Environmental Monitoring

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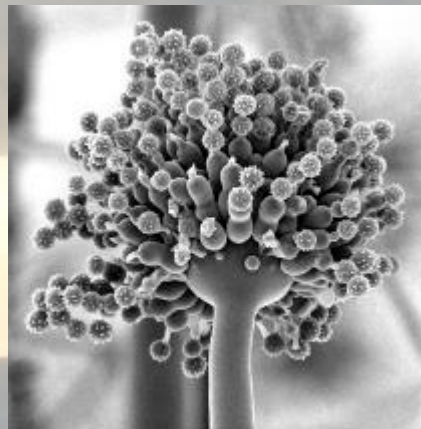
Decontamination Units

- **Decontamination facilities are designed, constructed, maintained and controlled to provide a controlled environment that minimises adventitious contamination of clean and disinfected reusable invasive medical devices (RIMD)**

- **Where does this adventitious contamination come from and how is it assessed?**

Routes of microbial contamination

- **Indirect Transmission**

  Transfer of a microorganism from person to person via an inanimate object.
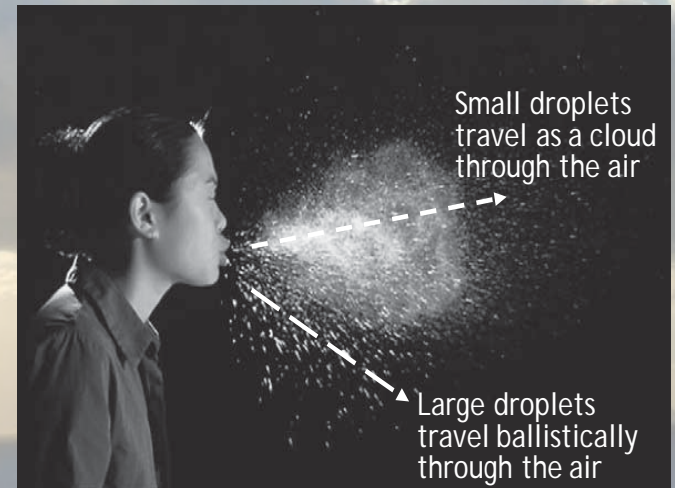 Eg. Improperly cleaned instruments/endoscopes, equipment or environment

- **Direct Contact Transmission**

  Hand to hand

Personnel

- Normal human body flora

- Assumption is that the occupants are contaminated and will shed skin cells, hair, bacteria.

- "Microbial plume"

- The type and rate at which bacteria are shed will be dependant on the individual.

- Personal hygiene /health

Small droplets travel as a cloud through the air

Large droplets travel ballistically through the air

- **Water Transmission**

  Contaminated supply or purified waters, bio-film formation

- **Droplet and air transmission**

  Droplets of water (aerosolised) of less than 5µm or dust particles can remain airborne for long periods of time and travel long distances

Airborne contamination – ventilation

Filtration
    Ill fitting filters
    Compromised filters
    Clogged Filters

Ductwork
    Dirt
    Corrosion
    condensation

Plant
Operating below specification
    i) pressures
    ii) air changes

Badly Maintained

Pathogens and diseases that have the potential to be transmitted via the airborne route Pathogen

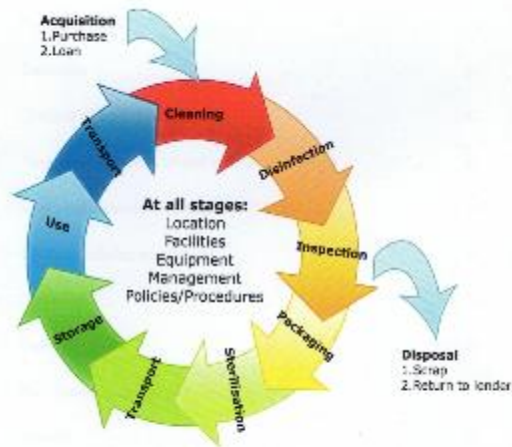|			
Aspergillosis	Inhalation of airborne conidia (spores)	Meningitis	Respiratory droplets from nose and throat
Blastomycosis	Conidia, inhaled in spore-laden dust	(*Haemophilus influenzae*)	
Chickenpox/shingles	Droplet or airborne vesicle fluid or respiratory tract secretio	Meningitis	Respiratory droplets from nose and throat
Adenovirus	Transmitted through respiratory droplets	(*Streptococcus pneumoniae*)	
Cryptococcosis	Presumably by inhalation	Mumps	Airborne transmission or droplet spread
Human parvovirus	Contact with infected respiratory secretions	Nocardia	Acquired through inhalation
Rotavirus	Possible respiratory spread	Whooping cough (*Bordetella pertussis*)	
Norwalk virus	Airborne transmission from fomites	Plague (*Yersinia pestis*)	Rarely airborne droplets from human patients. In the case of
Histoplasmosis	Inhalation of airborne conidia		deliberate use, plague bacilli would possibly be transmitted as an aerosol
Influenza	Airborne spread predominates	Pneumonia (*S. pneumoniae*)	Droplet spread
Lassa virus	Aerosol contact with excreta of infected rodents	Staphylococcal diseases	Airborne spread
Legionellosis	Epidemiological evidence supports airborne transmission	Streptococcal diseases	Large respiratory droplets. Individuals with acute upper respiratory
Measles	Airborne by droplet spread		tract (especially nasal) infections are particularly likely to transmit infection
Meningitis	Respiratory droplets from nose and throat		
(*Neisseria meningitidis*)			

