

# Lessons to learn from Roadmapping in Cleaning and Decontamination



Graham Christie



Peter Fryer



Ian Hall



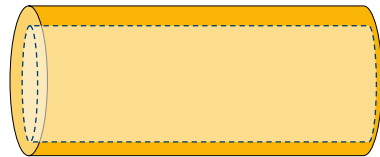
Julien Landel



Kath Whitehead

Ian Wilson  
*Chemical Engineering & Biotechnology*

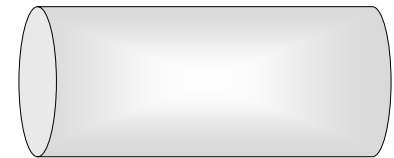
# Cleaning and decontamination



purge



clean



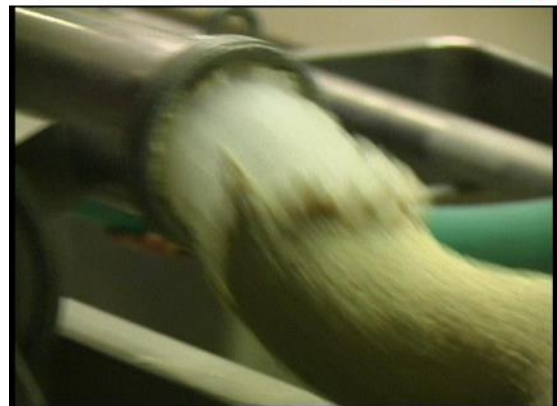
decontaminate

# How clean is clean?



RISK

# Cleaning and decontamination are universal activities



# Major UK sectors with intensive cleaning activity

Agriculture

Energy

Environment

Food & Drink

Healthcare/Public Health

Hospitality

Nuclear

Personal Care Products

Pharmaceuticals

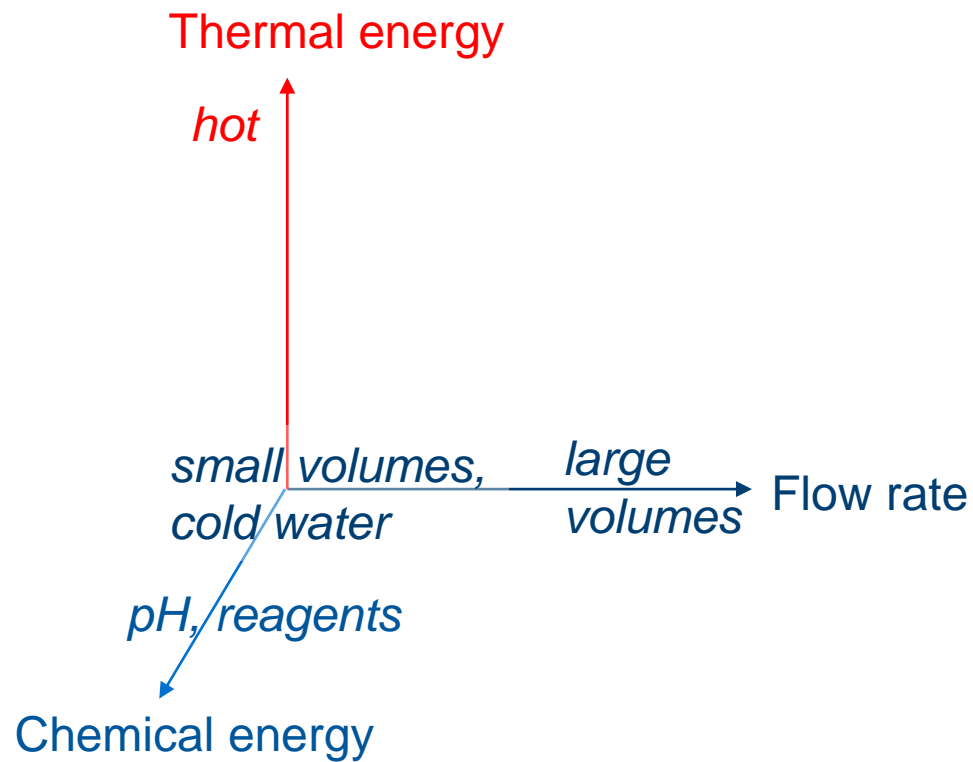
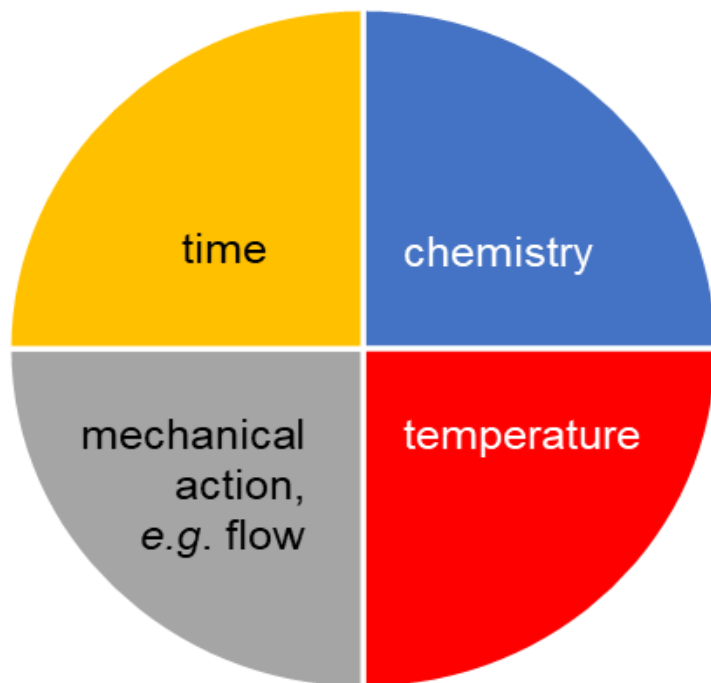
Shipping

