No compromises in Quality Assurance: When to select XRF, LIBS or Spark Technology

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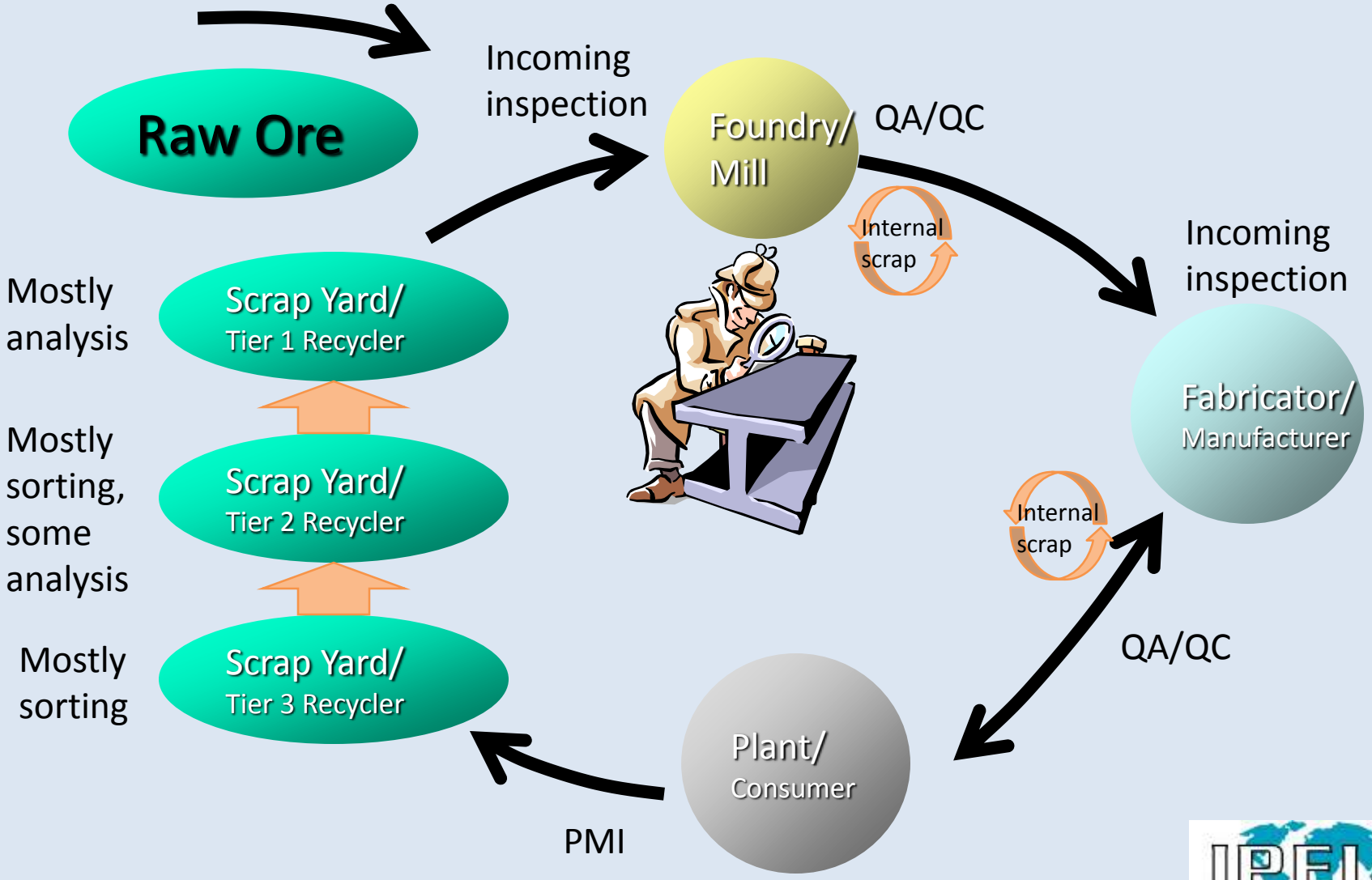
Agenda

- Why is a rigorous alloy Quality Assurance Program needed?
- Potential Supply Chain Risks
- Selecting the right technology

Cycle of Metals



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Supply Chain Management

Manufacturing

Can you control all your incoming material?

Who is responsible for goods that leave your facility?

YOU!

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Supply Chain Management

Potential concerns

- Unknown suppliers
- Unknown raw material
- Negligence
- Deception
- Counterfeit parts

…but you're responsible for product going out your door

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Supply Chain Management

What can you do?