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- "Taken collectively, this degree of challenge to sterilization and disinfection systems is extraordinarily excessive".

- It is critical to provide evidence that control systems, individually and in combination, are effective in maintaining the environment, thus ensuring the decontamination status of the RIMD/flexible scope has not been compromised.

- Control systems including
- PPE
- Cleaning protocols
- Infrastructure
- Ventilation

- To best ensure the welfare and safety of personnel working within that environment

Health Service Executive
Recommended Practices
For Central Decontamination Units

Acquisition
1. Purchase
2. Loan

Cleaning

Disinfection

Transport

At all stages:
Location
Facilities
Equipment
Management
Policies/Procedures

Use

Inspection

Storage

Packaging

Transport

Sterilisation

Disposal
1. Scrap
2. Return to lender

Note: The lifecycle diagram used in this document is © Crown Copyright. Source: Department of Health, United Kingdom.

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Air monitoring methods

1. Passive settling of microbes using 90mm diameter 'settle' plates which contain either Tryptone Soya Agar (TSA) or Sabaroud Dextrose Agar (SDA).
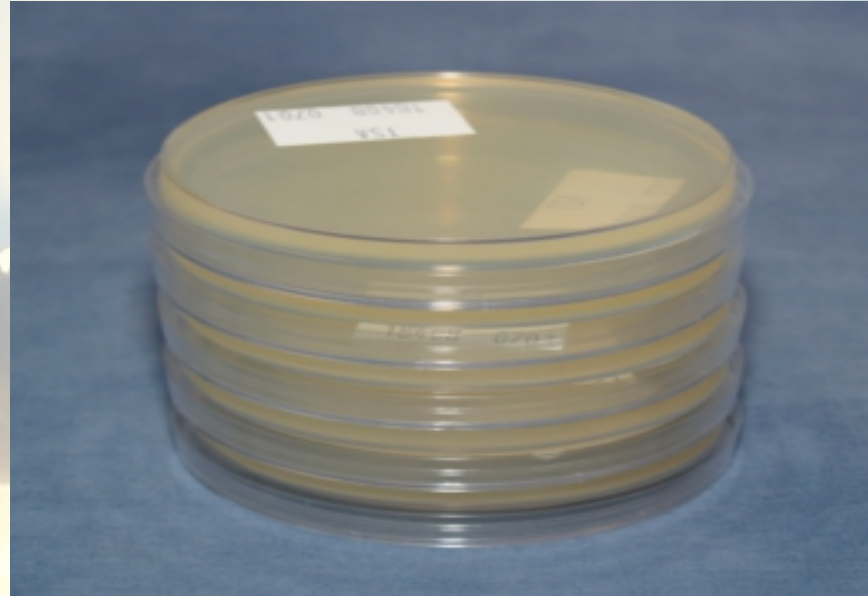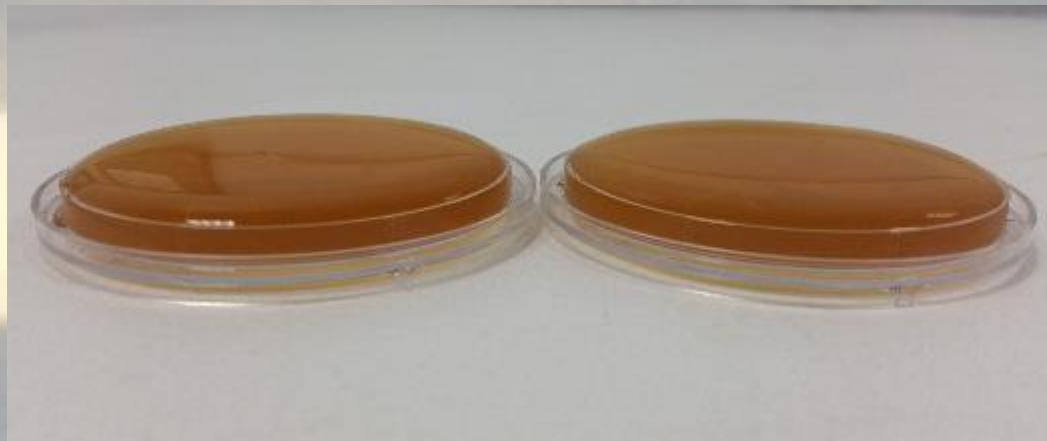
Active Air (impaction) sampling

