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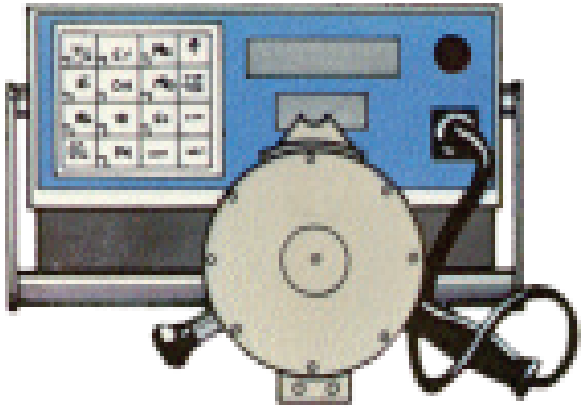
Thermo Scientific Niton XRF Analyzers "Latest Developments in PMI Tools for Alloy Verification"

Mark Lessard
Business Development Manager

Evolution of Portable XRF

- Earliest Portable XRF alloy analyzers
  - Large and bulky, >20 lbs (10 kg)
  - Two-piece devices
  - Battery lasted only few hours
  - 11 element-sequential, less than a hundred alloys
  - Required minutes of testing per sample
  - Limited alloy analysis performance; calibration range
  - Primarily high alloyed content grades
  - Fixed excitation intensity (in millicuries) isotope sources
  - Limited ability to optimize measurement conditions
  - Temperature and other environmental conditions dramatically affected performance and reliability



First generation alloy analyzer, the TN 9266, circa 1970s

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Evolution of Portable XRF

- Since late 1960s, XRF has evolved through 7 generations; each generation has added new capabilities
  - Smaller
  - Faster
  - Better performance
  - Easier to use
- Today, nearly all alloys can be tested with these powerful tools

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A Feature-rich Family

- Easy to use, exceptionally fast
- Ergonomic design
- Lightweight
- Customizable menus; easy-to-read, icon-driven, color, touch-screen display
- Long battery life
- Multi-language support
- Standard analysis range of more than 25 elements (Mg to U)
- Nondestructive test
- Moisture-proof, dust-proof
- Bluetooth wireless, USB communications
- Password-protected user security

