Science & Technology Facilities Council
ISIS Neutron and Muon Source

Challenges of Radioactive Waste Characterisation at ISIS

Some Examples

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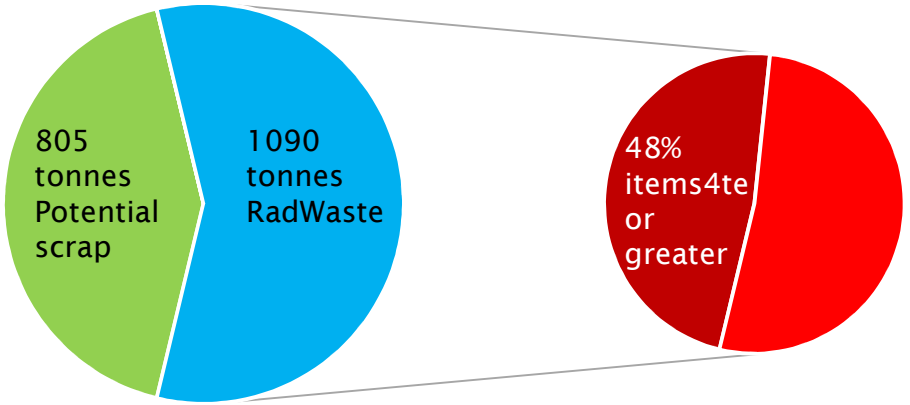
Part 1 of 3

SETTING THE SCENE

PROPERTIES: SIZE OF WASTE ITEM

ISIS Metallic and Shielding wastes



PROPERTIES: Examples of large items

ISIS waste is dominated by big items , such as:

- Magnets each over 9te
- Magnet trolleys each about 9te
- Shutters 7te each for TS1
- Shielding up to 12te per item
- Tanks such as Tank IV is 7te 12m long

PROPERTIES: Activation

NON-UNIFORM SPREAD Sometimes easy to predict and sometimes not

Material Irradiated	Examples of Resulting Radionuclides
Steel	Co-60, Fe-59, Mn-54, Co-57, H-3
Concrete	Eu-152, Eu-154, H-3, Co-60
Copper	Ni-63, H-3
Aluminium	Na-22

Safety-related Requirements

- Minimise worker doses
- No dust releases
- No gas releases
- Minimise secondary waste
- Minimise costs

MINIMAL INTERVENTION!!

So, now you have your waste item

- Complete well documented history
- Correct design drawings
- Material specification known
- Experience of characterising
- Pattern of activation known