Surfaces - Contact (Rodac) plates

Plates - 55mm dia. Area ~ 25cm^2

TSA and SBA

Disinfectant neutraliser

Ideal for flat surfaces

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Surface - Swab sampling

- Swab sampling for irregular surfaces and difficult to get to places

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Monitoring Programme

- A monitoring plan (locations) of the sampling sites will typically include

    – Close to where RIMDs are handled and stored
    – Air inflows
    – Areas of high activity
    – Problem areas

- At Rest

- In operation

Dirty Side

Washer/disinfector Washer/disinfector Washer/disinfector Washer/disinfector

CD CE

S4

Lobby

S5
CG
S8

Step Over

Sink

CF

CC S3

CH
S7

S6

S1

S2
CB

Cleaners store

IAP Room

CA

Autoclave Autoclave Autoclave Autoclave

Sterile Store

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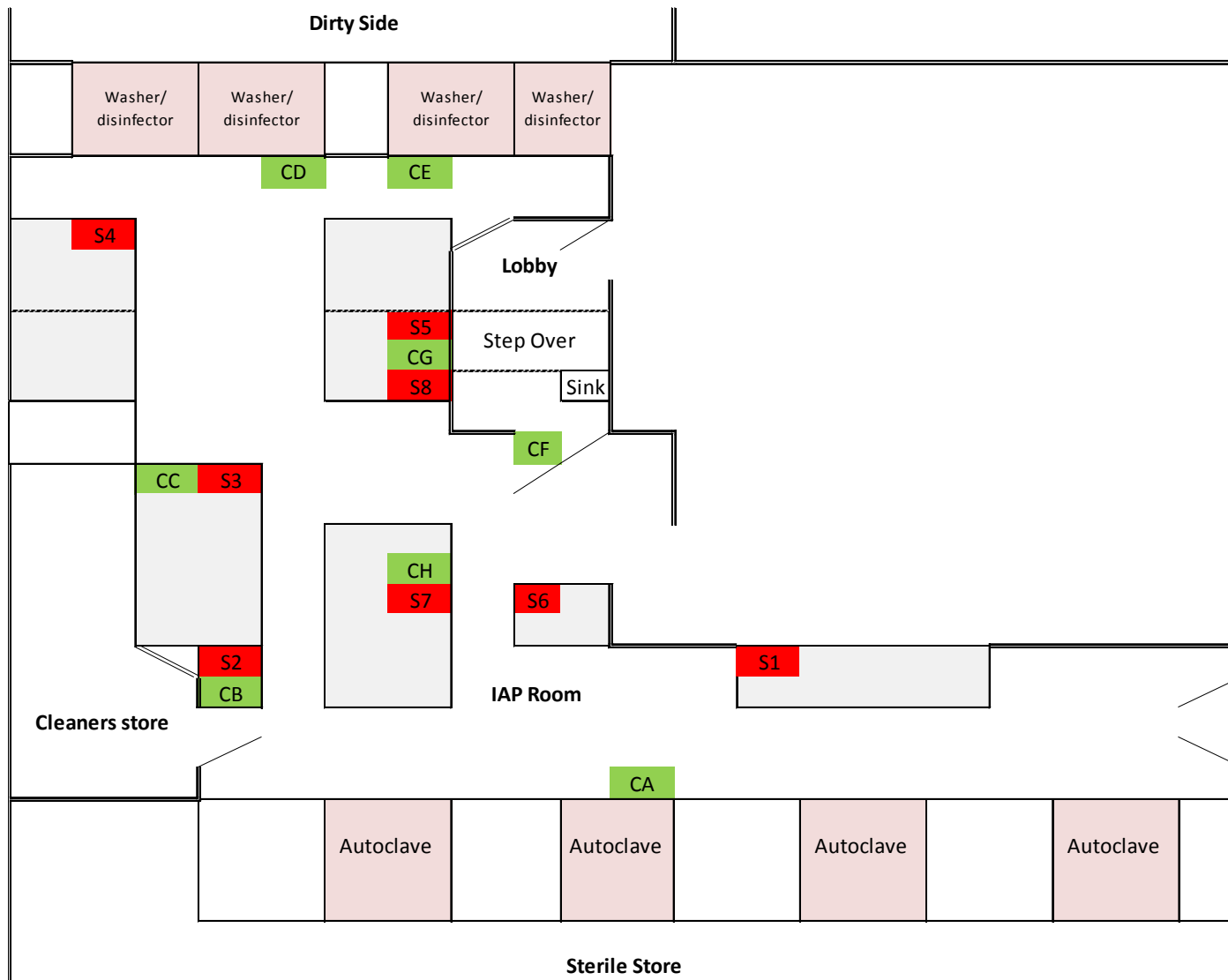
Settle Plate	Position
S1	Trolley in front of Western Steriliser
S2	Back wall PC station (next to cleaner store)
S3	Back wall, Middle, infront of printer
S4	Back Wall, right hand side of preparation bench
S5	Front wall, preparation bench closest to entry door
S6	Trolley middle shelf directly oppisite entry door
S7	Middle of cleanside on tolley
S8	Front wall, preparation bench top shelf