Niton XL3t GOLDD+

Niton XL3t

Niton XL2 GOLDD

Niton XL2

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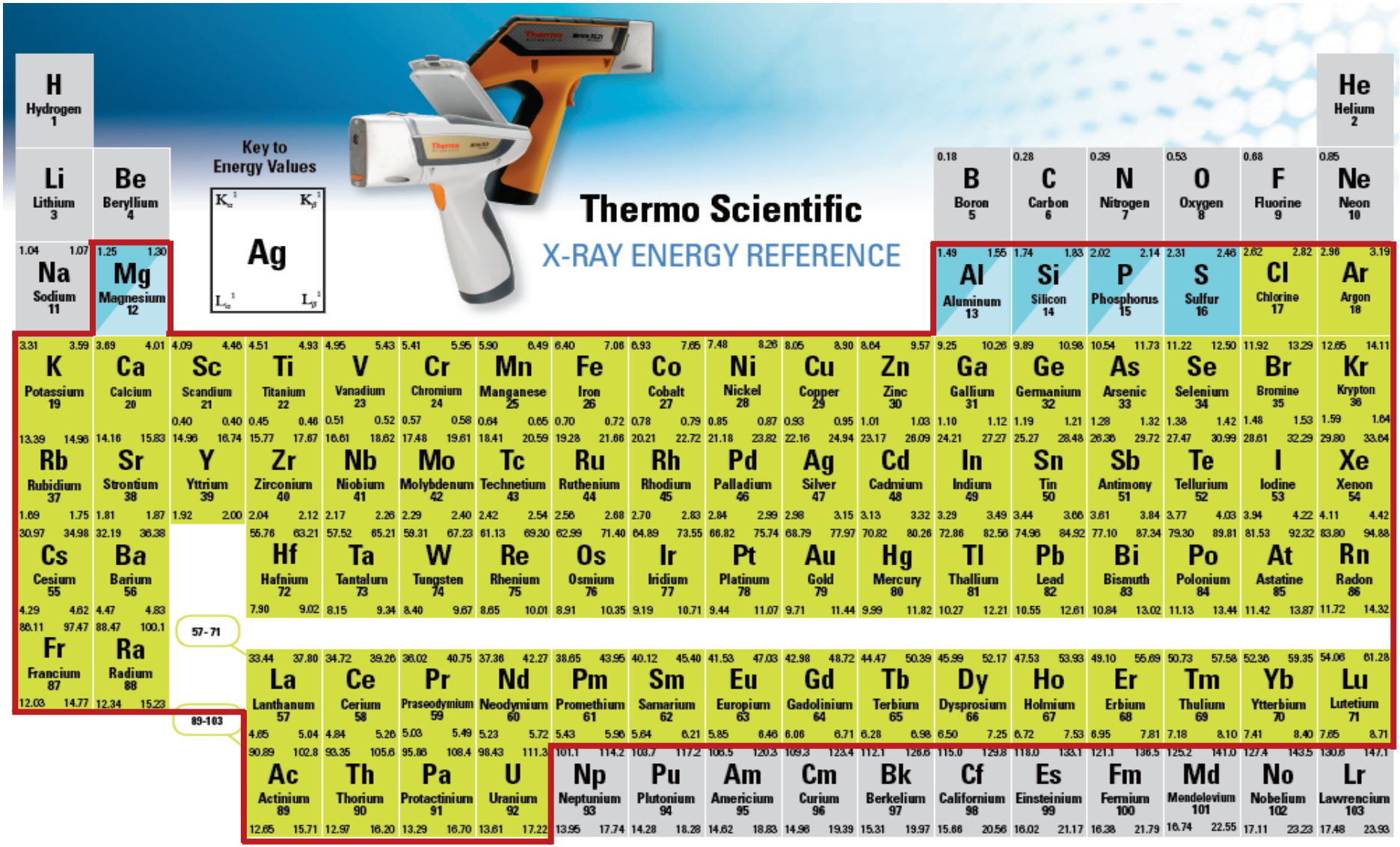
Elements Detected Using Handheld XRF



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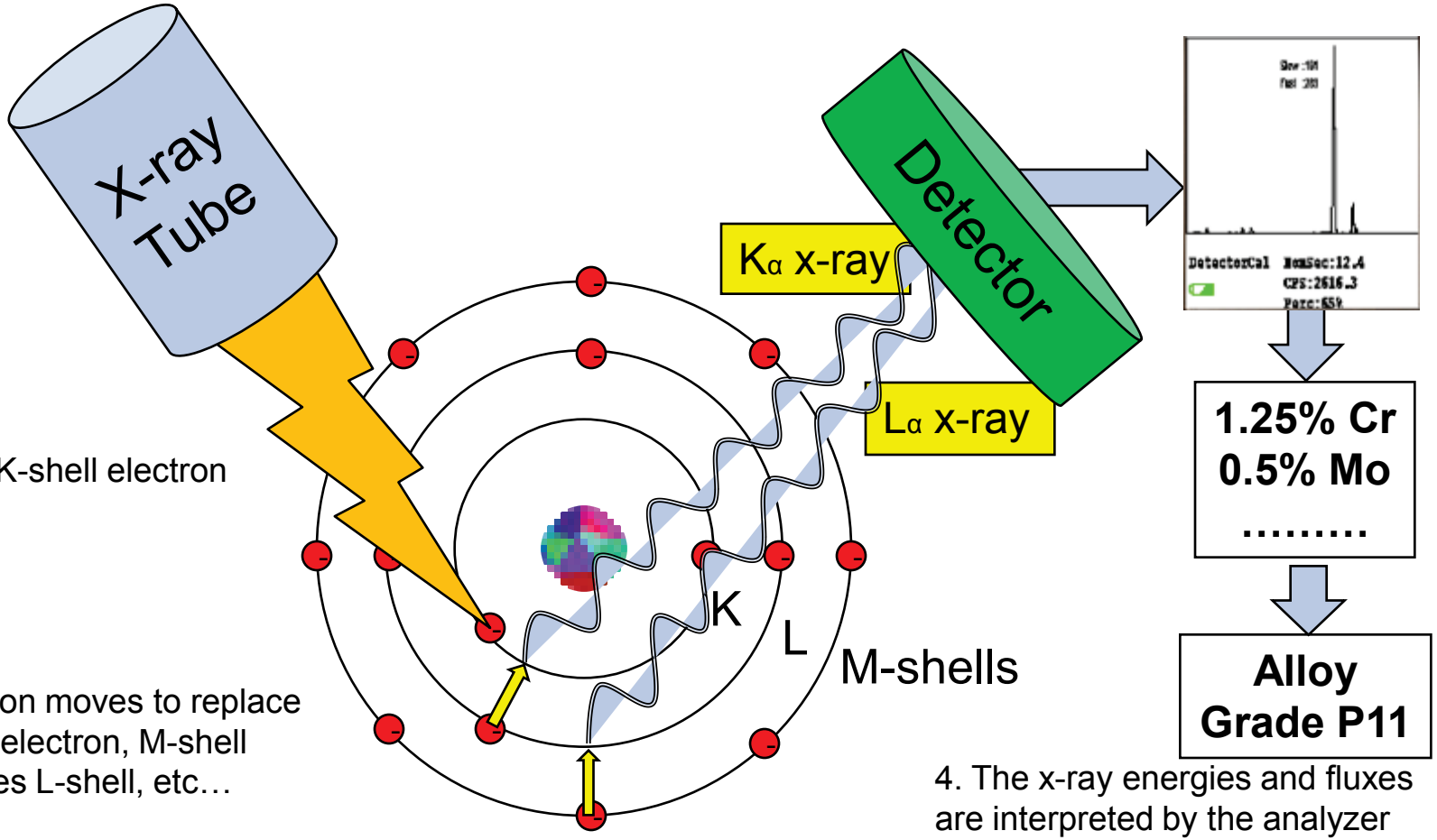
X-Ray Fluorescence (XRF) – A Simple Overview