Water

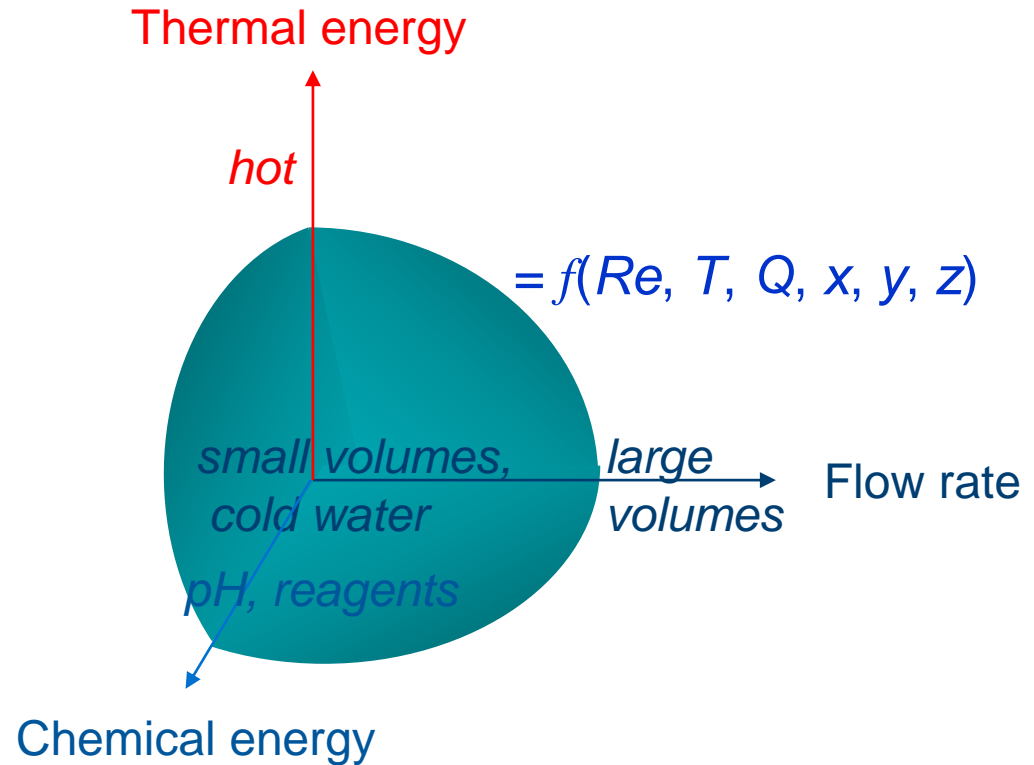
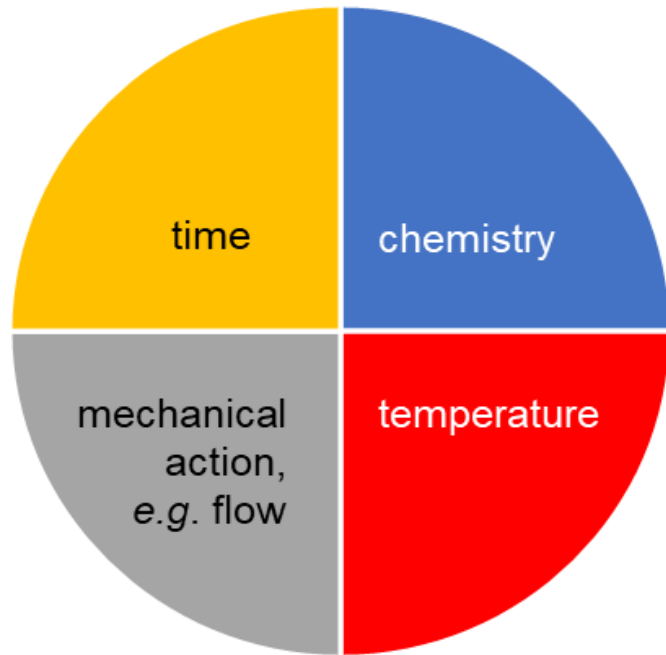
## Recent incidents



