# Oxygen Supply at Worcestershire Acute Hospitals.

The 2 acute sites within WAHT have VIEs for oxygen storage.  The safe supply of oxygen is determined by the size of the evaporators and the diameter of the piping to and within the building.

At Worcester Royal Hospital, the maximum flow which can be delivered by the VIE is 3000 l/min.  With the connection of the VIE to the Aconbury development this is the maximum that can be safely delivered throughout the site.  Within the buildings there are flow restrictors to some wards, so maximal flow per ward area may be in the order of 500 l/min.  At present the monitored flow shows that the Worcester Royal Hospital site is running well within the maximal flow rate from the VIE at under 800 l/min.  At present there is no indication of a need to monitor oxygen delivery on the Worcester Royal Hospital site.

At the Alexandra Hospital site, the infrastructure is older and the maximum oxygen delivery with the current evaporator is 3000 l/min.  The absolute figure will vary with the environmental conditions but exceeding this has the risk of pulling liquid oxygen into the system resulting in a loss of oxygen supply to the building.  In addition, the arrangement of internal pipe work, which may be imagined as a spurs coming off a central spine,  limits flow to each spur at 300l/min  Exceeding flows at a ward level but not the total flow from the VIE will not be a safety issue for the hospital site but may result in low pressure alarms on the individual wards, and lower delivery to oxygen outlet points.

Current activity with COVID-19 requires the delivery of high flow inspired oxygen as the major therapeutic intervention.  With a facemask this can be up to 15l/min.  When continuous positive airway pressure (CPAP) systems are used then the maximal flow rate may reach a peak of 30 l/min though the average flow is likely to be significantly lower.  High Flow Nasal Oxygen has no particular role in the treatment of Covid-19, but is another technology that consumes oxygen at rates of up to 30 l/min. There are a number of oxygen concentrators available which can deliver 5 l/min or if used in parallel 10 l/min which should be used where possible.  This will aid in the reduction of oxygen consumption on the site.  It is essential to monitor oxygen usage on the Alexandra site to ensure the maximal oxygen flow remains with in safe margins.

The site team will audit and document oxygen usage per bed space on each ward twice daily at 6:00am and 6:00pm.  This will be collated by the site team at the Alexandra site on recorded and emailed out on the SNAP report template twice per day

The oxygen use audit will be circulated to the operational teams outlined in Appendix 1.  The maximal flow should be maintained below 250l/min per Ward to create a safe margin.  When the maximal flow rate is calculated the following action plan should be instituted:

| Maximal Oxygen flow per ward | Actions |
| --- | --- |
| 0-170l/min | Site open normally |
| 171-200 l/min | Any new use of CPAP must be flagged to the site team to adjust risk model.<br><br>Institute oxygen conservation measures:<br>• Consider if patients still require CPAP or if the FiO2 can be safely reduced<br>• Ensure patients using facemask oxygen with flows of less than 10 l/min are on oxygen concentrators |
| 201-230l/min | Identify any new arrivals who are high risk for needing CPAP and transfer to WRH.<br>• Senior Clinican to be made aware and make forward plan with ward staff |
| 230-250+ l/min | Identify cases at high risk of escalation to CPAP on Alex site for transfer to WRH<br>• Senior Clinician to be made aware and make a forward plan which is logged with ward staff and the incident room |

Ward usage l/min =

Number of Trilogy CPAP machines in use x 30 l/min (Domiciliary CPAP machine x 15)

+

Number of nasal high flow machines in use x 50 l/min

+

Number of patients on oxygen with facemask x 6 l/min

The escalation process below to be followed for each level of escalation, and should be included in the weekend briefing for all weekend oncall teams.

| Green – Normal Business |
|---|

| Yellow – Stage 1 Alert |
|---|

Bed Manager Collates the O2 consumption reading as **171-200 ltr/min**.

Team to be alerted

Onsite Matron / Emergency Department Consultant / Respiratory Consultant / General Medical Consultant oncall (if out of hours) are alerted.

- Consider if patients still require CPAP or if the FiO2 can be safely reduced
- Ensure patients using facemask oxygen with flows of less than 10 l/min are on oxygen concentrators

WRH Incident Control Room to be informed / actioned to be logged

Update on actions to be circulated to Appendix 1 circulation list

Bed Manager Collates the O2 consumption reading as **201-230 ltr/min**.

Team to be alerted

Onsite Matron / Emergency Department Consultant / Respiratory Consultant / Alex ITU consultant / General Medical Consultant oncall (if out of hours) are alerted.

- Consider if patients still require CPAP or if the FiO2 can be safely reduced
- Ensure patients using facemask oxygen with flows of less than 10 l/min are on oxygen concentrators
- Identify any new arrivals who are high risk for CPAP and transfer to WRH

Site Lead (in hours) / Oncall Manager and Executive Director Oncall (out of hours)

Liaise with WRH ED Consultant and WMAS as necessary regarding resource for patient transfers.

WRH Incident Control Room to be informed / actioned to be logged / Datix to be raised

Update on actions to be circulated to Appendix 1 circulation list

Author: M Hallissey. 16/4/20 amended by Robin Snead 26.10.2020 v2.
Approved by Silver Control

**Red – Stage 3 Alert**

Bed Manager Collates the O2 consumption reading as **230-250 ltr/min**.

Team to be alerted

Onsite Matron / Emergency Department Consultant / Respiratory Consultant / Alex ITU Consultant / General Medical Consultant oncall (if out of hours) are alerted.

- Consider if patients still require CPAP or if the FiO2 can be safely reduced
- Ensure patients using facemask oxygen with flows of less than 10 l/min are on oxygen concentrators
- Identify any new arrivals who are high risk for CPAP and transfer to WRH
- Identify cases at high risk of escalation to CPAP on Alex site for transfer to WRH

Site Lead (in hours) / Oncall Manager and Executive Director Oncall (out of hours)

Liaise with WRH ED Consultant and WMAS as necessary regarding resource for patient transfers.

WRH Incident Control Room to be informed / actioned to be logged / Datix to be raised

Update on actions to be circulated to Appendix 1 circulation list

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In the event of patients being selected for transfer between sites through this process the following transfer criteria should be followed to ensure clinical safety in maintained.

COVID patients who are suitable for full escalation to ITU for intubation (as documented on a RESPECT form by a senior decision maker), who are at high risk of requiring CPAP should be transferred before they become unstable. Patients with an fi02 of 30- 40% and a respiratory rate of less than 25 may be transferred to ARU after full verbal hand-over to the respiratory consultant (or medical registrar, out of hours) if the reviewing clinician at AGH agreed that they are stable for transfer without a medical escort.

If transfer of unstable patients with a higher fi02 and respiratory rate is deemed absolutely essential, this must be with a medical or anaesthetic escort and with cross-county ITU team involvement before transfer'.

Out of hours transfers represent a significant risk to patients safety such that transfer decisions should be made as early in the day as possible.

**Appendix 1**

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