

# [PREPARE]\*

Assessing the implications of pharmaceutical release to the environment as a result of usage during a major disease outbreak



Centre for Ecology & Hydrology  
NATURAL ENVIRONMENT RESEARCH COUNCIL

## POLICY BRIEFING

# Will the medicines used in a flu pandemic mean that sewage treatment plants do not work properly?

At a technical meeting held at Oxford University in November 2007, it was suggested that medicines used during an influenza pandemic might cause disruption to sewage treatment plant processes.<sup>1</sup> A further meeting to assess the likelihood of this was held on 3<sup>rd</sup> March 2009. The meeting attracted experts from the pharmaceutical industry, water companies, independent research institutions, and organisations involved in forming and implementing public policy. The antibiotics that would be used to address secondary infections during an influenza pandemic were the focus for the meeting.

*An expert meeting at Oxford University addressed the topic*

## Would it matter if the medicines used to treat people during a pandemic influenza affected sewage treatment plant performance?

Sewage treatment plants are an essential part of national infrastructure:

- They prevent substances and microorganisms that are potentially harmful to human health from being discharged to the environment.
- They help to protect drinking water supplies in parts of the country where river water is used for this purpose.
- They prevent pollution of rivers that are of economic and social value.

*Sewage treatment plants are vital for protecting public health and the environment*

There are approximately 7,000 sewage treatment plants in the UK, ranging from small plants serving a few houses to facilities with the capability to serve several million people. When a sewage treatment plant fails to treat wastewater to the intended standard, effectively it is often due to disruption of the microorganisms within the plant. This is expensive and time-consuming to put right.

## Background to current understanding

A large proportion of the active ingredient in many medicines is eliminated from the body in urine or faeces. This may be in a form that is capable of harming living things, including bacteria. The active ingredient enters the sewerage system and is carried to treatment plants. A wide variety of medicines can be detected in sewage even under normal (non-pandemic) levels of usage.

Sewage treatment plants depend on microbial communities to break down potentially harmful substances. While a few antibiotics have been shown to be readily biodegradable, the majority are not.

The experience of operators of sewage plants is that their treatment systems usually continue to function despite the variety of potentially harmful substances passing through them. Nonetheless, given the effect of antibiotics on individual microorganisms and their communities, past experience is not an accurate guide to the future. There is no precedent for the high levels of antibiotics that are likely to be present in sewage treatment plants during a pandemic.

*Past experience is not a good guide to sewage treatment plant performance in a pandemic*

<sup>1</sup> Singer et al. (2008) Meeting Report: Risk Assessment of Tamiflu Use Under Pandemic Conditions. *Environmental Health Perspectives*. 116(11) November 2008. pp1563-1567.

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## How current understanding was evaluated

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Experts heard presentations that included the following information:

- Antibiotic usage during a pandemic, based on a novel epidemiologic model and current UK guidelines for pharmaceutical treatment of secondary infections (e.g. bacterial pneumonia) originating from influenza-like illnesses.
- Modelling of the concentrations of medicines that may enter the sewerage system
- The potential for degradation of medicines in, and before they reach, sewage treatment plants.
- The types of effect that medicines may have on bacteria in sewage treatment processes.
- The types of sewage treatment plants and their operation.

They had the opportunity to discuss this information and identify areas of consensus and divergence of opinion.

## Conclusions

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1. There is currently insufficient evidence to provide assurance that sewage treatment plants will function reliably in a pandemic. Moreover, there are plausible mechanisms for disruption of sewage treatment during a pandemic which cannot be ruled out. A prudent and precautionary view would suggest that further investigation and contingency planning is needed.
2. The variability in the types of sewage treatment plants, operating conditions, nature and timing of a pandemic introduce considerable uncertainty in the scale of any effect. For instance, lower winter temperatures can slow the breakdown of the constituents of sewage, including medicines.

*There are plausible mechanisms for disruption of sewage treatment plant processes by the medicines used during a pandemic*

## Recommended action

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1. *Immediate (within 1 year)*. Conduct 30-60 day trials on a pilot sewage treatment plant to establish if the levels of antibiotics anticipated during a flu epidemic can affect key processes in sewage treatment plants such as nitrification and flocculation.  
*Suggested key participants: universities and other independent research organisations, water industry, environmental regulators*
2. *Within 2 years*: undertake risk assessment of the vulnerability of freshwaters and drinking water abstraction points to reduced performance of sewage treatment plants in the event of an influenza pandemic.  
*Suggested key participants: universities and other independent research organisations, water industry, environmental regulators*
3. *Within 5 years*: undertake realistic field-scale tests of the effects of pharmaceuticals to be used during an influenza pandemic on different kinds of sewage treatment systems.  
*Suggested key participants: universities and other independent research organisations, water industry, pharmaceutical industry*

*The consensus among experts is that further investigation and contingency planning would be prudent*

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This briefing note has been prepared by the PREPARE Initiative, based on its observations from the meeting in Oxford on 3<sup>rd</sup> March. The views expressed in this briefing are not necessarily those of individual participants or their employers. The contribution of all participants in the meeting is gratefully acknowledged.

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The participants of the 3<sup>rd</sup> March meeting were: Mr. Ian Bernard, Environmental KTN; Dr. Elise Cartmell, Cranfield University; Mr. John Churchley, Severn Trent Water; Dr. Mike Dempsey, Manchester Metropolitan University; Mr. Brian Ellor, United Utilities; Prof. Bryan Ellis, Middlesex University; Dr. Murray Gardner, University of Oxford; Prof. David Graham, University of Newcastle; Dr. John Holmes, University of Oxford; Dr. Bruce Howard, University of Oxford; Dr. Andrew Johnson, Centre for Ecology and Hydrology; Dr. Oliver Jones, University of Cambridge; Dr. Franz Karcher, European Commission; Ms. Helen Keeble, South West Water; Dr. Charles Knapp, University of Strathclyde; Prof. Klaus Kümmerer, University of Freiburg (Germany); Prof. Nancy Love, University of Michigan (USA); Ms. Liz Mullis, Environmental KTN; Dr. Mike Murray, Association of the British Pharmaceutical Industry; Prof. Gerald Noone OBE, Worshipful Company of Water Conservators; Prof. John Oxford, Retroscreen Virology Ltd.; Mr. Peter Pearce, Thames Water; Dr. Francesco Pomati, Eawag (Switzerland); Dr. Richard Puleston, University of Nottingham; Mr. Tony Rachwal, Independent consultant; Dr. Andrew Riddle, AstraZeneca; Dr. Jim Ryan, GlaxoSmithKline; Dr. Mark Scrimshaw, Brunel University; Dr. Andrew Singer, Centre for Ecology and Hydrology; Dr. Jürg Oliver Straub, F. Hoffmann-La Roche; Dr. Arthur Thornton, Atkins; Dr. Stephen Toovey, F. Hoffmann-La Roche; Dr. Nikolaos Voulvoulis, Imperial College London; Dr. Paul Whitehouse, Environment Agency.