**Title of Medical Article:** "Emission of bacteria and fungi in the air from wastewater treatment plants - a review. "

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**Type of Publication:** Review article which summarises authors own views from review of 130 other articles worldwide which were published prior to 2011.

**Significance of the Article:** Relevant to the health of future residents Basingstoke and Deane Borough Council's LDF Policy No. SS3.9 – Land East of Basingstoke due to the nearness of Thames Water Sewage Treatment Plant, Chineham, Basingstoke (describe as a wastewater treatment plants – abbreviated as "WWTP" in the article).

**Author of Executive Summary**: MrTB Lytle, 19 Oct 2015 on request by Katharine Makant, BDBC, for use by Mr M Fox, Inspector of BDBC's Local Plan

## Summary and Findings of Medical Article

### Definition:

**Bioaerosol:** a term commonly used to describe dead (non-viable) or living (viable) airborne biological particles (microorganisms), such as fungal spores, bacteria (pathogen and non-pathogen), pollen, and viruses and their fragments and by-products, like bacterial endotoxins, mycotoxins, peptidoglycans, (1-3)-beta-D glucans, which may affect living organisms (e.g. humans) infectiously , allergically, toxigenically or pharmacologically. These microorganisms can be transmitted to the ambient air in wastewater droplets, which are generated during aeration or mechanical moving of the sewage (air stripping). Bioaersols can contain such biological particles that can be viable (living) even after being transported several thousand kilometres and have shown to be capable of causing an infection (e.g. the epidemic of meningitis, which spread from the African belt to Scandinavian countries).

### Summary:

The spread of pathogenic microorganisms, endotoxins, odours (e.g. molecules of human faeces and urine) and dust particles in the air is an inevitable consequence of waste production and waste management. Pathogens, mainly found in human excreta (faeces and urine), and secretions of patients are transferred in general by sewage and municipal waste from households and hospitals, create unspecified health hazard in the surroundings of WWTPs. The generation, treatment, and disposal of the human and animal waste contribute to the increase in the production of bioaerosols Thus, the risk of infections associated with wastewater treatment plants (WWTPs) **(such as the Thames Water Sewage Treatment Plant, Chineham)** has become of a particular importance in recent decades.

Sewage and unstable sludge contain various pathogens such as viruses, bacteria, and human and animal parasites. These microorganisms can be transmitted to the ambient air in wastewater droplets, which are generated during aeration or mechanical moving of the sewage. Bioaerosols generated during wastewater treatment may therefore pose a potential health hazard to workers of these plants **or to habitants of their surroundings.** The degree of human exposure to airborne bacteria, fungi, endotoxin and other allergens may vary significantly depending upon the type and the capacity of a plant, kind of the facilities, performed activities and meteorological conditions. Humidity of the atmosphere exceeding 50% as is common in England can protect pathogenic bacteria from dying once they become bioaerosol and allow their spread as infective organisms.

Due to overwhelming urbanization trend in some crowded areas of the world, quite often WWTP and related sewage works, **originally located away from urbanized areas, become surrounded by new residential and/or shopping districts.** In such situation the question of hygienic sustainability of WWTPs site location arises not only in terms of frequent noxious odours (e.g. molecules of human faeces and urine), but also in terms of intermittent enteric illness and related syndrome of unknown origin among nearby residents. In many studies concerning sewage workers health, a particular type of disease is mentioned, probably of viral origin, which infects workers at WWTPs, and is referred to as ―Sewage worker's Syndrome. Its symptoms are general discomfort, weakness, acute rhinitis and fever. Some studies show a significant connection between cases of respiratory and intestinal diseases of workers of WWTP and habitants of the nearby areas and viral species (characteristic to sewage) in bioaerosols.

This review is intended to summarize the information on bioaerosols and highlight the significance of bioaerosols emitted during municipal waste treatment for public health and condition of the environment. Comparing the degree of contamination with bioaerosols generated by WWTPs which use different types of sewage treatment systems, seems to be particularly important. The determination of the spreading range of bioareosols allows

defining the size of the potential health hazard zone to workers of WWTPs and inhabitants of the surrounding areas.

**Tables 1 and 2** at the end of the article indicates the types of the microorganism within bioaerosols and how far they can spread when released from wastewater treatment plants. These were obtained **by actual air samples taken in and around such treatment plants and not by use of a mathematical model used in the WSP Odour Assessment of the Thames Water Treatment Plant for the Land East of Basingstoke SS3.9 for BDBC.**

The entire article is attached as a PDF file in full for further reading as deemed necessary.