1. X-ray ejects K-shell electron

2. L-shell electron moves to replace ejected K-shell electron, M-shell electron replaces L-shell, etc…

3. Reduced energy state is given off as a "Kα", "Lα", etc. x-rays, the energies of which are read by the detector

4. The x-ray energies and fluxes are interpreted by the analyzer into the corresponding elements, concentrations, and resultant alloy grade

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GOLDD Technology

- Thermo Scientific presents the Niton XL3t XRF Analyzer with GOLDD Technology
- This new analyzer delivers
  - Light element detection (Mg, Al, Si, P, S) without helium or vacuum purging
  - The lowest limits of detection and the fastest analysis available
  - True lab-quality performance in a handheld instrument

GOLDD New Alloy Capabilities for PMI / Fabrication

- Low Z elements in ***stainless*** for PMI and QC tested in air. Si in Zecor alloy at 6%, Al in 13-8Mo, 17-7 and 301 separation by 1% Al, 303/304 and 410/416 separation by 0.1 to 0.3% S

- The Niton XL3t GOLDD can measure Cr, Ni, and Cu at extremely low levels for flow accelerated corrosion in aqueous processes and HF Alkylation units at petroleum refineries (API RP-578)
  - Cr+Ni+Cu must be less than 0.2%/2000 ppm…LOD for sum is 0.06%%/600 ppm at 10 sec per filter

- Si in C Steel for sulfidation corrosion (RP-939-C)
  - Si can be tested to assure levels above 0.1% ….LOD for Si with He purge (required for high temp work) is 0.04%/400 ppm% in 15s

- S in Steel for free machining steels determination …. S at 0.15-0.3%
  - Separate resulfurized steel in 10-15s …. LOD for S (no Mo) 0.02%/200 ppm

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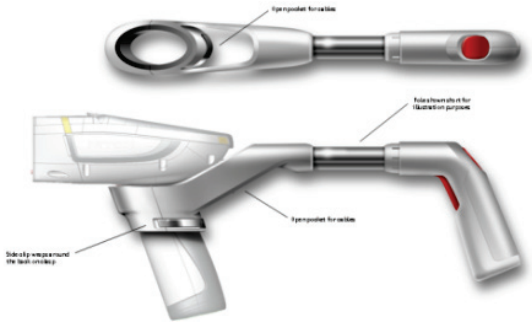
PMI Processes that use Niton® XRF Analyzer

- Incoming QA/QC
  - Assurance that the material you receive matches the order.
- Inventory Management & Recovery
  - Ensure that segregation of material is kept in check.
  - Recover “lost” materials for proper re insertion into the supply chain.
- Outgoing QA/QC
  - Certify shipments to the client.
- In process material identification
  - Routine Inspection of piping systems & process components to ensure no incompatible alloys present.
- Maintenance and fabrication related material identification
  - Provide assurance that no incompatible alloys are inserted into the process stream during construction and maintenance procedures (new pipes, valves, etc.)

