

## QUALITY MANAGEMENT OF WATER SUPPLIES UNDER 24x7 SCHEMES, AT SECTOR NO. 21, PCMC, PUNE

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### ABSTRACT

Drinking water is not only a basic need of life but its supply is also important for achieving the goal of health for all. The primary aim of Pimpri Chinchwad Municipal Corporation (PCMC), Pune is to provide water to the consumer for 24x7 hours by framing the legislation on regulation of drinking water through a scheme which is named as 24x7 water supply scheme.

In continuous water supply, PCMC takes the efforts to provide quality and its continuous supply to the consumer. Hence before provision of continuous water supply, we have considered 'leakages' in the distributaries as it is the most responsible factor for water contamination. For detecting leakages and to provide safe qualities of water, a sample of water from consumer water tap was analyzed for chlorine and turbidity test.

Helium gas was used to detect leakages in the water mains. It is seen that, this technique is safe, easy to operate and have accurate results to find leakages in water mains.

**Keywords** – water leak detection, pipe lines, Helium gas leak detector, water quality management, successful implementation.

### I. INTRODUCTION

Generally, in India Intermittent Water Supply System is used to supply drinking water to people by the Local bodies. In this system water is supplied to users for less than 24 hour in a day for specified hours i.e. in the morning or evening or as per available time. Water is supplied to the consumers usually at the peak hours of the water usage i.e. morning 6 am to 9 am and evening 5 pm to 8 pm. In this system, consumers have to store the water in between supply hours. The needs of the study are as follows:

1. 24 x 7 system reduces contamination level as the pipes are under positive pressure and entry of contaminants into the pipes is restricted.
2. Due to steady pressure in the pipe increase the life of pipe distribution network. No fatigue for pipes.
3. A better demand management is possible due to elaborate metering and effective leakage control. It is also easy & just to calculate water charges based on consumed volume.

4. Reduction in consumption due to change in habit from storing of water to non storing, also it generate excellent customer satisfaction
5. People can manage their time effectively, they can allot more time for rewarding activities.
6. Due to fully metered system easy to carry out water.

### II. METHODOLOGY

#### Helium Mass Spectrometer (MS) Leak Detection Method

This method was first used in Manhattan, New York by the Uranium Enrichment Plant for 'Manhattan Project'. This method is used for the first time in India and for the second time in the world. In India it is been used for the project, '24x7 Water Supply System' in sector 21, PCMC. Helium gas is used for leak detection because it is Non-toxic, Inert and non-condensable, not present in the atmosphere at more than trace amounts, relatively inexpensive, readily passes through leaks due to its small atomic size, Non-flammable, Available in various size cylinders, and Available in purities appropriate for medical usage. This gas belongs to zero group (Noble gases) in periodic table having atomic mass 4.002202

#### 2.1 Procedure for Helium Gas Leak Detection

Leakage on the pipe line was finding out by carrying three steps.

- 1) Helium Injection
- 2) Pipe & Cable Detection
- 3) Leakage Detection

The details of the above steps are given below

1. Helium Injection
  - Initially, a cylinder of Helium gas is fixed to the outlet of the ESR
  - The injecting pressure of the Helium gas was maintained such that 30% of the Helium gas in the cylinder has to be injected in 30 minutes. For this criterion, the pressure was to be maintained at 9.5 kg/cm<sup>2</sup>. (Fig.2.1)
  - The pressure was checked at an interval of 15 mins.
  - A Pressure-meter to measure the pressure of the water in the pipe was attached to the pipe.



Figure 2.1 Pressure meter with helium gas cylinder

## 2. Pipe & Cable Detection

- With the help of Pipe & Cable Detector, the underground pipes and cables are detected. Fig.2.2(a)
- The Locator is having the receiver and transmitter; receiver is divided in two parts – Antenna & Receiver. Fig.2.2(b)
- The Receiver receives reflected waves from the cables and indicates the location and the depth of cables. After detecting the cable, a hole is drilled at every 2 m. to 3 m. apart from the point where the cable is detected so as to avoid drilling in the cable. The depth of the hole is 40 cm. Fig.2.2(c)



(a)

(b)



(c)

(d)

Figure 2.2 Leak detection

## 3. Leakage Detection

- Above the drilled holes, a vacuum pipe is placed that is connected to the Spectrometer Fig.2.2 (d). There is a filter in between the vacuum pipe and spectrometer which filters the moisture and soil particles coming from the vacuum pipe, if any. Only air is carried away further.