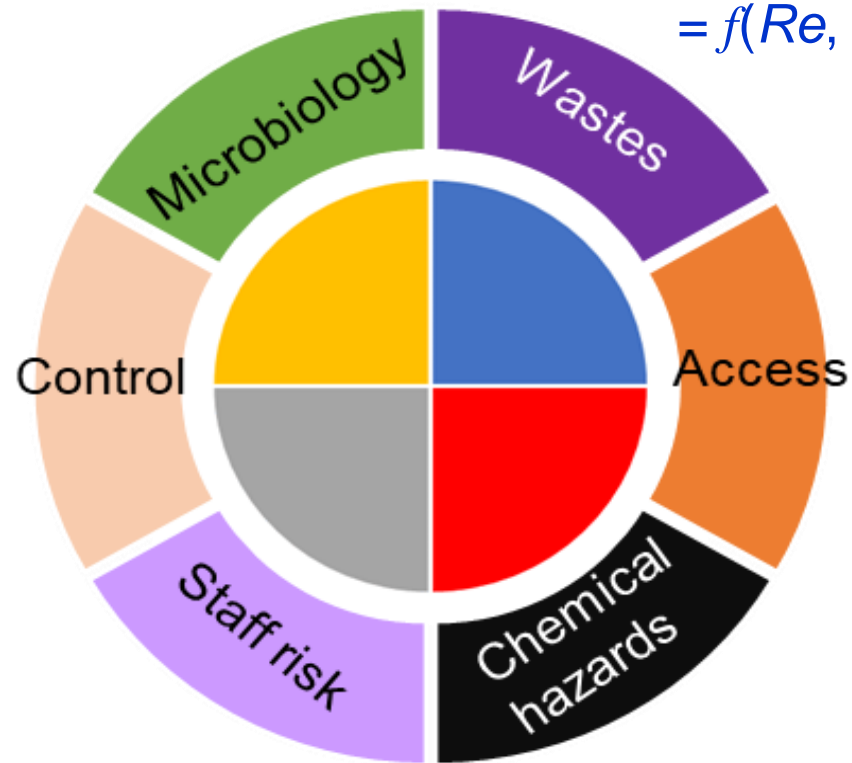
# Sinner's Circle and Sustainability



# Sinner's Circle and Sustainability



# A 21<sup>st</sup> Century Sinner's Circle



$$= f(Re, T, Q, x, y, z, A, B, C)$$





Engineering and  
Physical Sciences  
Research Council



# Roadmapping of Quantitative Modelling of Cleaning and Decontamination

20-22 April 2021



UNIVERSITY OF  
BIRMINGHAM



Manchester  
Metropolitan  
University

MANCHESTER  
1824

The University of Manchester

# Aims of the workshop

To **map** expertise and current activities in the area of cleaning and decontamination in the UK and beyond, in all relevant disciplines, and particularly those where quantitative methods are employed as this supports the transfer of solutions or approaches from one field to another.