Field Use for Hot Pipes and Difficult Access



Extension Pole /Tri-Pod

- Variable pole length
- Dual Electronic Triggers
- Clip on Tri-Pod adapter for hands-free analysis of samples on ground or table

XL3 *without* heat shield: 315° C

XL3 with heat shield : 450° C

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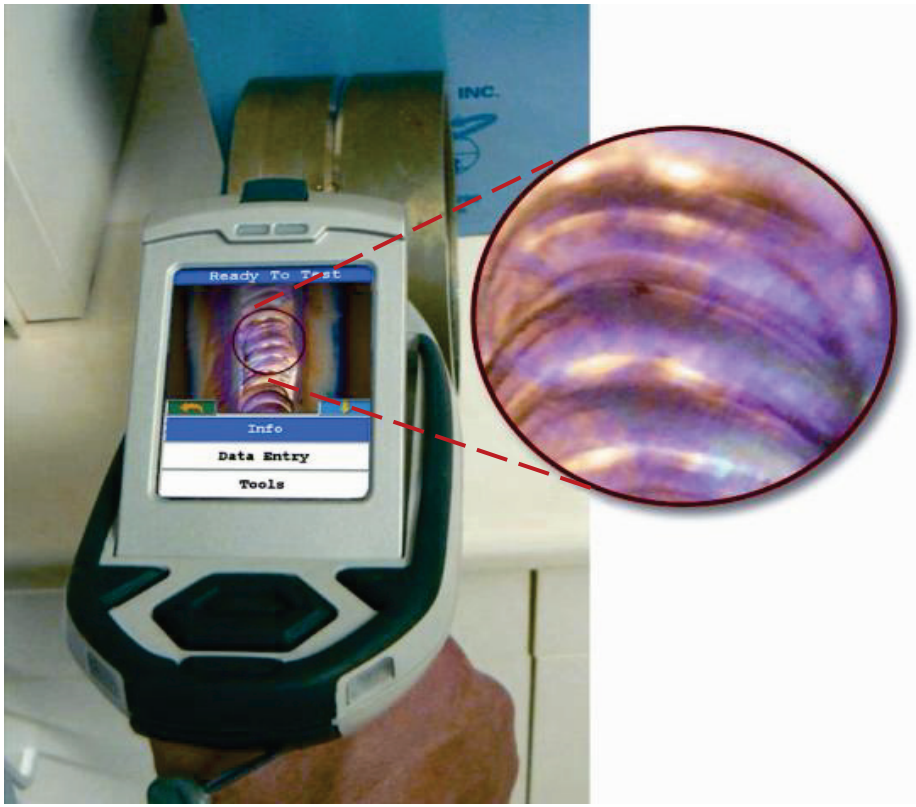
WeldSpot and CamShot

- The integrated color CCD camera & small spot, built into the nose of the analyzer
- Allows the user to
  - view a live picture of the analysis area,
  - save the image along with the elemental analysis results and spectra.
- Here we are viewing a welded object through the lens of the Thermo Scientific NITON analyzer camera.
- Small spot & Camera are unique to Niton
  - Only possible due to fast integrated electronics



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Smart Library

- Smart library, using the most accurate and robust FP, makes the correct Grade ID more often
  - >400 grades
- Identify tramp elements with ease
- Excellent analytical results
- Robust analyzers are sealed to the environment, delivering lab-quality performance

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PMI - What They're Saying

"The [Thermo Scientific Niton] XL3t provides quick results giving us a more efficient engineering process…we have also used it on general plant inspections…For practical purposes, it is far superior to using the services of an analytical laboratory."

