

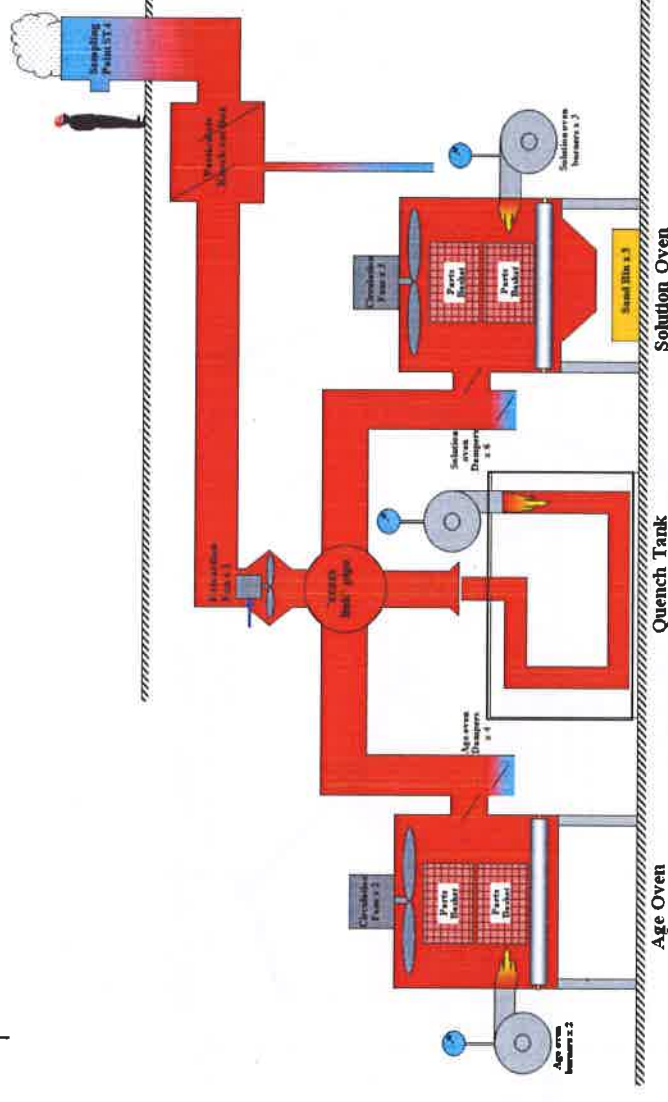
Toyota

RECEIVED

24 JUL 2014

Present situation

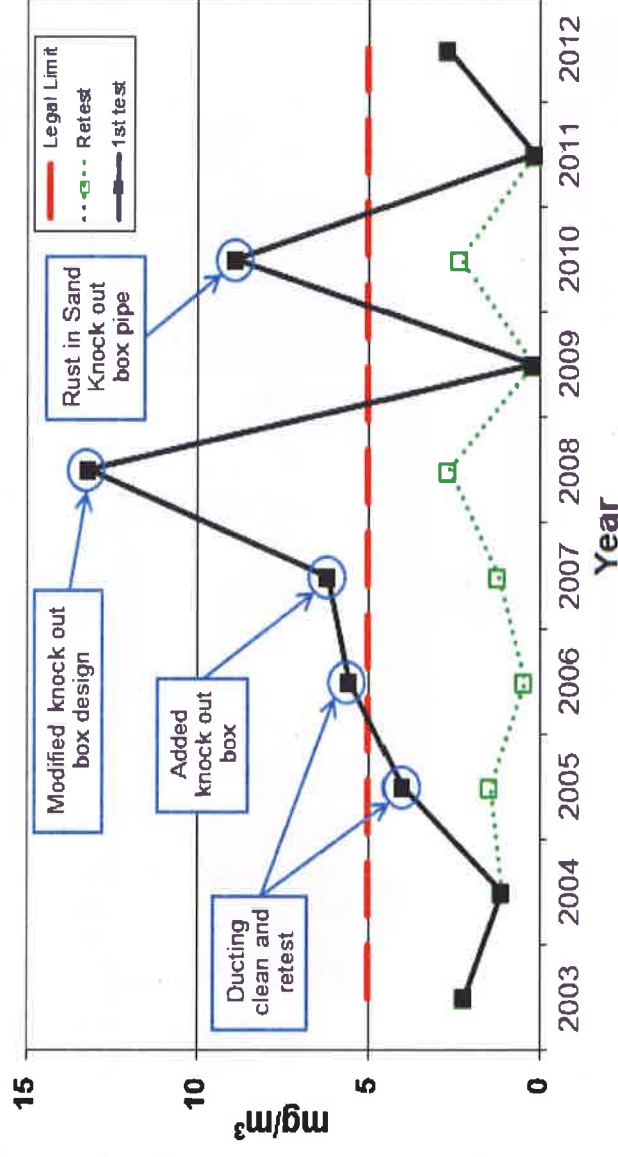
- T6 heat treatment furnace in Casting. Bakes the engine heads to improve strength
- Gases inside each oven section are exhausted to atmosphere
- Exhausts are subject to permitted emission limits on carbon monoxide, nitrous oxides and particulate matter (dust)
- Emissions tested yearly by third party (permit requirement). Legal limit for particulate matter is $5\text{mg}/\text{m}^3$
- Original concept designed in Japan to work within Japanese dust limit of $50\text{mg}/\text{m}^3$