What has been done?

To provide a forum where industrial and governmental stakeholders can **share** aspects of future needs, both immediate and long term.

What is the need?

To identify strategic needs for **research**.

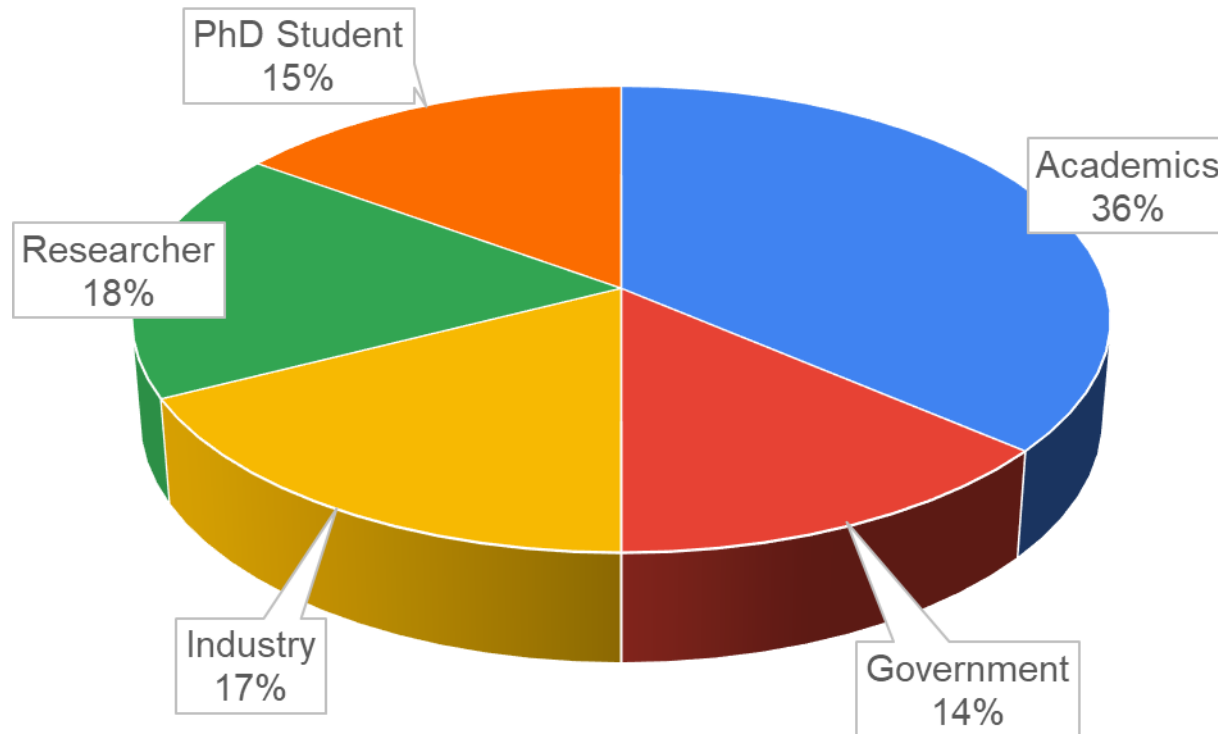
What needs to be done?

To ensure that the workshop materials will be freely available as an **archive** for all workers in the area.

How and what to communicate?

