



## **A Study On Oxygen Facility VIZ A VIZ Its Utilization And Costing At A Tertiary Care Hospital From North India**

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**Citation of this Article:** Dr. Ennas Chowdhary, Mr. Yasin Choudhary, “A Study On Oxygen Facility VIZ A VIZ Its Utilization And Costing At A Tertiary Care Hospital From North India”, IJMSAR – March – 2021, Vol. – 4, Issue - 3, P. No.11-15.

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**Type of Publication:** Original Research Article

**Conflicts of Interest:** Nil

### **Abstract**

Introduction: The centralized medical gas system provides an efficient, economical and dependable medical life support network that supplies medical gases, vacuum and compressed air to operating and special procedure rooms.<sup>(1)</sup>

### **Aim**

To study the oxygen facility, its utilization and costing.

### **Material & Methods**

Direct observation of facility, interview of staff for utilization and perusal of records to calculate cost incurred.

### **Results**

It showed that total oxygen generated is 3.93 lakh per hour. Maximum expenditure on oxygen cylinders was in the month of December followed by November.

### **Keywords**

Medical gases, Oxygen, Costing, Medical gas pipeline system

### **Introduction**

Gases administered to patients are called medical gases. A centralized medical gas system is increasingly becoming an essential requirement in hospitals. The centralized medical gas system provides an efficient, economical and dependable medical life support network that supplies medical gases, vacuum and compressed air to operating and special procedure rooms.<sup>(1)</sup>

Medical gases are supplied in compressed gas cylinders and piped to wards and critical areas through complex systems collectively known as the Medical Gas Pipeline Services (MGPS)<sup>(2)</sup>.

The use of medical gases is essential for adequate medical interventions in hospitals and health

centres provided their advantageous anaesthetic, analgesic and respiratory properties in the ambit of disease diagnosis, treatment, prevention or relief. Accordingly, they are currently classified as special medicines<sup>(3)</sup>.

Oxygen is the best known of all medical gases. Oxygen was discovered by Scheele and Priestley—the agent ubiquitous in modern medicine<sup>(4)</sup>. Antoine Lavoisier, named the gas oxygen, meaning acid former, in 1778<sup>(4)</sup>. The first recorded medical use of oxygen was on March 6th, 1885 in York, PA by Dr. George Holtzapple, who used oxygen for the treatment of pneumonia<sup>(5)</sup>. However, access to oxygen therapy is limited in many low- resource settings where the majority of hypoxemic patients who are admitted will not receive oxygen resulting in an increased risk of death.<sup>(6)</sup>

Medical oxygen is mainly used for the treatment and prevention of respiratory failure. In fact, oxygen therapy is regarded as the most demanded therapeutic intervention in hospitals<sup>(7)</sup>.

In view of the increasing demand for oxygen in hospitals, centralized distribution has become necessary. The non-interruption of oxygen supply is said to be more vital than any other service in the hospital<sup>(8)</sup>.

### **Aim**

The aim of the present study was to study the oxygen facility, its utilization and costing.

Material & Methods:

**Study setting:** The study was carried out in 1015 bedded tertiary care hospital from North India which provides wide range of healthcare services to a large population . It has a well established medical gas supply system that supplies medical gases, vacuum & compressed air to various patient care areas especially critical areas like

ICU & operating rooms. It also has back up supply of oxygen cylinders.

**Study Design:** Observational descriptive study

**Study Period:** 7 months (September, 20 to March, 21)

### **Method**

- a. Direct observation of medical gas pipeline system (MGPS) & oxygen concentrator plant for its design & overall working.
- b. Interview of staff was conducted to obtain information regarding its utilization.
- c. Perusal of records for calculating costs incurred.