OK FOR PUBLIC PERMITTER	DATE
LC	29.8.14
CHECKED TO PUBLIC REGISTER	EDCM

Problem

- Non-conformances on 4/10 previous annual tests
- Two classed as Environmental Rank B Incidents
- Containment measures taken, root cause never found
- Potential remains for further non-conformances

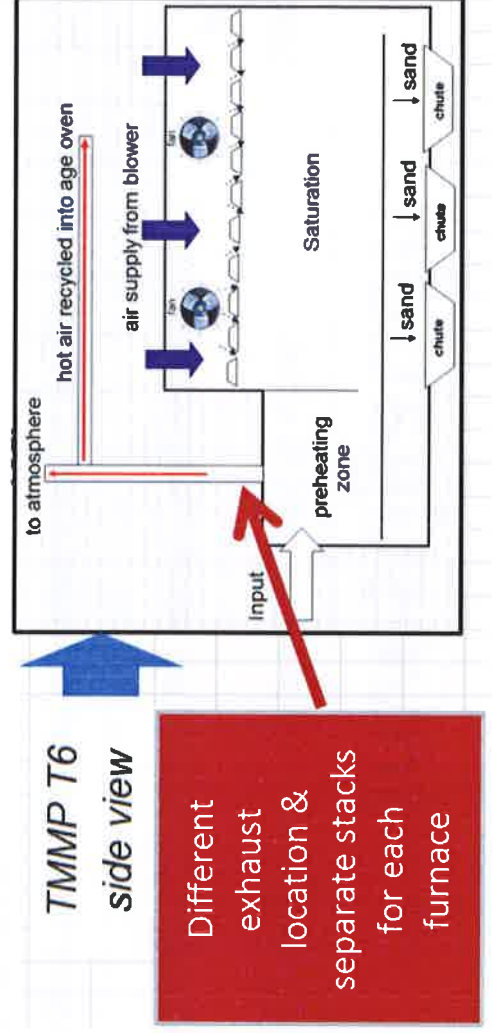


- Environmental incidents harm the reputation of the plant and pollute the local environment.