Part 2 of 3

EXAMPLES RELATING TO CHARACTERISATION

Shutters: Use

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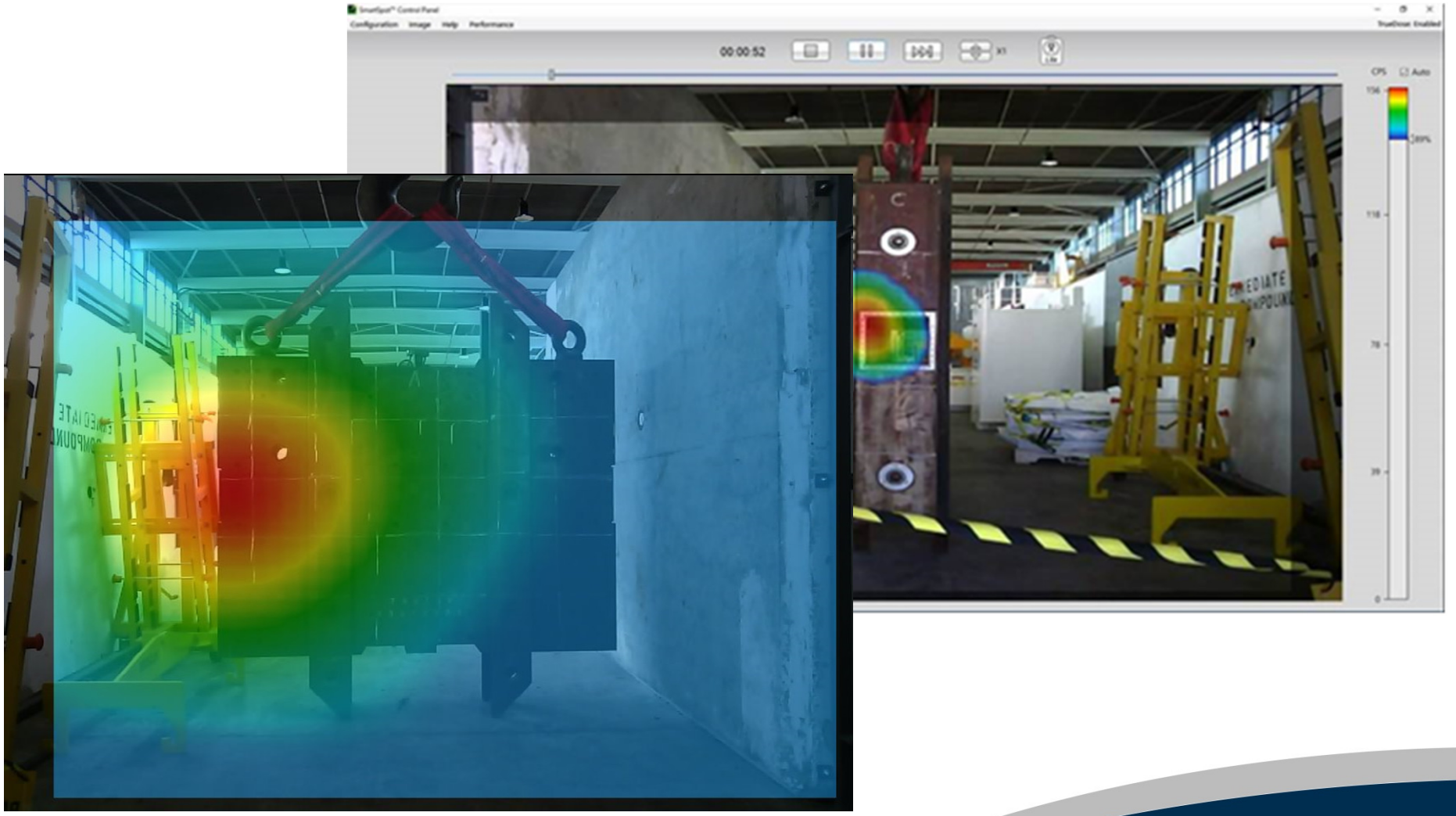
Shutters: Gamma-camera



Shutters: Sampling

Beam entry face

100	153	68
180	332	120
370	700	310
140	230	90
100	138	65
40	58	30

Side view

100	80	21	7	3.2	1.5	0.5	0.3
180	180	30	9	3	1.2	0.4	0.4
370	170	28	17	5.8	1.4	0.7	0.6
140	140	22	10	2.5	1	0.3	0.3
100	110	18	8.5	2.3	0.9	0.1	0.2
40	34	12	5	1.4	0.7	0.3	0.1