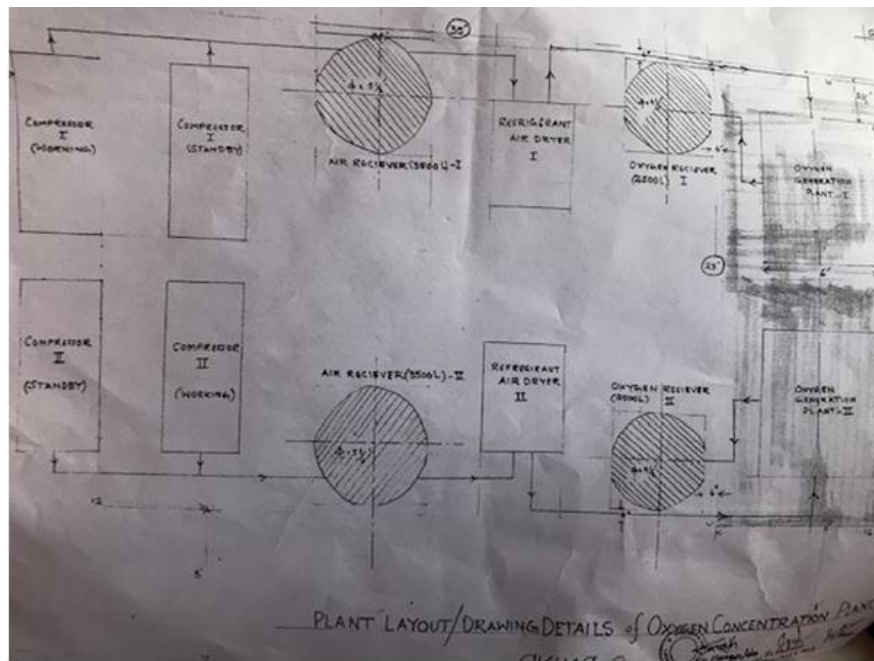
### **Results**

Oxygen facility is located on ground floor. It has three oxygen concentrator plants two of them have the capacity of supplying 1250 liter per minute (lpm) and one with the capacity to deliver 750 liter per minute (lpm) . It also has 974 bulk cylinders each having capacity of 6800 liters, 129 B type cylinders having 1500 liters capacity. Oxygen is supplied to patient care areas by medical gas pipeline system.

### **Components of oxygen concentrator plant**

1. Compressed air system: It comprises of screw air compressor air cooled with microprocessor based control panel , coupled with motor assembly . The compressor delivers air at minimum 7 kg/cm<sup>2</sup> . It is fitted in sound proof enclosure having required rating motor assembly along with set of hoses and connectors suitable for 415V , 50 HZ, 3 phase electric supply with upto 50deg.c ambient temperature and class 'F' insulation . It is supplied with oil vapour absorber and activated carbon tower for arresting the oil content and odour from the air up to the permissible limit.
2. Filtration systems: The filtered air quality to the oxygen generator should conform to ISO 8573 class

- 4 & should be standard medical grade air of filtration grade of 0.01 micron.
- 3. Air receiver: It has capacity of 3500ltrs along with auto drain valve ,inter connecting piping , NRV ,Control switch, pressure gauge ,hoses, connectors, digital flow meter etc.
- 4. Refrigerant Air dryers: Its inlet pressure is equal to outlet pressure from air compressor , inlet air temp. Less than 40 deg. C , ambient temperature +0deg.c to +40deg. C.
- 5. Oxygen receiver: It has the capacity of 2500 ltrs.
- 6. Main electrical panel
- 7. Automatic change over panel
- 8. Manual oxygen control panel
- 9. 2KVA Online UPS
- 10. Servo controlled automatic voltage stabilizer



Lay out /details of the oxygen concentrator plant

Oxygen generation when computed comes out to be 3.93 lakh per hour while as it is 94.32 lakh per 24 hours. 1.95lakh per hour was generated from oxygen concentrator plant and 1.98 lakh per hour from cylinders.

**Table 1:** Expenditure on oxygen cylinders (bulk and B type)

	September 2020	October 2020	November 2020	December 2020	January 2021	February 2021	March 2021
No. Of D type cylinders utilized	10507	13222	15742	18506	14904	10268	6750
Cost of D type cylinder(Rs. 242 per cylinder)	25,42,694	31,99,724	38,09,564	44,78,452	36,06,768	24,84,856	16,33,500
No. Of B type cylinders utilized	1134	962	889	813	643	503	511
Cost of B type cylinder(Rs 59 per cylinder)	66,906	56,758	52,451	47,967	37,937	29,677	30,149
Total cost of both cylinders(in rupees)	26,09,600	32,56,482	38,62,015	45,26,419	36,44,705	25,14,533	16,63,649

It is clearly inferred from Table 1 that expenditure on oxygen cylinders both bulk and B type was studied and maximum expenditure on oxygen cylinders was in the month of December followed by November and January.

Cost incurred in installing one oxygen concentrator plant is Rs. 58,47,500 where as for installing three such plants cost incurred is Rs. 1,75,42,500.

### **Discussion**

Safe medical gas installations are absolutely critical, since any failure might result in a high clinic risk episode for patients<sup>(9)</sup>. The installation of medical gas facilities in health assistance buildings require a variety of storing and distribution equipment: Portable gas cylinders, single cylinders batteries, cryogenic tanks and specific devices for self-production of medical air<sup>(10)</sup>. Technical staff should be appropriately trained in the handling of flowmeters and of the specific equipment involved in medical gas installations<sup>(11)</sup>.

Total expenditure on oxygen cylinder was studied for 7 months in which showed maximum expenditure in the month of December followed by November. In contrary study carried out by Reddy P et al showed maximum expenditure on oxygen in the month of September followed by July and October.<sup>(12)</sup>

### **Conclusion**

The study in conclusion established that maximum expenditure on oxygen cylinders was observed in the month of December followed by November. Liquid oxygen plants which supplies a centrally piped system throughout the health facility by self- vaporization should be introduced in the hospital which would further help in delivering better patient care.

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