# Attendees

April 2021 80 delegates on-line



September 2021 hybrid follow up meeting

# Keynote presentations - applications



Worth Calfee *US Environmental Protection Agency*

Development of capabilities to support large-scale biological incident response operations



Conor Collins *GSK*

Cleaning of manufacturing equipment in Pharma – current approaches and challenges



Sam Collins *Public Health England*

Decontaminating people



Alex Jenkins *Sellafield Ltd*

Decontamination for the nuclear industry

# Keynote presentations – physical sciences



Julien Landel *University of Manchester*

Fluid mechanics of cleaning and decontamination



Omar Matar *Imperial College London*

Numerical simulations of multiphase flows in the presence of surfactants



Peter Fryer *University of Birmingham*

Scaling up (and scaling down) cleaning



Dennis Heldman *Ohio State University*

Current research on cleaning and sanitation in food manufacturing facilities

# Keynote presentations – life science and business angles



Luis Melo *University of Porto*

Biofilms disinfection and cleaning – an overview



Martin Seed *NHS Manchester*

Respiratory hazards in healthcare cleaning



Jim Taylour *Taylour Consulting*

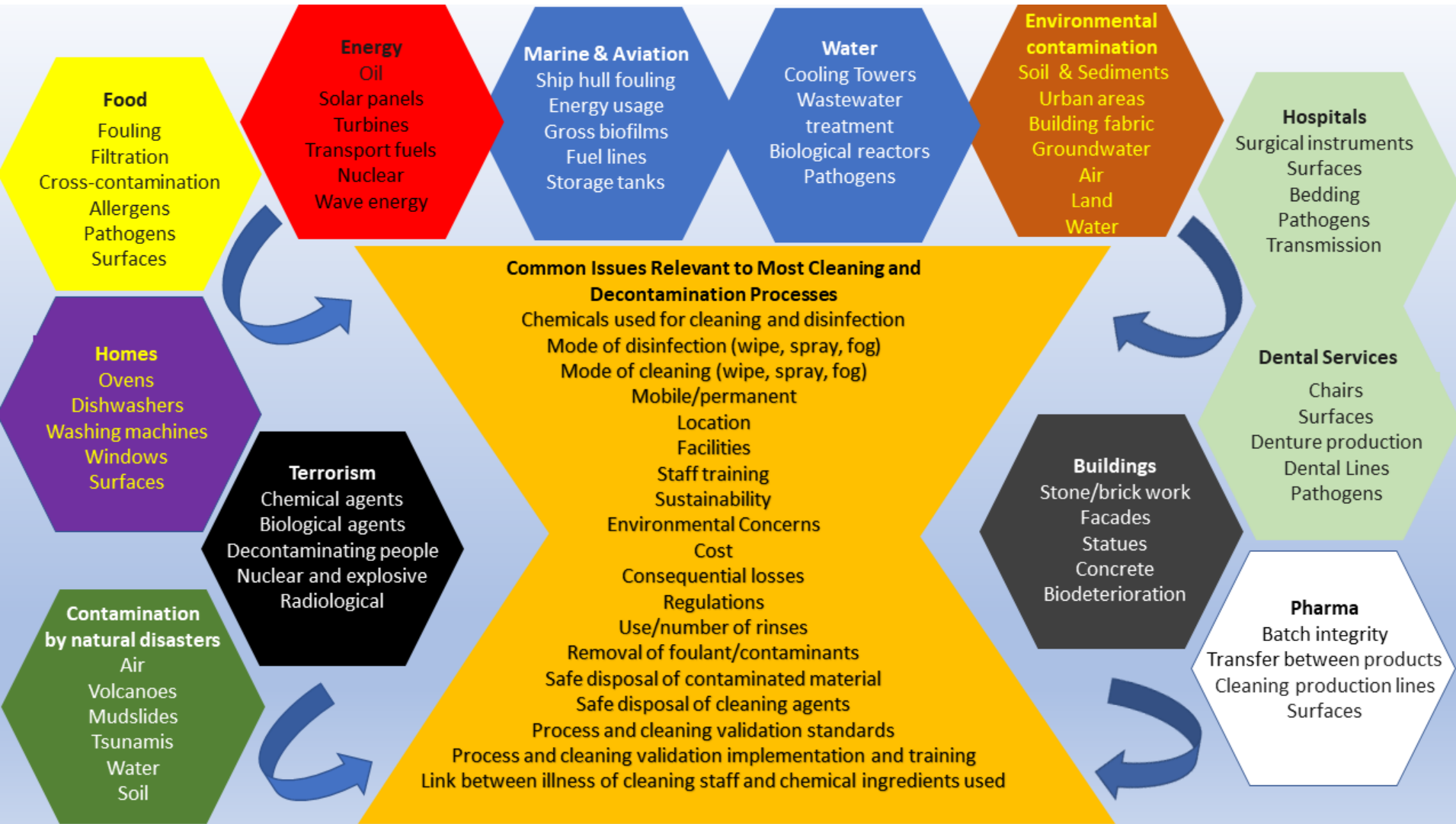
What suppliers and cleaners need. How do we get cleaning right?