- Next to the filter there are two jars containing silica gel (Blue color). A sniffing probe is connected to one of the jars.
- The silica gel filters the moisture if any after filtering and hence protects the spectrometer.
- The filtered air finally enters in the spectrometer. The spectrometer then shows the amount of the Helium gas. The saturated concentration of helium is  $3.5 \times 10^{-6}$  Kg/cm<sup>2</sup> in the atmosphere but if the spectrometer reading is exceeding  $7 \times 10^{-6}$  kg/cm<sup>2</sup> then there is a possibility of leakage. At such case, few more holes are drilled along the radius of the detected hole, if the reading is increasing or up to  $7 \times 10^{-6}$  Kg/cm<sup>2</sup> then surely there is a leakage. Fig.2.2(e)



(e)

Figure 2.2 Pictures during leak detection

## 2.2 Leakage Repair Work

After detecting leakages on pipeline in sector 21, following types of connection repair is done

1. Ferrule Connection: ferrule is used when at end of pipe leak is found. Following Fig. 2.3 shows the ferrule connection.



Figure 2.3 ferrule connection

1. Sluice Valve:

A Sluice Valve is often used on larger diameter mains (2" or greater) mainly for industrial and commercial feeds. This works covers or maintenance and renewals of any type of Sluice Valve including, chamber frame and cover rebuilds, repacking glands, is spindles, repairs to bolts and flange plates and full replacement of valves with main work. Figure 2.4 shows the sluice valve repair



Figure 2.4 sluice valve repair

## 2. Mains Repair

This covers all repairs and maintenance of all water mains and supply pipes greater than 1” in diameter. There are many different types of materials that have been used in the installation of water mains from Asbestos Cement, PVC, Medium Density Polyethylene (MDPE), copper, galvanized iron to the more common ductile and cast-iron. With this there are many fittings to adopt and maintain these different materials for use in repairs to water mains, new connections for supplies to properties and general preservations, refer the Fig. 2.5 below.



Figure 2.5 mains repaired connection at sector 21

## III. RESULTS AND DISCUSSION

While detecting leakages on pipeline, we studied 31 leak spots out of 31 leaks, 5 do not have any leakage and 26 were having leakages which were repaired. The position of various leak points is shown in the figure 3.1 which are marked by star ( \* ). The number followed by star ( \* ) indicates Helium concentration obtained and the numbers mentioned in the bracket with red colour indicates the serial number of leak.

