Project Profile
Takuma Co Ltd

CLIENT: **Takuma Co Ltd**

LOCATION: **Lakeside, UK**

VALUE: **£ 30k**

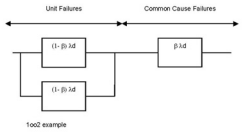
DURATION: **6 Months**

PROJECT: **Lakeside Power Station SIL report**

Technica completed a Safety Integrity Level report and calculations for a new power station on behalf of Takuma.

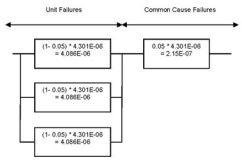
This included generation of Safety Instrumented System loops based on the design provided by Takuma, SIS and package vendors. SIL verification calculations were carried out for large and complex Safety Instrumented Functions which included steam turbine and burner packages. The project required close liaison with Takuma engineers and included a final report with recommendations.

- ✓ SIL Verification Calculations in accordance with IEC61508
- ✓ Instrumentation CAD
- ✓ Liaison with equipment suppliers for reliability data
- ✓ Handover report and recommendations



1oo2 example

The β value of 5% can be applied to the 2oo3 configuration as shown below:



To calculate the PFD of the Unit Failures:

$PFDa = (\lambda d)^2 * (TI)^2$

$PFDa = (4.086E\text{-}06)^2 * (8760)^2$
PFDa = 1.67E-11 * 76737600
PFDa = 0.00128
PFDa = 1.28E-03

To calculate the PFD of the Common Cause Failures:

PFDb = λd * (TI / 2)
PFDb = 2.15E-07 * 4380
PFDb = 0.000942
PFDb = 9.42E-04

To calculate the PFD of the subsystem:

PFD_t = PFDa + PFDb
PFD_t = 1.28E-03 + 9.42E-04
PFD_t = 0.002222
PFD_t = 2.222E-03

Table D1 - Scoring Programmable Electronics or Sensors / Final Elements

ITEM	LOGIC SUB-SYSTEM		SENSORS & FINAL ELEMENTS		VALID INPUT
	Xls	Yls	Xsf	Ysf	1 OR 0
Separation / Segregation					
Are all the cables for the channels routed separately at all positions ?	1.50	1.50	1.00	2.00	0
Are the logic subsystem channels on separate printed-circuit boards ?	3.00	1.00			1
Are the logic subsystem channels in separate cabinets ?	2.50	0.50			0
If the sensors/final elements have dedicated control electronics, is the electronics for each channel on separate printed-circuit boards ?			2.50	1.50	1
If the sensors/final elements have dedicated control electronics, is the electronics for each channel indoors and in separate cabinets ?			2.50	0.50	0
Diversity / Redundancy					
Do the channels employ different electrical technologies for example, one electronic or programmable electronic and the other relay ?	7.00				0
Do the channels employ different electrical technologies for example, one electronic, the other programmable electronic ?	5.00				0
Do the devices employ different physical principles for the sensing elements for example, pressure and temperature, vane anemometer and Doppler transducer,etc ?			7.50		0
Do the devices employ different electrical principles/designs for example, digital and analogue, different manufacturers (not re-badged) or different technology ?			5.5		0
Do the channels employ enhanced redundancy with MooN architecture, where N=M+2 ?	2.00	0.50	2.00	0.50	0
Do the channels employ enhanced redundancy with MooN architecture, where N=M+2 ?	1.00	0.50	1.00	0.50	1
Is low diversity used, for example hardware diagnostic tests using the same technology ?	2.00	1.00			0
Is medium diversity used, for example hardware diagnostics tests using different technology ?	3.00	1.50			0
Were the channels designed by different designers with no communication between them during design activities ?	1.00	1.00			0
Are separate test methods and people used for each channel during commissioning ?	1.00	0.50	1.00	1.00	0
Is maintenance on each channel carried out by different people at different times ?	2.50		2.50		0
Complexity / Design / Application / Maturity / Experience					
Does cross-connection between channels preclude the exchange of any information other than that used for diagnostic testing or voting purposes ?	0.50	0.50	0.50	0.50	1
Is the design based on techniques used in equipment that has been used successfully in the field for >5 years ?	0.50	1.00	1.00	1.00	1
Is there more than 5 years experience with the same hardware used in similar environments ?	1.00	1.50	1.50	1.50	1
Is the system simple, for example no more than 10 inputs or outputs per channel ?		1.00			1
Are inputs and outputs protected from potential levels of over-voltage and over-current ?	1.50	0.50	1.50	0.50	1
Are all devices/components conservatively rated (for example, by a factor of 2 or more) ?	2.00		2.00		1