– *Mark Taylor, senior engineer, Tetra Engineering, in "Sophisticated Metal Analyser Helps Protect Power Station Pipes,"* Insight – Nondestructive Testing & Condition Monitoring, Vol. 51 No. 8 August 2009, p. 414

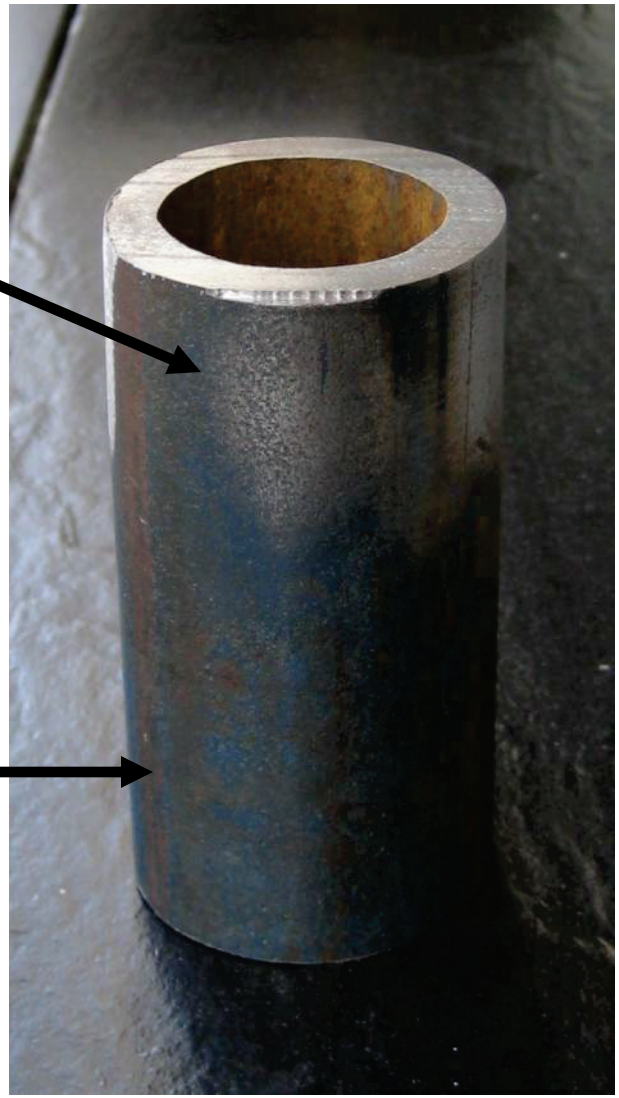
GOLDD HF Piping, C Steel Material from Warehouse

Hand 'ground' with diamond paper (15 min)

Cu	Ni	Cr	RE Sum
0.313	0.124	0.082	0.519

Unprepared, light oxidation

Cu	Ni	Cr	RE Sum
0.655	0.228	0.097	0.981



- When testing HF Alkylation system piping, achieving high accuracy at low concentrations is critical. As such, sample preparation is very important.

- Objective is to discern whether the material contains Residual Element (RE) Sum (Cu+Ni+Cr) less than 2000 ppm (0.2%). RE Sum above that level can be an indicator of accelerated corrosion susceptibility. Inspectors want to ensure RE Sum levels are less than 2000 ppm to avoid excessive FAC and possible system failure.

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Do Not Rely Solely on Supplier Material Certifications