Beam exit face

0.3	0.5	0.5
0.4	0.2	0.5
0.6	2.6	0.5
0.3	0.2	0.3
0.2	0.1	0.2
0.1	0.3	0.2

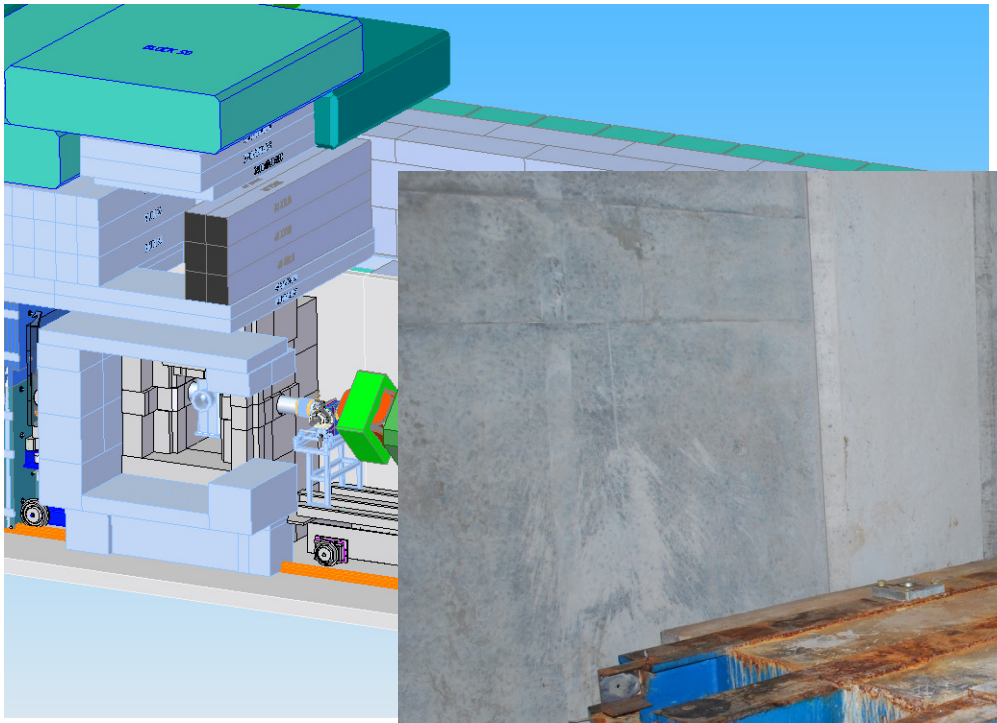
Dose rates across faces (μSv/h)

- Surveys
- Sampling
- High-resolution gamma-spec and modelling

Shutters : conclusions

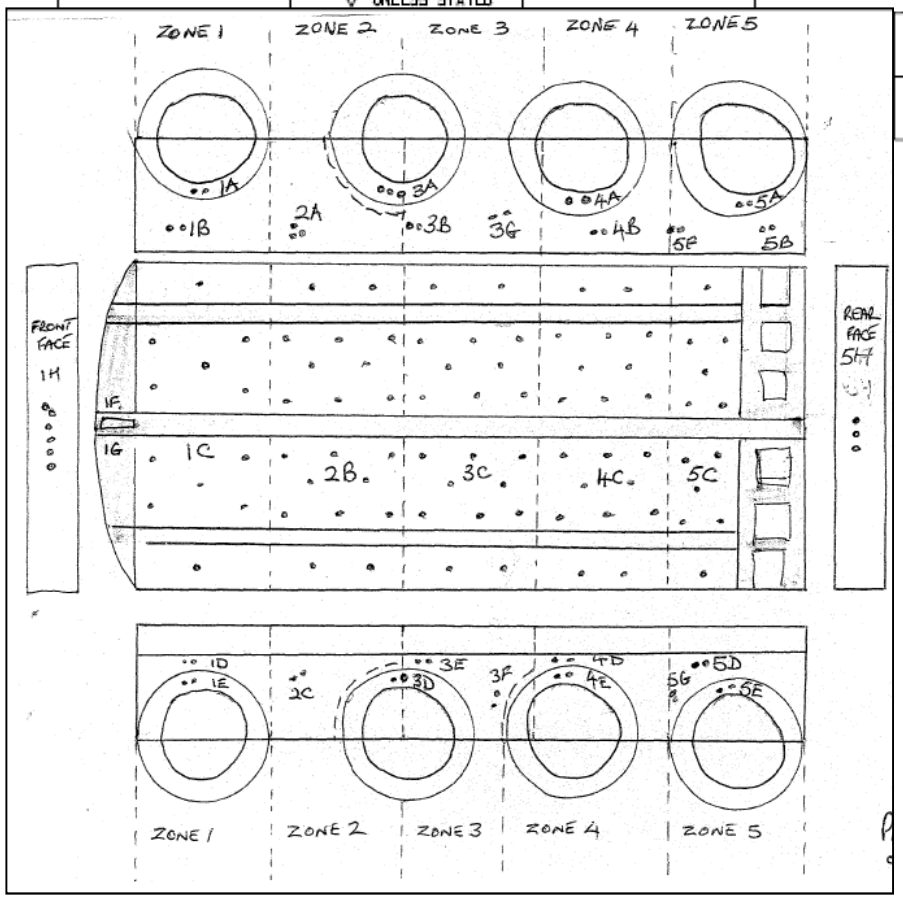
- Shutters pattern of activation supports consideration of current holdings as LAW not HAW as originally anticipated
- Cast iron half-depth 150mm
- Concrete activation half-depth 300mm