Allister Theobald *Warwick Chemicals – Lubrizol Corporation*

The business angle

# Sectors and challenges



# Quantitative models - QMs

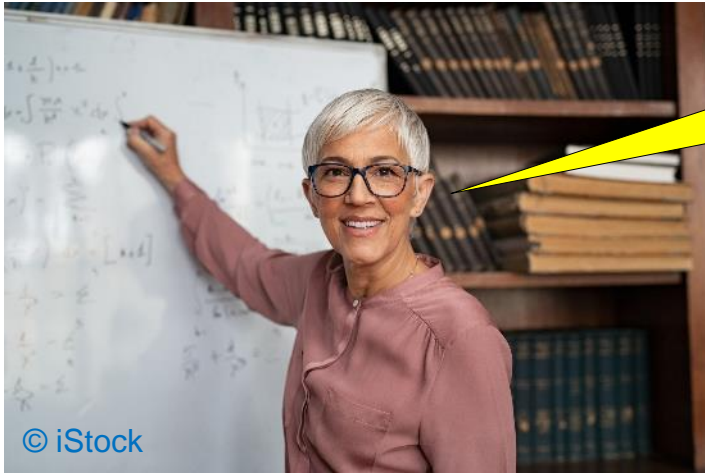
QMs are needed for

- Selection and design of cleaning operations
- Optimising and adjusting existing processes
- Transferring results between applications
- Quantifying resource consumption, waste generation and costs
- Supporting management decisions involving resources and risk
- Meeting and developing standards, regulations, legislation
- LCA and sustainability studies





# These are messy problems



$$\text{Answer} = f(Re, T, Q, x, y, z, A, B, C)$$

What do we want to know?

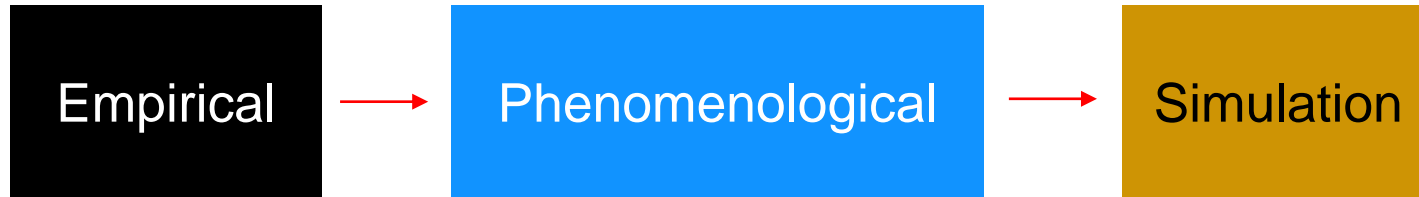
Do we know the input parameters?



Soil history  
Process timescales  
Reaction timescales  
Resource availability  
Response times

Soil length scales  
Device size(s)  
Distribution of soil  
Delivery of cleaner(s)  
Cleaning action length scales