Contact Plate	Position
CA	Central Autoclave , Control panel
CB	Back wall PC station (next to cleaner store), Lower shelf
CC	Back wall, Middle, Printer side
CD	Middle WD, Control Panel
CE	Right WD panel
CF	Entry door, push panel
CG	Front wall, preparation bench top shelf
CH	Trolley, center Cleanside

Frequency of monitoring

- Settle plates – monthly

- Contact plates – weekly

- Active air sampling – monthly (if used)

- Breakdown, maintenance or change in practices

Microbiological analysis

- "The absolute CFU value has limited scientific meaning"

- Single microbiological result – to many variables!

- True value - repeated analysis and trending

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Control Limits

- The limit values should be based on averaged values achieved over at least a six month period.

- This will be unique for each decontamination unit

- Typical action limits for Class 8 facilities

|	Contact plate CFU/plate	Settle plate CFU/plate
Class 8 Alert	5	5
Class 8 Action	30 (floor counts)	20
Class 7 Alert	4	3
Class 7 Action	5 (10 floor) (20 floor, dirty side)	5

Action and alert Limits

- **Alert level** – CFU levels that, when exceeded, signal a possible deviation from normal operating conditions and may not require action, but may need to be monitored more closely.

- **Action level** – CFU levels that, that when exceeded, indicate a deviation from normal operating conditions and require immediate action.

Date	Control	Sample Point/Total Viable Count							
		S1	S2	S3	S4	S5	S6	S7	
05.06.14	0	25	27	29	33	28	22	20	U
12.07.14	0	26	35	28	26	30	20	13	U
19.08.14	0	21	10	9	10	5	3	4	U
26.09.14	0	17	5	19	27	7	2	9	U
26.10.14	0	20	8	22	27	7	2	11	U
02.11.14	0	14	18	20	16	24	13	21	U
10.12.14	0	5	8	6	6	12	2	27	U
17.01.15	0	4	5	5	3	4	8	2	U
24.02.15	0	12	7	10	7	8	6	10	U
31.03.15	0	13	11	11	8	6	10	9	U
07.04.15	0	14	5	9	13	10	5	14	U
17.05.15	0	26	34	26	30	6	22	16	U
24.06.15	0	10	11	27	13	1	7	11	U
25.07.15	0	57	51	44	35	36	30	52	U
08.08.15	0	84	60	71	67	32	18	70	U
16.09.15	0	2	3	4	2	0	0	5	U
23.10.15	0	8	4	7	5	0	0	0	U
02.11.15	0	4	1	7	5	3	2	1	U
	Average (x)	20.1	16.8	19.7	18.5	12.2	9.6	16.4	
	No. (N)	18	18	18	18	18	18	18	
	SD	7.1	10.5	8.6	9.9	9.2	7.3	6.6	
	Alert Limit	34.3	37.8	36.9	38.4	30.5	24.1	29.6	
	Action Limit	41.4	48.2	45.5	48.3	39.7	31.4	36.2	