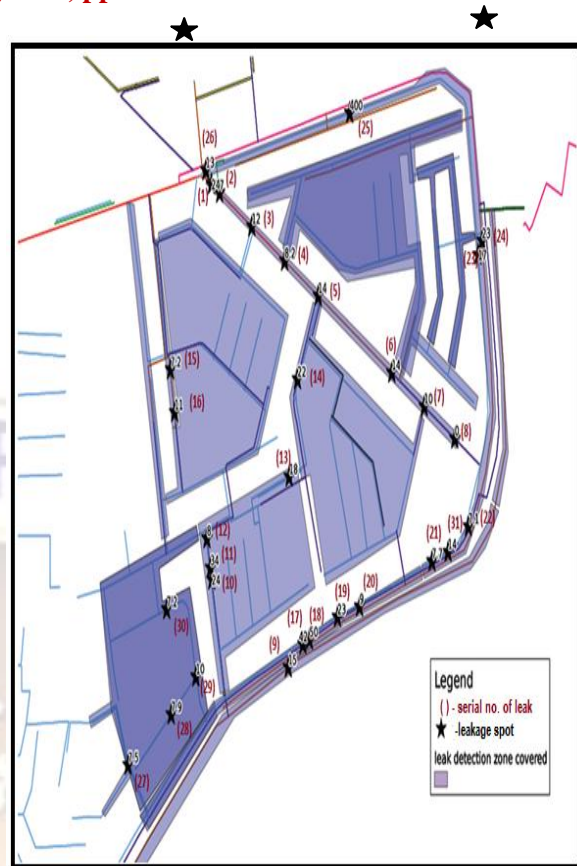


Figure 3.1 Details of pipe with leak spot and Helium concentration

## IV. FIGURES AND TABLES

### 4.1 Leakage Detection Information:

Having detected all leakages, their repairing was done on the site with immediate action so that the accidents could not be taken place by the excavated trenches and also to avoid the water loss at the leak point. The detail information about leak point and its repairing is mentioned in the table 4.1. Table 4.1 Information about the leakage area and type of leakages:

Leak Number	Helium	Perfor-man- ce date	Leak location	Di- a- m- eter of pi- pe	Ty- pe of cr- ack	Meth- od of repair- ing
1	24	14-1-2012	Near Chicken Chowk, Opposite of Kaveri Housing Soc, Scheme No 12, Building	250	Hou- se Con- n- e- c- t- i- o-	Small pipe piece & ferrule replaced

			No 14.		n & F e r r u l e C r a c k	
<b>2</b>	7	14-1-2012	Near Chicken Chowk, Opposite of Sharayu Housing Soc., Scheme No 12, Building No 12	250	No Leak	-
<b>3</b>	12	14-1-2012	Opposite of Yamuna Nagar Shopping Complex (Ratna Hospital)	250	T-joint Crack	Lead wool used
<b>4</b>	8.2	14-1-2012	Near Hanuman Sweets, Opposite of Kunj Vihar(1)	200	Ferrule Crack	Ferrule replaced
<b>5</b>	14	14-1-2012	Opposite Of Swatantrya Veer V.D. Sawarkar Chowk, Near Nandan Bungalow Plot No.89	200	T-joint Crack	Lead wool used
<b>6</b>	14	14-1-2012	Opposite of Shiv Sankalp Bungalow , Plot No 466, Yamuna	150	No leak	-
						Nagar
<b>7</b>	10	14-1-2012	Near Mohak Bungalow , Plot No 370, Sector No 21.	150	Ferrule Crack	Ferrule replaced
<b>8</b>	10	14-1-2012	Bajaj road, opposite of venkatesh bungalow nigadi.	150	House Connection & Ferrule Crack	House connection and ferrule replaced
<b>9</b>	15	17-1-2012	Bajaj road, opposite of Venkatesh bungalow Nigadi.	200	Main line Crack	Replaced pipe piece
<b>10</b>	24	18-1-2012	Near Rajnigandha building, sch no 10, Peth no 21, Yamuna nagar.	150	Ferrule Crack	ferrule replaced
<b>11</b>	34	18-1-2012	Near Rajnigandha building, sch no 10, Peth no 21, Yamuna nagar.	150	Ferrule Crack	ferrule replaced
<b>12</b>	8	18-1-2012	Opposite of Jay Tulja Bhavani Mitra Mandal, Kranti Chowk,	150	Ferrule Crack	ferrule replaced

			Sec No 21.			
13	18	18-1-2012	opposite of scheme no 6, building no 32-36(near Neeta Beauty Parlour)	100	House connection crack	Replaced pipe piece
14	22	19-1-2012	Opposite of Sch No 6, Building No 25-27, Trimurti Society	150	House connection crack	PVC house connection replaced
15	7.2	21-2-2012	Near swapnali housing soc. (opp of Gracious building no 23), sch no 11, building no 31.	200	Ferrule crack	Ferrule replaced
16	11	21-2-2012	Near Mauli housing soc, sch no 11, building no 29(opp of Mata Vaishnavi Pratishthan ground)	200	crack on 200 mm line	used clamp on crack piece
17	42	23-2-2012	Near Shree Radhakrishna bungalow, Bajaj Road, house no 39, Leak between 17 & 18	150	House & ferrule Crack	House connection and ferrule replaced
18	50	23-2-2012	Near Shree Radhakrishna Bungalow, Bajaj Road, House No 40	150	House & ferrule Crack	House connection and ferrule replaced
19	23	23-2-2012	Near Shantavi Bungalow, Bajaj Road.	150	House connection crack (Leakage at 4 points)	temporary replaced by rubber tube
20	29	24-2-2012	Near Krushna Nivas Bungalow( Venkatesh Classes), Bajaj Road	150	No leak	-
21	55	24-2-2012	In front of Pravin Seat Cover( Near Om Bungalow ) Plot No 401, Sector No 21	150	No leak	-
22	55	25-2-2012	In front of Mr Barshetti, plot no 399, Sector No 21.	150	Hole on House connection	replaced house connection