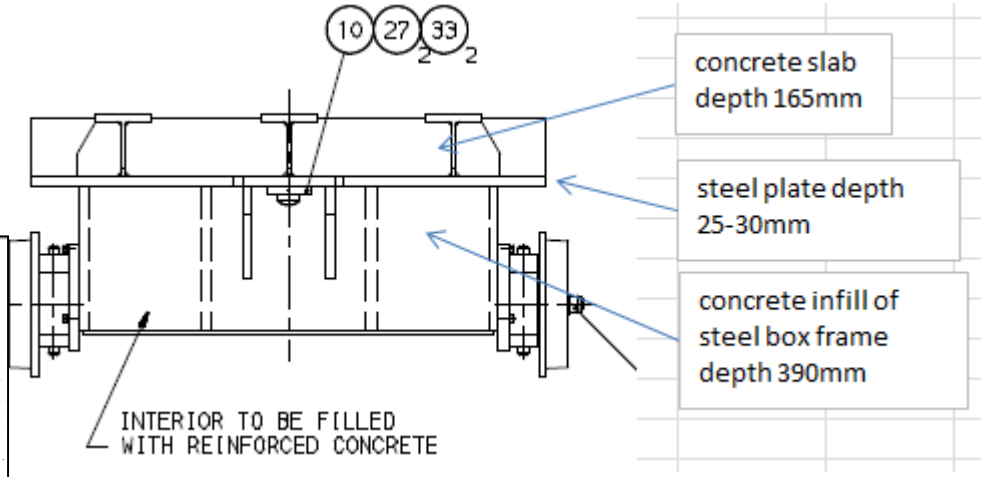
Magnet Trolley



Magnet Trolley - sampling

ISSUE	DATE	MOD. NO.	DRN. BY	CHKD.	APPD.	STATUS
A	20.06.06	---	KVR/S&P	JRH	---	MANUF.
TOLERANCES UNLESS STATED		FINISH CLEAN REMOVE ALL BURRS			ORIGINAL SCALE 1:10 DO NOT SCALE	
MATERIAL & SPEC. SEE ITEM LIST		SURFACE TEXTURE µm √ UNLESS STATED			0 500mm	





Magnet Trolley

Typical activities found for trolley
(approximately 10 years after activation)

	3H	55Fe	54Mn	57Co	60Co	152Eu	154Eu	
Concrete	227	-	-	-	13	33	4	Bq/g
Steel	-	239	0	0	15	0	-	Bq/g