Trend analysis
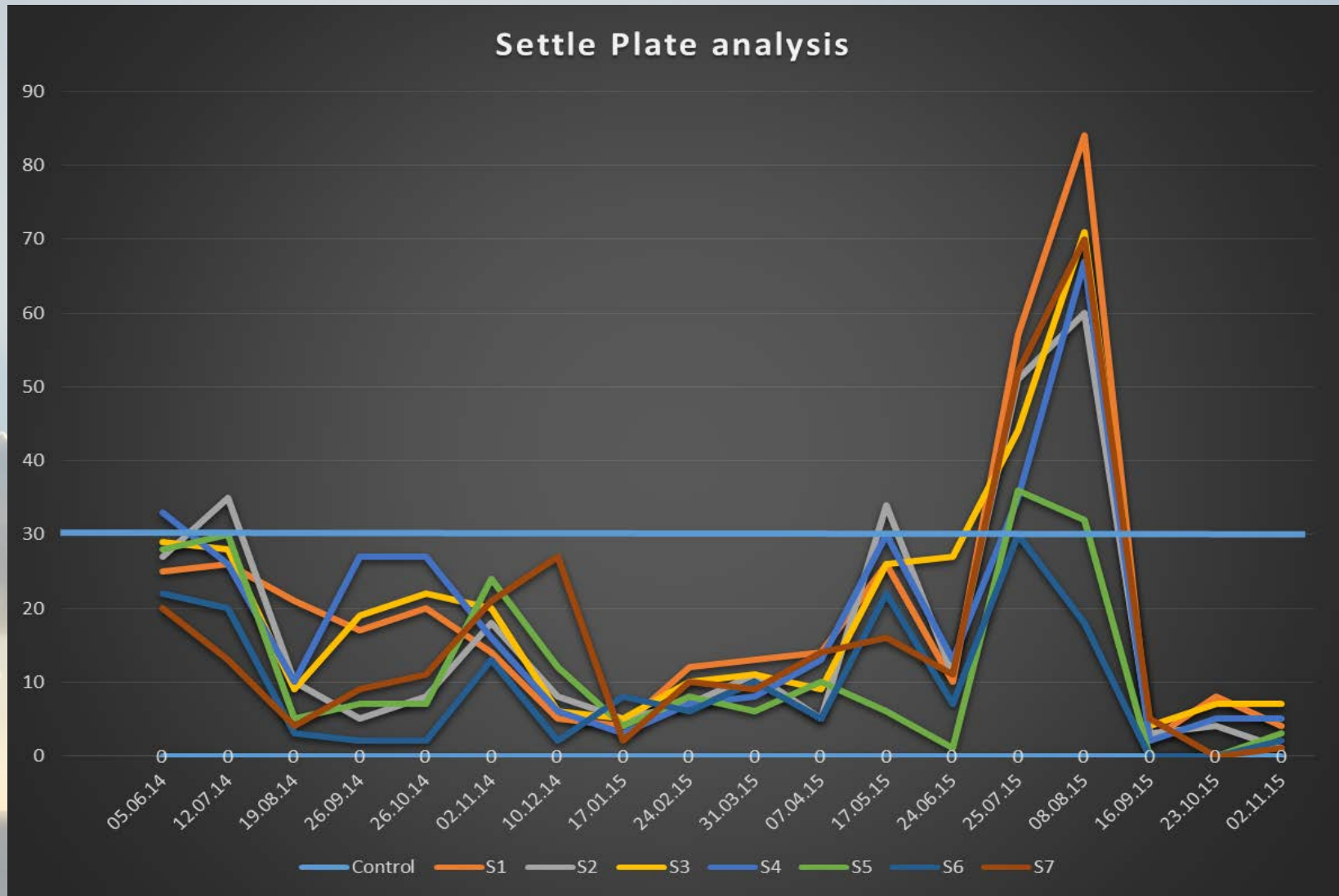
Investigation and corrective actions

- Multi-disciplinary approach – Include the laboratory and microbiologist

- Unusual activity, maintenance, suspected contamination, abuse

- System breakdowns

- Change in staff

- Change in policies

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