The Covid-19 Complex

Water, wastewater and the pandemic

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The impact to date

- Cash flow for utilities
- Maintenance work
- Capital projects
- Resilience and planning
- Smart water and resilience
- Meeting the Sustainable Development Goals
- Covid-19 detection in the sewerage network
- An essential service

The need for resilient utilities

- England & Wales –Business as unusual
- Furloughing and affordability (poorest 20% spend 12% of HI on leisure and 1.5-2.0% on water)
- Impact on tourism and leisure (highly regionalised)
- Commercial and retail revenues – some uncertainty here
- Operating and maintaining work being maintained
- Temporary deferral of capital projects (no deferral of AMP7)
- The role of contingency planning (risk management & 25 year plans)

A mixed picture in Europe and the USA

- Utilities in Denmark, France and Germany have demonstrated resilience, with capital projects maintained or resumed
- Temporary bill payment suspensions in France and Italy
- Minor changes in domestic water consumption in Karlsruhe (smoother demand curve during day, 3-4% overall increase)
- Investor Owned Utilities in the USA are committed to maintaining services and no customer cut-offs
- Yet 40% in the USA live in areas without cut-off protection

Two AWWA surveys in the USA

- American Water Works Association (AWWA) survey in April estimates fall in revenues and higher costs (W&WW) of $2.29 bn per month
- This assumed 12% unemployment – it is currently 15%
- 90% of utilities suspending water shut offs, 67% waiving late payment fees and 50% restoring water supplies where shut off
- Second AWWA survey found 10% of utilities reporting lower cash flow
- Bluefield forecasts a $69 bn fall in capex between 2020 and 2029
- Just 67% of utilities surveyed had contingency plans in place
- All identified AWWA respondents were municipal operations

Smart water and resilience

- Remote metering and monitoring, data transmission, integration and display have a profound impact
- Smart metering removes the need for physical inspections
- Improved customer communications via social media, etc
- Remote monitoring means less staff in the field
- Smart leakage detection for smaller and faster repairs
- Network monitoring with minimal staff present
- Maximise the lead time to potential problems

SARS-Cov-2 and sewage

- ‘The sewer is the conscience of the city’ (Victor Hugo)
- The sewage treatment plant collects its community’s ills
- Most, if not all of the Covid-19 virus is degraded during digestion and excreted as RNA, fragments of genetic material (SARS-CoV-2)
- Sewage monitoring’s central role in the near elimination of Polio and as a tool to respond to any re-emergences
- Also used for Hepatitis A, Norovirus, Salmonella and AB-resistance
- Separating the RNA from the sludge is somewhat time consuming

Early detection

- SARS-CoV-2 RNA excreted within three days of being infected
- Physical manifestation of symptoms takes 10-14 days
- A high proportion of cases are asymptomatic
- Daily sampling gives a 7-10 day lead against waiting for community manifestation without need for personal testing
- Looking at the impact of early lockdown, this is significant
- Likewise, the ability to focus responses towards hotspots
- Preparedness for a second (and indeed, third) wave

Linking the data

- Making testing both local and national
- Beckton serves 3.5 million people, for example
- Migrating up the sewerage networks – the postcode possibility
- Bangor University and DCWW taking weekly samples at 21 WWTWs covering 75% of Wales's population
- National schemes are being developed in Australia, New Zealand and the Netherlands
- Two projects in the USA seek to cover 10% (Biobot, MIT & Harvard) and 70% (HHO, U of Arizona) of the population

Limits to monitoring

- Can we move towards quantitative monitoring?
- The ideal would be know how many are infected per sample
- HHO Arizona detecting one case per 114 (worst case) and 2 million (best case) people in a sampled population
- No two samples, let alone WWTWs are identical
- External factors (foul-storm sewer mix, rainfall, temperature, residence time, etc) and internal factors need to be considered
- A classic case of the those in the labs needing to work with engineers to effectively meld the in vivo with the in vitro

Emerging concerns: Sewers as a conduit?

- We are not quite sure if no viable Covid-19 viruses enter the sewerage network, this is a new area
- The sewage treatment process removes almost all of the SARS-CoV-2 RNA from the effluent
- To Bidet or not to Bidet?
- Panic buying in March saw kitchen rolls being bought out
- Anticipate higher (mis)use of wet wipes
- More fatbergs and blockages will, alas, be on their way

Covid-19 and SDG6

- Water & Sanitation SDG6 will not be met by 2030
- Lack of access to safe water inhibits hygiene
- Shutdown in India pinpointed illegal industrial discharges
- World Bank notes 10-50% fall in water revenues collected
- Utilities that depend on cross-subsidies from industrial & commercial customers are particularly vulnerable
- This ought to be a call to action; for capacity building, policy implementation, budget and tariff setting and implementation
- It may be used as an reason to defer projects

Monitoring the unmeasured

- Cranfield University using wastewater-based epidemiology (WBE) to develop a simple, paper based RNA test for use in the field
- Can be used by non specialists for less than £1 per test
- Link it to smartphone based reporting
- Michigan State University's (MSU) Viral-PD model developed in 2017 for early viral RNA detection in effluent
- MSU is seeking to adapt Viral-PD to detect SARS-CoV-2 in rivers and other watersheds where sewerage and WWTWs are absent

The new norm?

- Too many near misses in the past two decades
- Globalisation and mass global tourism create the perfect conditions for new pandemics
- Authoritarian regimes do not wish to appear weak, so early onset data suppression will continue
- Pandemic planning will be essential in the future
- Highlighting the crucial role for smart approaches
- The ‘Spanish Flu’ pandemic highlights the risk of a second (and third) wave and the need to have sewage based monitoring

Policy: Science or politics?

- Which approach to PPE ought to prevail?
- There is an irony when Luddites are fed by social media
- The politicisation of science suggests a culture in retreat – do we wish to live in a knowledge-based economy?
- A virus is not beholden to any party or point of view
- Utilities have demonstrated the importance of risk management and contingency planning – Governments could take heed
- Can we afford to improvise again if and when a second (or third) wave of infections emerge?

Covid-19 is indeed complex

- The greater scrutiny PSP utilities face means more customer focus, greater resilience and adoption of contingency planning
- Erstwhile intrusive regulators such as Ofwat have upped our game
- Populist politicians (Mexico, USA & Brazil) having their problems
- Will we ever know how many died in China or Iran?
- Water-Based Epidemiology is a powerful tool for the early and effective detection of subsequent outbreaks
- The challenge now is to develop nationwide monitoring networks calibrated for the early and pinpointed detection of new outbreaks