NRW have power to stop process if permit non-conformances continue

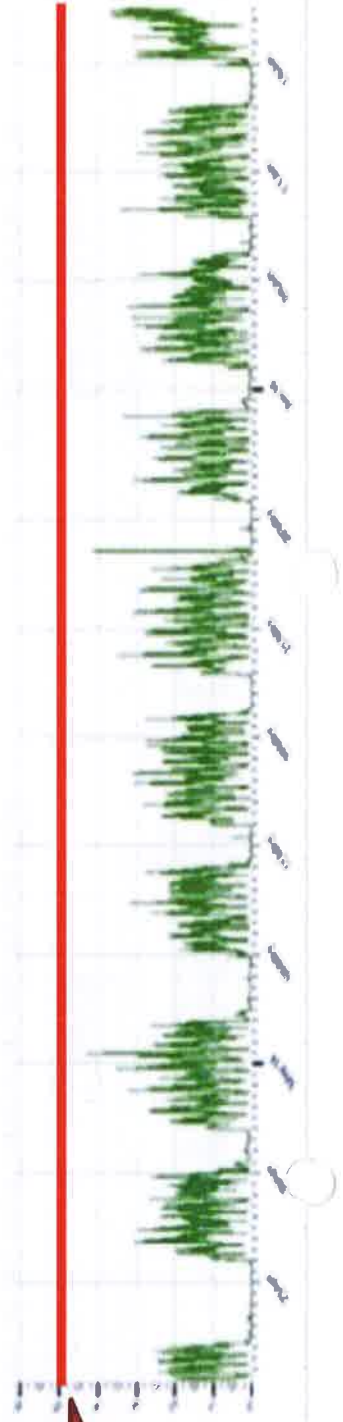
Investigation

Stage	Check	Conclusion
Confirm stds	Confirmed to be running according to PCS	Process running to standard
	PCR history checked, no changes found	
	Classification of equipment challenged to increase limit	Cannot increase limit
	Process has regularly complied with current limit	
Bench- marking	Japan uses rotary furnaces, benchmark not possible	UK T6 is unique. No / few learning points available
	Poland plants use same equipment but have fundamental design difference	



Investigation

Investigation	Loss of part weight during process = 95% sand	Sand not likely to be primary cause of exceedance
	< 3% of current emissions are sand; "household dust"	
	Burner expert found exhaust imbalance & negative pressure in furnace	Oven set up <u>could</u> encourage dust exhaustion
	Best practice & design intent = positive pressure	
	Continuous monitor fitted. Works on light scatter; calibrated to annual test method (isokinetic filter sample - $1.4\text{mg}/\text{m}^3$). No exceedances in 2 months	Despite set up issue, no emissions problems seen. CANNOT IDENTIFY ROOT CAUSE
	Attempts to recreate exceedance unsuccessful	
	Cannot guarantee recreating same problem(s) and Rank B's	



Conclusion

- Some opportunities identified to change set up / layout for potential improvements. No guarantee changes would improve emissions
- Despite current good condition, no confidence that process is under control and will not exceed limit in future
- Need "insurance policy" to guarantee eliminating the environmental risk

Options

<u>Options</u>		Env risk	Quality risk	Ease to do	Cost	Time	Comments
Continue monitoring		△	○	○	X	○	Enable us to properly c/m, but unknown how long it will take to find problem. Will be required to report all exceedances. Monitor hire = £500/week, purchase ~ £10k
Do nothing		X	○	○	○	○	Doesn't eliminate possibility of non-conformances
Modify input controls (e.g. burner settings)		X	△	△	△	△	Unknown if improvements will prevent non-conformance. May affect intended operation of equipment and quality of parts
Redesign furnace to match Poland design		△	△	△	X	△	Reason not clear for better performance, change not guaranteed to solve UK problems. Potentially very high cost and may affect operation/quality
Install filter (control output)		○	○	○	△	○	Arrests any dust that travels up the stack, regardless of the source. Initial investment cost is higher but guaranteed to be complete before next annual test

Supplier	Equipment	Purchase cost	Lead time	Running cost (annual)	Maintenance cost (annual)	Comments	Risk
Camfill	Cartridge filter	£26,930.00	5 weeks	£576.00	£792.00	Same principle as baghouse, but with cartridges instead of bags. Much more robust and reliable, less risk of failure	○
Filter sourcing	Cartridge filter	£27,750.00	8 weeks	~£500	~£1000	Same principle as baghouse, but with cartridges instead of bags. Much more robust and reliable, less risk of failure	○
Pennaire	HEPA filter	£8,600.00	10 weeks	£0.00	~£2050	Non-standard design for this application, no working examples to confirm. Estimated costs very rough	X

Plan

- **Install a particulate filter in the exhaust duct work**
- **Modification is not part/model specific.**
No changes required for any future generation engine types/models
- **Preferred supplier is Camfill. Already supply filters for AHU's, long standing contract with good relationship & nearby support**



Timing plan

[illegible]