Core science insight

The soil is rarely well understood

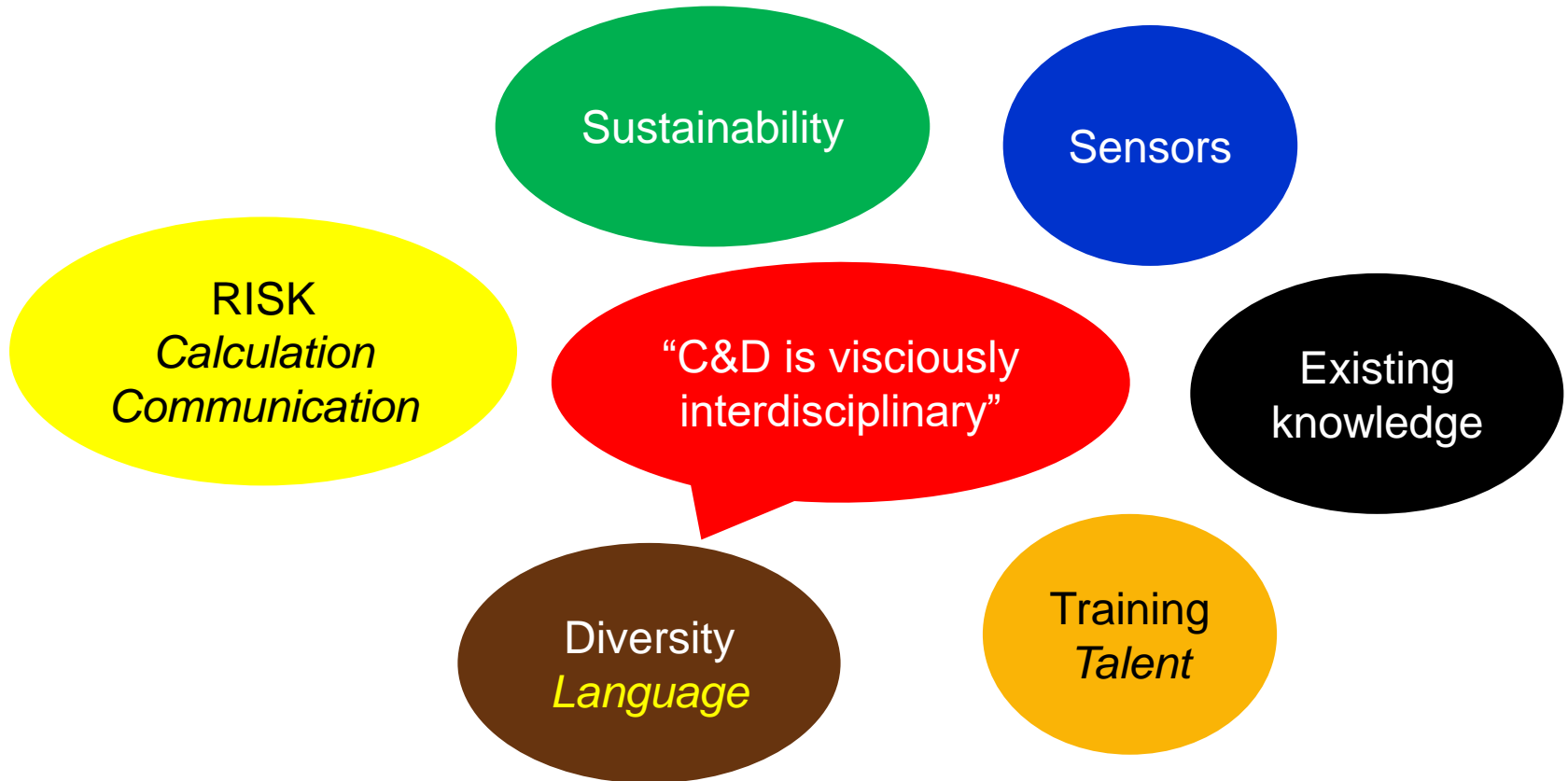
Rarely simple calculations

Robust numerical methods are needed

Defining 'clean' can be difficult: evaluation of Risk



# Needs and Challenges



# Roadmap



EPSRC Workshop Grant EP/T033991/1  
A Roadmap for Quantitative Modelling of Cleaning  
and Decontamination



- Community 
- Training
- Communication [www.modcad.org](http://www.modcad.org)
- Science base



LATEST NEWS



KNOWLEDGE BASE



CALENDAR



2021 WORKSHOP



# The important bit..



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[www.modcad.org](http://www.modcad.org)

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