- Trust, but verify
- Request certificates of compliance
- Test incoming materials
- Test outgoing product

A successful program will have a combination of ALL of the above!

Right tool for the job

LIBS

XRF

OES (arc / spark)

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XRF- Strengths

- Fast, accurate and precise tool many application
- Mg - U
- Analysis from ppm-level to 100 %
- Rugged
- Most adaptive

XRF- Limitations

- Detection limits higher than OES
- Slower than LIBS on all elements
- Cannot analyse Carbon, Lithium (Al-alloys) or Beryllium (Cu-alloys)

LIBS- Strengths

- Fastest sorter on the market
- No x-rays
- Very simple to use
- Less vulnerable to sharp samples than HHXRF
- Easy user maintenance
- Samples can be measured in hand
- Short learning curve on how to use
- Point and shoot operation

LIBS - Limitations

- Analytically not as accurate as HHXRF
- Detection limits higher than HHXRF
- More sensitive than HHXRF to operating conditions (temperature, humidity)
- More sensitive to surface conditions (dust, dirt, rust/oxide layer, water) than HHXRF
- Battery needs to be replaced during a working day

OES instruments - Strengths

- High accuracy analysis
- Truly portable can be taken to where the samples are
- Ultimate performance on light alloys and trace elements
- Precise analyse for elements like C, P, S and even Nitrogen (for Duplex steels)
- OES is the only method capable to separate L- from H-grades

OES Instruments - Limitations

- Mobile but not hand-held
- Requires sample preparation
- No automatic calibration selection
- Total measurement time longer than when using XRF or LIBS
- Narrower element selection compared to XRF and LIBS
- Price compared to customer requirements and alternative instrumentation available

Metal Producers

- Ensure melt chemistry
  - Verify incoming scrap matches specifications
  - Detect poison elements
  - Test raw ores, ferrometallic additives
- Outgoing QC
  - Verify target chemistry was achieved
  - Certify batch chemistry
  - Warehouse screening
- Test internal scrap
  - Re-use
  - Sell
- On-site supplier vetting

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Metal Producers

		HHXRF	LIBS	OES
Incoming material inspection, internal scrap	Scrap metal	X	X	X
	Scrap metal	Rapid, non-destructive testing	Fastest metal sorting for high volume	High precision and accuracy, measures C
	Scrap metal – poison elements	Most elements available	Picks up some elements XRF can't	Best LOD for detecting poisons
	Minerals	X		
Outgoing QC	Batch certification			X
	Warehouse screening	X	X	X
On-site supplier screening		X	X	X

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Metal Fabricators

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Metal Fabricators

Fabricator/
Manufacturer

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Metal Fabricators

- Start with metals and finish with different shape or size, or create completed assembly
- Outgoing products are built to customer specifications
- Best (or only) chance to verify composition is incoming inspection
- Metals should arrive with material test report (MTR) but…
  - May be incorrect or incomplete
  - Residual elements may not be included or tested

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Metal Fabricators

- In oil & gas industry:
  - Mechanical integrity is biggest source of “large property damage losses”
  - Per API 578 “Mill test reports should not be considered a substitute for a PMI test.”
  - Installing equipment with an erroneous MTR could result in catastrophic release of hazardous chemicals or energy
  - Fabricators may be required to test before shipping products

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Metal Fabricators

- Verify incoming materials
  - Reject off-spec material
  - Additional information to MTR
  - Ensure they go into right warehouse location
- Quality control
  - Last check before goods leave the production line
  - Create certificate
- Welding inspection

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Metal Fabricators

		HHXRF	OES
Incoming inspection	Metal sheet, coil, billet	X	X
	Warehouse screening	X	X
Outgoing QC	NDT verification	X	
	Seal of approval		X
	Warehouse screening	X	X
	Internal scrap	X	X
Weld inspection	Raw materials	X When C not needed	X When C is needed
	In situ	X	X

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Summary – Choosing the right tool

I want to...

	LIBS	HHXRF	OES
rapidly sort stainless steels	★★★	★★	★
sort Aluminium alloys	★★★	★★	★★★
accurately determine the chemical composition of Aluminium and Titanium alloys	★	★★	★★★
determine the Ni, Cu and Mo contents accurately	★	★★★	★★★
analyse penalty and trace elements on < 0.1 % level	★	★★	★★★
analyse samples with minimum preparation needed	★★	★★★	★
bring the analyser where the samples are	★★★	★★★	★★
sort plastics	-	★	-
sort electronic scrap	-	★★	-
sort / analyse catalytic converters	-	★★★	-

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Delivered by Marc Forbes

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