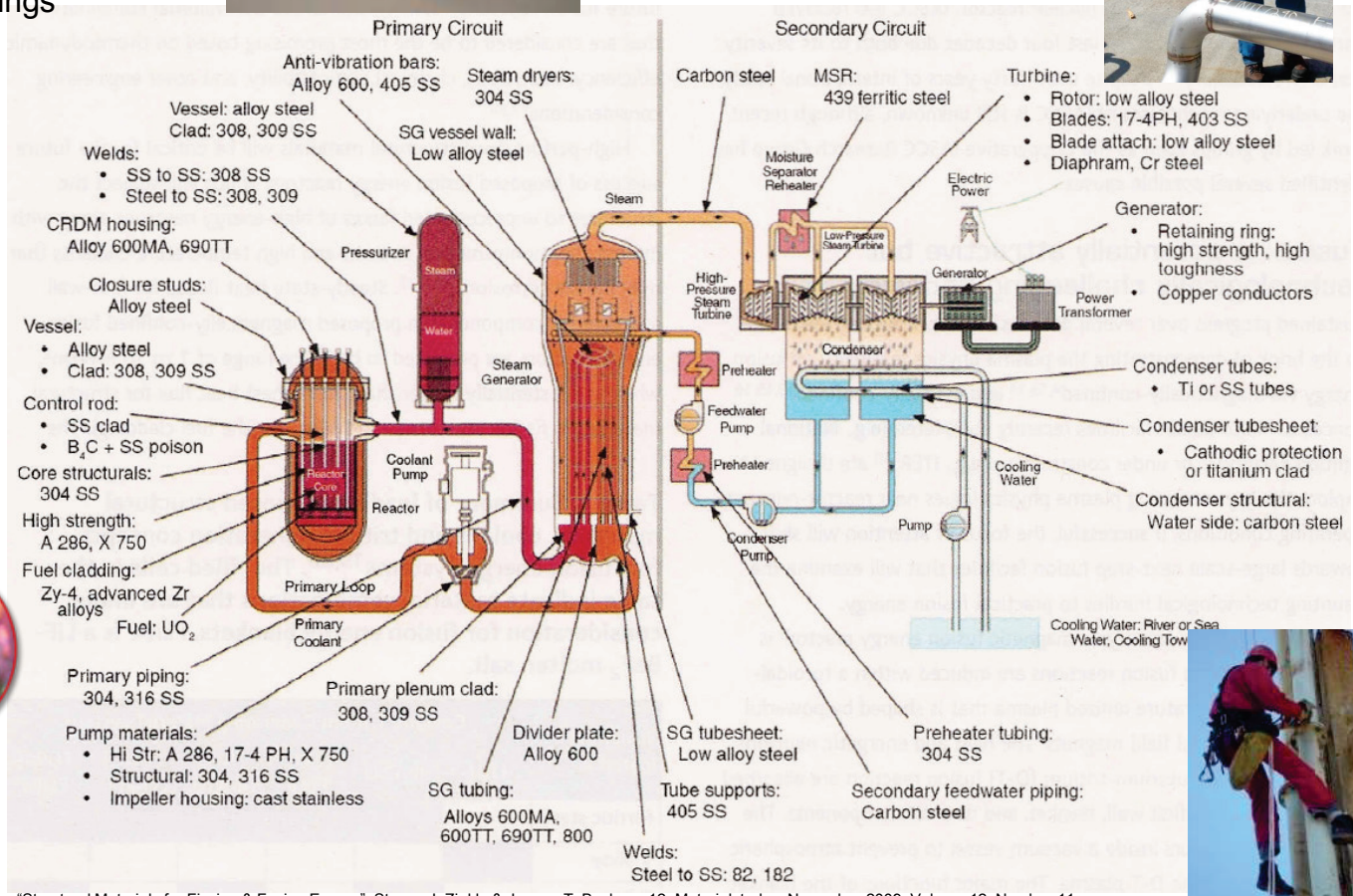
- Experience has shown that you cannot rely on material certifications alone; There can be significant errors

- One study performed by Thermo Fisher Scientific personnel at a customer site revealed as much as 40% of material certifications did not match actual chemistry

Trust but Verify

Handheld XRF PMI Applications

- Existing piping systems
- Pipe fittings, valves & flanges
- Welds & welding consumables
- Longitudinal pipe and weld fittings
- Weld overlays or cladding
- Components from distributors
- Forgings
- Instruments
- Bolting
- Expansion joints and bellows



"Structural Materials for Fission & Fusion Energy", Steven J. Zinkle & Jeremy T. Busby, p 12, Materialstoday, November 2009, Volume 12, Number 11

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Major Advantages of Thermo Scientific Niton Analyzers

- **>20,000 analyzers installed - more than all competitors combined**
  - Use #1 worldwide; it's #1 for a reason!
  - Compare data w/75-95% of your customers
- **No PDA**
  - Fast boot up
  - No separate bus to slow electronic comm's
  - No lock ups
  - No weak link (operating specs)
  - Fast testing and result calculations
  - Tamper-proof data
- **Better Performance for alloys**
  - Much faster IDs
  - More correct ID calls
  - Smart Library for automated testing (point-and-shoot)
  - LEC feature automated
  - Optimum grade library (UNS + as produced)
- **Field Hardened**
  - Robust: use in rain, dust, snow, heat, cold and harsh conditions
  - Less downtime from damage
  - Longer useable life
- **Small, light**
  - Less operator fatigue
  - Convenient to use
  - Ergonomically designed
- **Comprehensive support**
  - Repair service worldwide
  - World-class application experts
  - Top sales support
- **Camera and small spot**
  - Focus on 3mm spot or weld
  - Photo document of tested area
- **World-class Accessories**
  - PMI Kit
  - PTS