Magnet Trolley

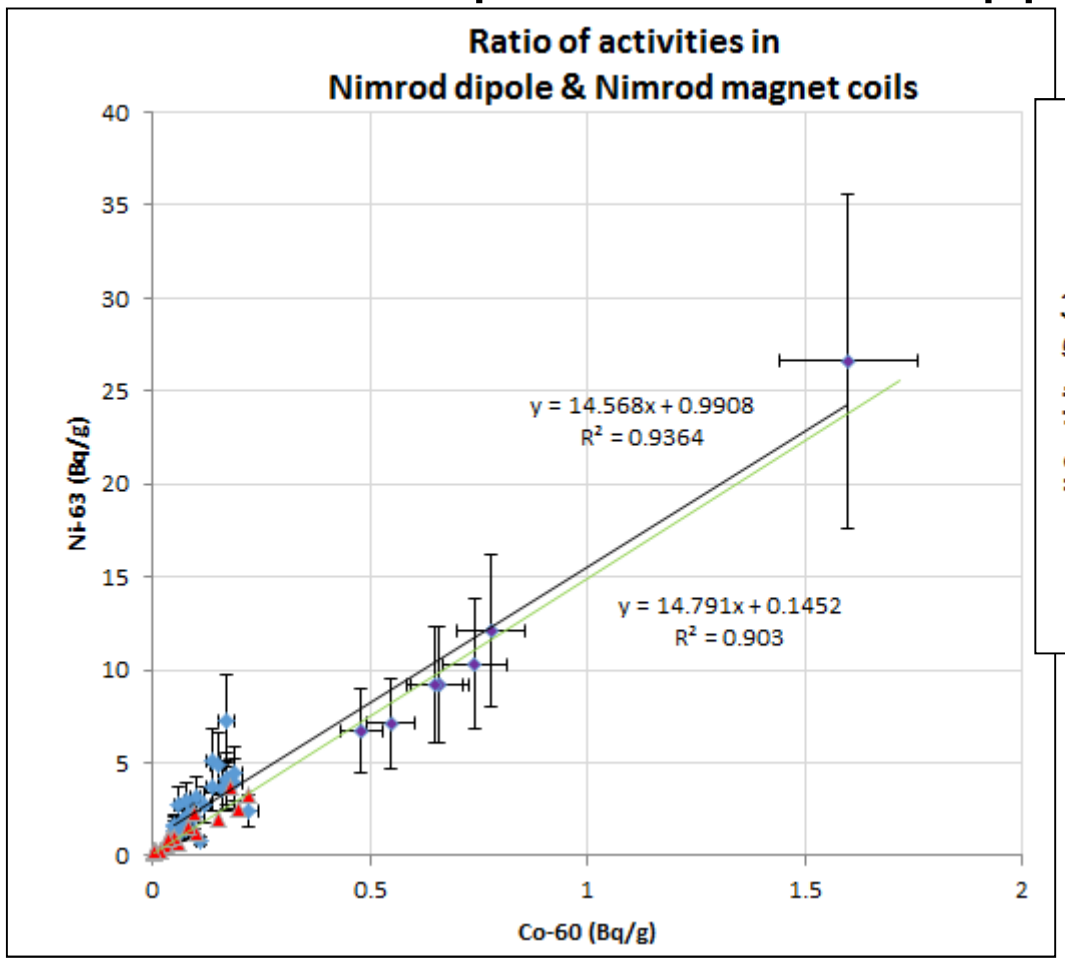
- Magnet trolley was found not to be HAW as initially designated
- Cost saving as was sent to special landfill rather than the LLWR (National Low Level Waste Repository)
- Use for other trolleys characterisation – less samples and quicker

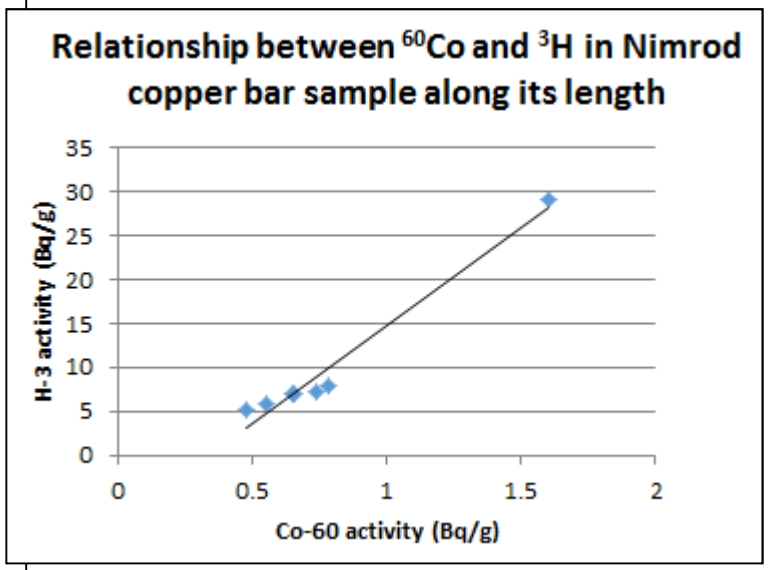
Linac Tank IV

Archive photo of tank on delivery to site late 1950's

Linac Tank IV

- Previous experience with copper





Conclusions re. Linac Tank IV

- Copper pipework sampled for destructive analysis of ^{60}Co:^{63}Ni:^{3}H
- Steel sampled for destructive analysis of ^{60}Co:^{55}Fe:^{59}Fe:^{3}H
- Surveyed & gamma-spec.in low dose rate area
- Intact disposal to landfill currently anticipated.