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<b>23</b>	17	25- 2- 2012	Near to Triveni Nagar Water Tank, Opposite to Infant Jesus Chuch, Sector No 21.	10 0	Joi nt lea k	Lead wool used
<b>24</b>	23	25- 2- 2012	Near to Triveni Nagar Water Tank, Opposite to Infant Jesus Chuch, Sector No 21.	20 0	Joi nt lea k	Lead wool used
<b>25</b>	24	25- 2- 2012	snehabandha housing soc, sector no 21, scheme no 11, building no 44, near sia baba mandir	20 0	Fe rru le Cr ac k	Ferrul e replac ed
<b>26</b>	13	25- 2- 2012	At chicken chowk, sector no 21, yamuna nagar.	10 0	Joi nt lea k	Lead wool used
<b>27</b>	7. 5	02/3/ 12	Next to datta mandir, sector no 21, chal no 9, parlour	10 0	Fe rru le Cr ac k	Ferrul e replac ed

<b>28</b>	7. 9	02/3/ 12	In front guru krupa building, opposite of amber housing society( building no 19, scheme no 10)	10 0	Fe rru le Cr ac k	Ferrul e replac ed
<b>29</b>	10	02/3/ 12	Opposite of Ameya Housing Soc, Building No 23, Scheme No 10	10 0	N o lea k	-
<b>30</b>	7. 2	02/0 3/12	Near plot no 01, Jevandhara society, near sai baba mandir	10 0	Fe rru le cr ac k	Ferrul e replac ed
<b>31</b>	14	02/0 3/12	Near krushna nivas bunglow( venkatesh classes), bajaj road	15 0	Fe rru le cr ac k	Ferrul e replac ed

#### V. CONCLUSION

1. The leaks were found very accurately by using recent techniques. A total of 31 spots were studied, out of that, 5 have no leakage and 26 have the leakages which were repaired.
2. Pilot project of 24x7 water supply scheme is studied at sector no. 21.
3. A new system for locating pipe leaks is introduced. The system incorporates several new developments like recycling of waste water for gardening etc.
4. This helps to reorganize and restructure the wards as per increase of people in area.
5. The main water supply pipe lines were checked for its thickness, diameter, pressure, flow and quality of the pipe material. It was concluded that there is no need to change/replace the pipelines.
6. The water provided by PCMC to all people of sector 21 is of standard quality and passes the safe permissible limit.

## References

- [1] Mohamed Fahmy and Osama Moselhi, "Automated Detection and Location of Leaks in Water Mains Using Infrared Photography", *Journal of Performance of Constructed Facilities*, 24(3), 2010, ASCE.
- [2] Yuzhe and Xiaoling Zhang, "Key Assessment Indicators for the Sustainability of Infrastructure Projects", *Journal of Construction Engineering and Management*, 137(6), 2010, ASCE.
- [3] Yeou-Koung Tung, Huan - Feng Duan, Pedro J. Lee and Mohamed, "System Response Function Based Leak Detection in Viscoelastic Pipelines", *Journal of Hydraulic Engineering*, 2011, ASCE.
- [4] Jamie Montague Fischer and Adjo Amekudzi, "Quality of Life, Sustainable Civil Infrastructure, and Sustainable Development: Strategically Expanding Choice", *Journal of Urban Planning and Development*, 137(1), 2011, ASCE.

