Scope

The purpose of this procedure is to identify uncertainty sources and estimate the uncertainty of chemical analysis results.

Requirements for Safety & Environment
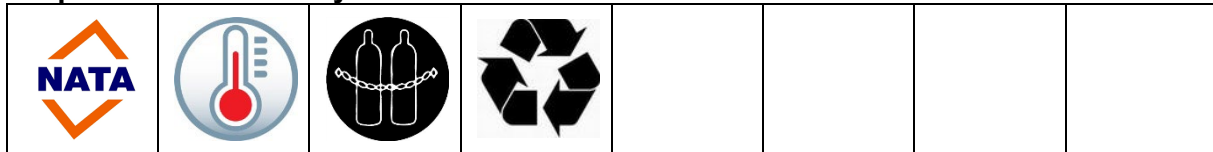
Method

The uncertainty of the results may arise from following sources;

- Standard uncertainty of samplings – $u_{Sampling}$
- Standard uncertainty of a test piece – $u_{TestPiece}$

The following formula will be used to calculate measurement uncertainty of the test item;

$$MU = k * \sqrt{u_{Sampling}^2 + u_{TestPiece}^2}$$

k – Coverage factor which is set to 2.

$u_{Sampling}$ **–** Total 21 samples (7 samples from each alloy group – LALYFE, CRNIFE & CRFE) have been analysed (1 spark each) and standard uncertainty values were taken as a $u_{Sampling}$ value for each element of that group.

$u_{Sampling}$ will only be taken into account for Hycast produced test pieces. It does not apply to customer provided samples.

The printouts of the sample analyses are filed in the Spectro Performance Tests folder.

	LALYFE		CRNIFE		CRFE	
	%	$u_{Sampling}$	**%**	$u_{Sampling}$	**%**	$u_{Sampling}$
C	0.2192	0.0045	0.0246	0.0020	0.6622	0.0061
Si	0.7741	0.0039	1.3307	0.0104	0.8534	0.0107
S	0.0060	0.0001	0.0140	0.0006	0.0065	0.0002
P	0.0114	0.0002	0.0314	0.0011	0.0148	0.0005
Mn	0.4691	0.0029	1.3851	0.0058	0.5897	0.0034
Ni	0.0113	0.0005	8.2059	0.0369	0.1166	0.0013
Cr	0.0486	0.0011	18.6376	0.0148	16.5305	0.0560
Mo	0.0031	0.0001	0.1207	0.0004	0.0147	0.0002
V	0.0017	0.0001	0.0852	0.0003	0.0395	0.0004
Cu	0.0106	0.0004	0.1488	0.0013	0.0144	0.0011
W	0.0050	0.0004	0.0340	0.0007	0.0093	0.0003
Ti	0.0048	0.0001	0.0022	0.0002	0.0026	0.0001
Sn	0.0031	0.0001	0.0056	0.0001	N/A	N/A
Al	0.0020	0.0010	0.0363	0.0028	0.0042	0.0001
B	0.0002	0.0001	0.0012	0.0005	N/A	N/A
Nb	N/A	N/A	0.0000	0.0000	0.0103	0.0002
Fe	98.4296	0.0064	69.9365	0.0455	81.1315	0.0529

$u_{TestPiece}$ **-** Standard uncertainty of the test piece which will be obtained from the test results.

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Standard uncertainties will be entered into the excel worksheets below for the calculation of expanded uncertainties for each element.

Reference (excel worksheet);
- *Lab Measurement Uncertainty – LALYFE*
- *Lab Measurement Uncertainty - CRNIFE*
- *Lab Measurement Uncertainty - CRFE*

Reporting Uncertainty
Refer to *Test Report*.

Responsibilities
Technical Manager / Quality Manager
The Technical Manager / Quality Manager shall evaluate the proper implementation of this procedure and make changes if necessary.

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