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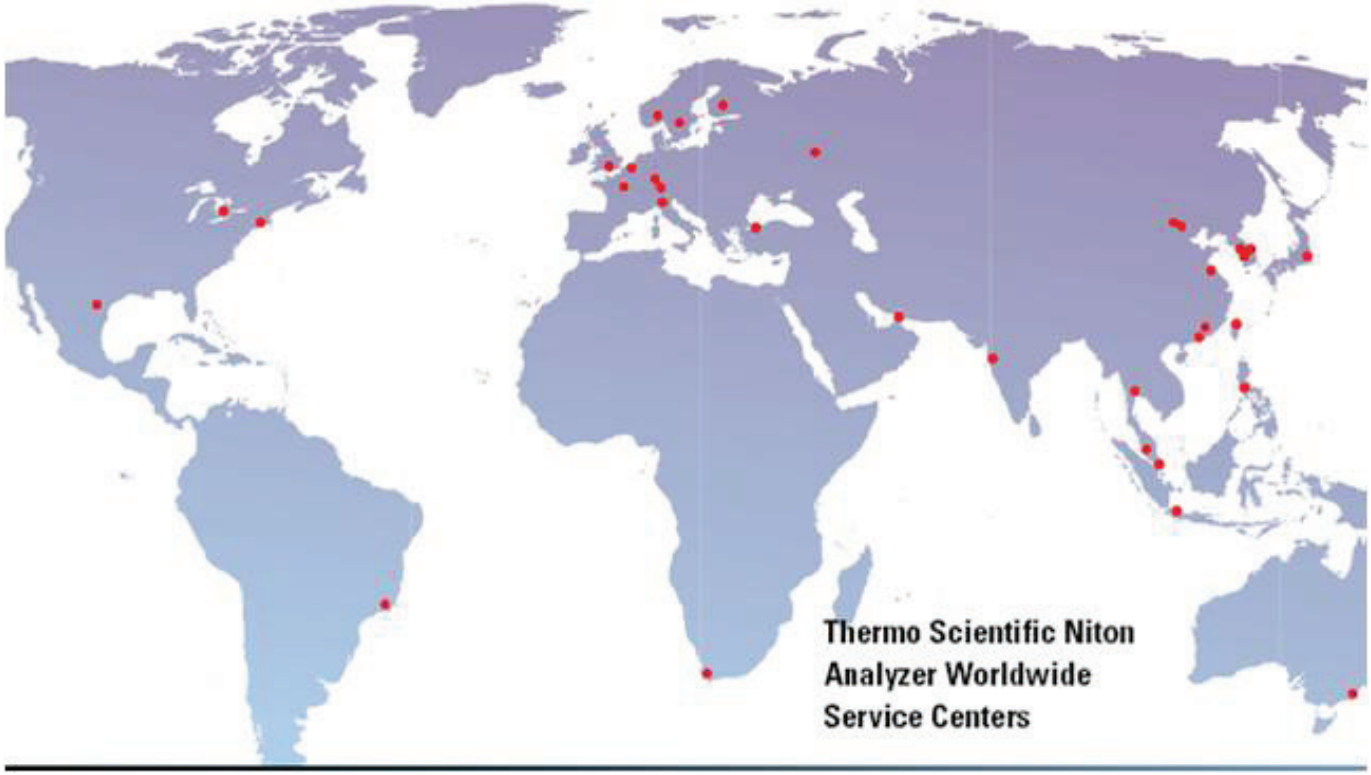
Worldwide Service and Support

More than 25,000 Thermo Scientific Niton XRF analyzers are in use daily in more than 75 countries on six continents



A dedicated network of more than 70 distributors and 30 factory-trained service centers around the world

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Thank You

Interactive Demonstration

And Questions?

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Questions & Answers?

Mark Lessard

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