Part 3 of 3

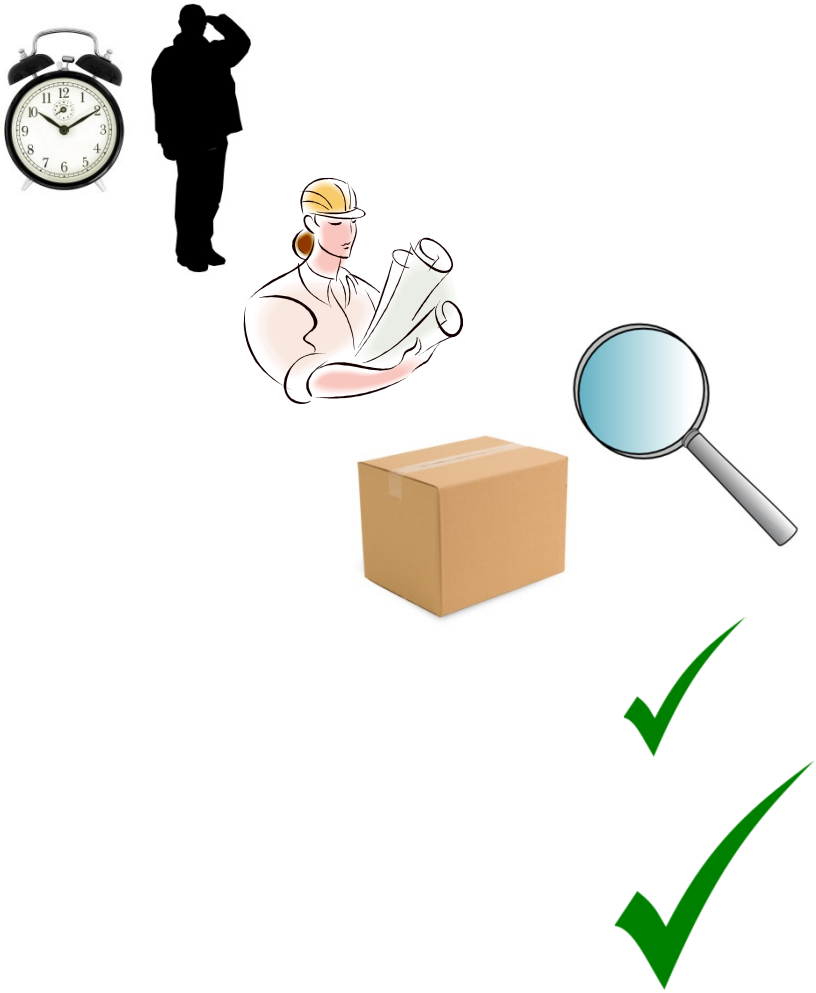
LOOKING INTO THE (NEAR) FUTURE

Steps in the disposal process

To recent times:

1. Store
2. After a long time, start to think about characterisation
3. Search for history and designs
4. Take samples
5. Consider disposal options (BAT)
6. Process &/or take more measurements
7. Dispose

Improvements



1. Anticipate
2. Plan to measure
3. Store & measure
4. Review data held and form action plan
5. Final review of BAT for disposal
6. Dispose

What benefits will this bring?

- Lower costs due to less sampling, purchase of storage flasks.
- Better data and thus more convincing arguments for increasing some accumulation times.
- Opportunity to dispose of some wastes earlier where longer accumulation times bring no benefits.

QUESTIONS