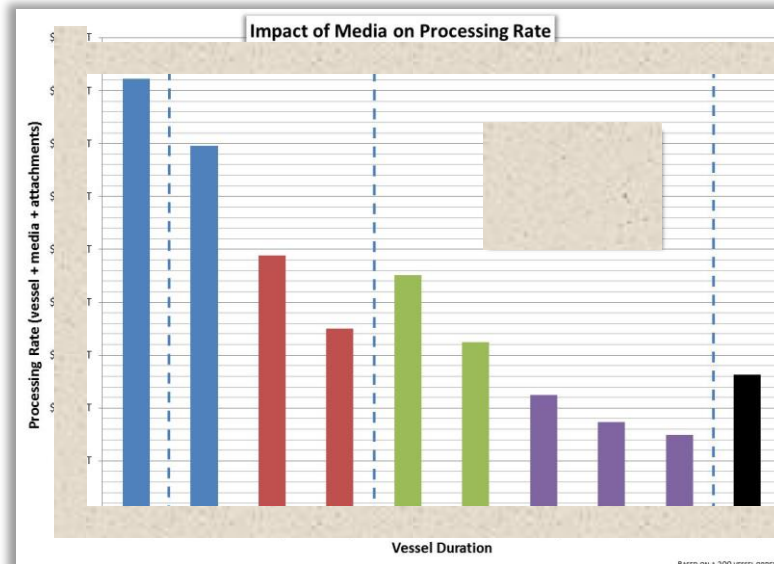


Sole System to Not have External Leaks or Trip Reactor Recycle Processing

WHAT NEXT?

New 1F Opportunities

- TEPCO Requests:
 - Longer Cs vessel life
 - Help reduce estimated 800 to 1,000/year generation of ALPS High Integrity Containers
 - Accelerate site safety improvements
- Responses:
 - Improved cesium media
 - Strontium media



Ion Specific Media (ISM) System

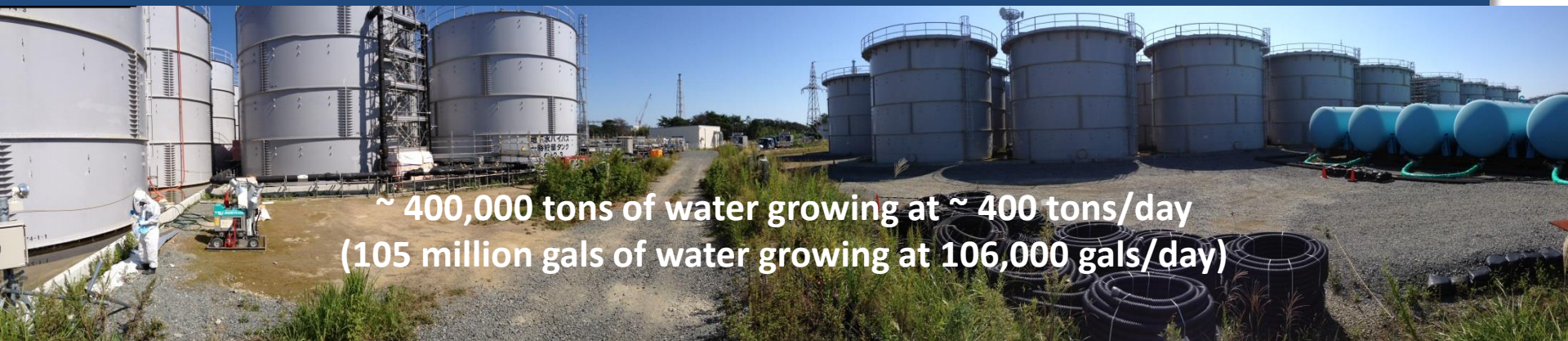
- 2012/2013 Status – Cs processing redundancy with SARRY
- Seeking to support improve safety status by processing
 - Building basement water
 - Trench water
 - Strontium removal

