**CIVE 5370M Indoor and Urban Air Quality Airborne Infection Risk Modelling**

**Infection modelling spreadsheets**

The folder labelled “airborne risk models” contains three excel spreadsheet models that can be used to explore the influence of various parameters on the spread of airborne infection.

*WR‐model.xlsm* Contains just the deterministic WellsRiley model that can be used to look at the influence of environmental and occupant parameters on new cases

*SIR‐deterministic.xlsm* Contains an SIR epidemic model with the WellsRiley model used to determine the contact rate. This can be used to look at the effect of disease and environment parameters on outbreak risk

*SEIR‐deterministic.xlsm* As the SIR model, but this time with an incubation period included

**Learning Objectives**

**After this session you will be able to**

**Quantify the effect of ventilation rate increase on the reduction of secondary infection numbers in indoor environments**

**Quantify the effect of incubation period on infection risk number**

**Task**

Use the spreadsheets to explore the following scenarios:

1. TB is an airborne infection and often has a very long incubation period, so is commonly modelled just using Wells‐Riley. Adults have a breathing rate around 10 l/min and quanta generation rates for TB have been found to range between 1 and 250 quanta/hour depending on the strain of the disease and type of infector. Ventilation rates in indoor environments typically range from 1 AC/h to 6 AC/h. Consider the case of a group of 100 students in a 1000m3 lecture room over an 8 hour period.
   1. How many new cases may you expect to see?
   2. Plot four graphs:
      1. 1) quanta=10, AC/h=1,
      2. 2) quanta=250, AC/h=1,
      3. 3) quanta=10, AC/h=6,
      4. 4) quanta=250, AC/h=6,
2. Influenza, SARs and measles have all been linked to airborne transmission in indoor spaces and some typical quanta generation rates are given in the table below. These diseases all have short incubation periods (1‐3 days) and infectious periods (2‐6 days). For a population of 100 people in a 5000 m3 hospital ward, compare the likely spread of the three diseases if one infector is present in the space.
   1. Calculate the R0 number and say if it is an increasing or decreasing epidemic?
   2. How much influence is the ventilation rate likely to have?
   3. What would happen if the people are immediately infectious?
   4. What would happen if prompt isolation reduced the removal rate by half?

|  |  |
| --- | --- |
| **Disease** | **Quanta/hr** |
| Influenza | 80-130 |
| SARS | 25-45 |
| Measles | 400-600 |