Improvements

- Make system more user friendly
- Extended vessel life
- Expanded media mission



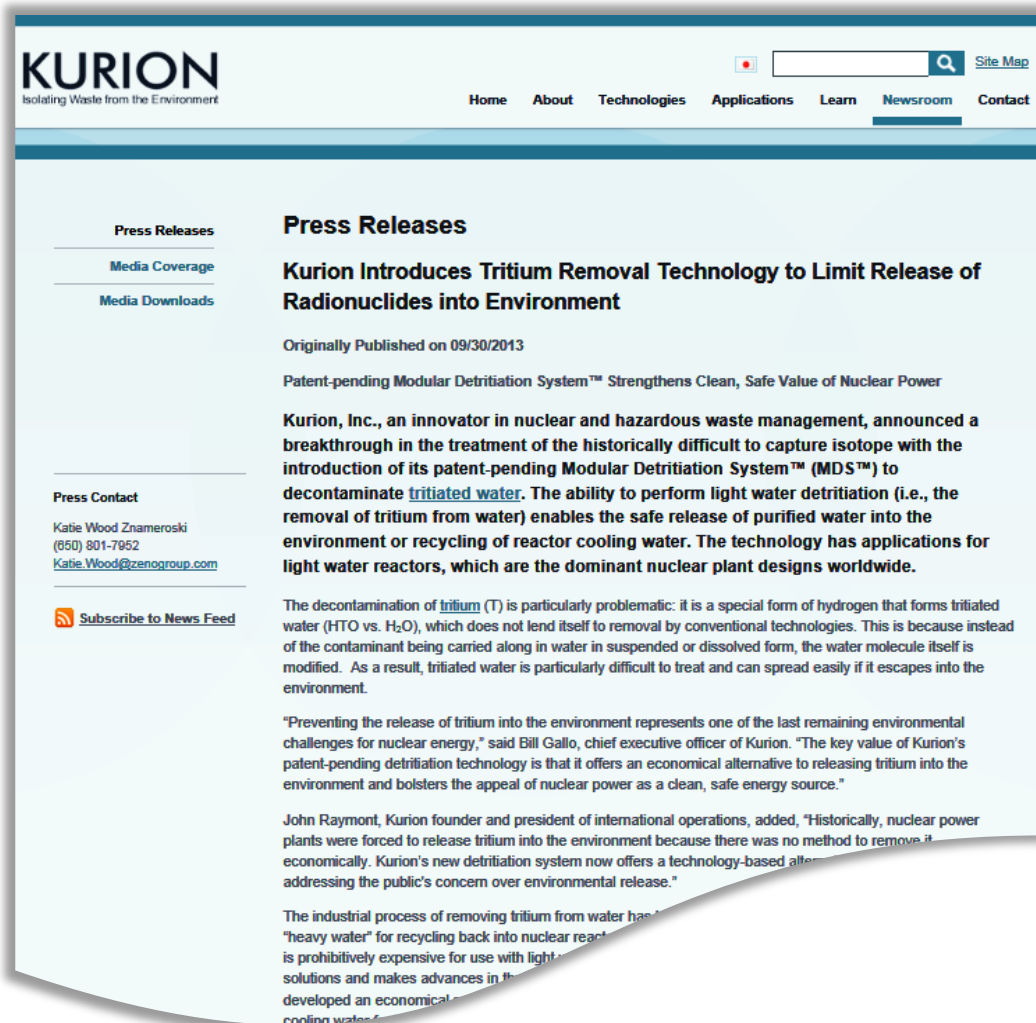
Fukushima Tank Farm Water Safety Improvements



Accelerate safety of tank farm by quickly
reducing Strontium levels

Modular Detritiation System (MDS™)

- Demonstrated:
 - Efficacy of light water detritiation
 - Detritiation in relevant range
 - Scalability
- TEPCO Engineering Scale = PWR Full Scale



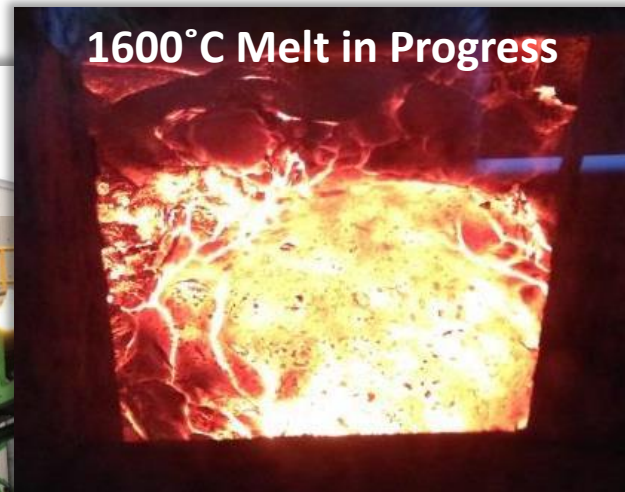
Success Enables Pursuit of PWR Market

GeoMelt® Demonstrations – Mie Prefecture

**Tour of ISVJ
Production 10 Tonne Melter**



1600°C Melt in Progress

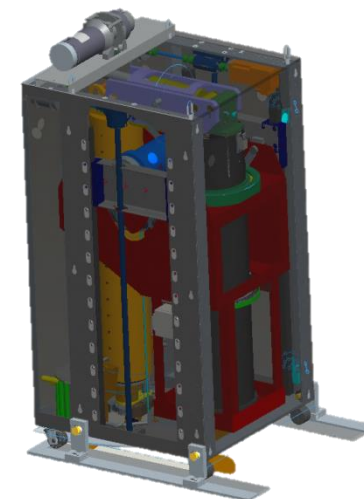


1 Tonne Eng Scale



Inspection and Repair Manipulators

- Location: Reactor #2
- Date: 2012 – Present
- Scope:
 - Design
 - Fabricate
 - Test
- Status:
 - Inspection Manipulator Fabrication Ongoing
 - Repair Manipulator Design in Process



Pending Changes at TEPCO

- Incoming TEPCO Chairman Fumio Sudo to spearhead reforms
- Restart of the 7-unit Kashiwazaki-Kariwa plant key to TEPCO's economic strength
- 1F carved out as "independent division" effective April, with ultimate independence still being determined
 - Naohiro Masuda named as Acting President
 - Toshiba and Hitachi executives will be included on executive team and expected to act in a fiduciary manner for TEPCO



Naohiro Masuda

- Fukushima [Daini](#) nuclear plant Superintendent at time of the 2011 Great East Japan Earthquake
- ['Iron-hearted' manager in charge of ending Fukushima nuclear crisis](#) - The Asahi Shimbun – Jan 14, 2014