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Monthly Variation of E-waste (categories) in Raddi chowki during two year study

R.K. Srivastava and Akhilesh Kumar Patel
Environmental Research Laboratory, P.G. Department of Environmental Science
Govt. Science College (Model & Autonomous), NAAC RE-Accredited – 'A' Grade,
College with Potential for Excellence, UGC, Jabalpur 482001(M.P.) India
Corresponding Author: R.K. Srivastava:

Abstract: *E-waste comes under a special category of waste which is the result of industrialization and ever increasing demand of electronic products in daily life. With increasing usage, waste production is also increasing. Now, the situation is alarming as a huge quantity of waste is generated by India as well as other countries. Only 3% of total WEEE-waste generated is recycled properly in India. The rest of it is handled by workers who work with bare hands, without masks under unhygienic conditions, informally recycling tons of E-waste for about 12-14 hours a day. It causes both environmental as well as health problems. No. of laws are framed but none is able to stop this informal recycling. The E- waste first is separated into the different categories, which are to be handled separately in the following dismantling and sorting process. The dismantling process itself is performed with simple tools such as screwdrivers, hammers and tongs. After the process of dismantling, the E- waste are categorize in the following types- Cable wire, Glass, Plastic, Metals, Circuit plates, Miscellaneous. Present study shows the monthly variation in E-waste categories in Raddi Chowki of Jabalpur over two year study.*

Keywords: *E-waste, categories, quantity*

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I. Introduction

E-waste consists of all waste from electrical and electronic equipments which have reached their end-of- life period or are not in useful condition and it should be either recycled or disposed off. Waste represents uncontrolled matter out-of-place, freely interacting and reacting, cultivating bacteria, fungi and toxins that may pose direct threats to our health *(Loon 2002)*.India is witnessing a major growth in electronic market. Due to rapid innovation in communication sector a large range of mobiles and communication equipment are available and it is developing rapidly. The computer and peripheral industry is also booming at very fast rate. In the duration of 20 years, computer processor speed has shot from 16 MHz to 3.6 GHz; in the same time span, the average length of ownership has dropped from 8 years to 3 years *(Babbitt et al. 2009)*. All these thing leads to increase in e-waste generation in India. India is second largest electronic waste generator in Asia *(Tanvi Pradhan, 2013)*. E-waste is produced by household appliances, industrial machinery and other miscellaneous equipment. House hold appliances includes refrigerator, juicer, mixer, grinder, induction, batteries, exhaust fans, television (cathode ray tubes), computer, laptop, mobile phones etc. Industrial machinery includes, CNC milling machines, CNC drilling machines, CNC lathe etc. Whereas machines like Gun Artillery, Tanks, X-ray machines, Medicinal Equipment's etc. falls under miscellaneous category. A UN study found that the manufacturing of a computer and its screen takes at least 240 kg (530 pounds) of fossil fuels, 22 kg (48 pounds) of chemicals and 1.5 tones of water *(Williams and Kuehr, 2003)*.

The directive 2002/96/EC of the European Parliament and of the council of 27 January 2003 on WEEE covers all electrical and electronic equipment used by consumer. An assessment conducted by the Manufacturers Association of Information Technology (MAIT) Indian hardware Trade Organization state that India produces almost 4, 00,000 tonnes of e-waste each year. Globally the consumption of electronics is increasing and every year we create more E-waste than before. The demand is irresistible so the need for a solution becomes ever more urgent. As the quantity of E-waste in the country is increasing at an alarming rate, a parliamentary panel has recommended creation of a legislative and enforcement mechanism to prevent India from becoming a dumping ground of E-waste for developed nations (Hindu, 2015). E-waste generated from non-usable or old electronics. E-waste contains chemical elements that have adverse effects on the environment and human health *(Ake 2009).*

II. Methodology

Study area

Jabalpur city is situated at the center of India in the state of Madhya-Pradesh. According to the 2011 census, it is the third-largest urban agglomeration in Madhya Pradesh and the country's 37th-largest urban agglomeration. Jabalpur city have a hot spots areas like Raddi Chowki for marketing of waste. It is to establish the geographical boundaries of the study area which were included the city boundaries of Jabalpur and select the area Raddi Chowki. It is situated at Adhartal area in Jabalpur and it is famous for E-waste trade, under this study Raddi Chowki is divided in four sampling points as R-1, R-2, R-3 & R-4 shown in fig. no.1.This area is very crowded and famous for selling and buying of the waste materials.

Fig. (1) – Raddi Chowki E-waste sampling locations

E-waste data (Categories) is collected from Raddi chowki in the study period. The duration of data collection was two year i.e. 2014-15 and 2015-16. Sampling locations were visited on monthly basis and data collected by the scrap vendors on quantity of different categories of E-waste i.e. Cable wires, Glass, Plastic, Metals, Circuit plates and Miscellaneous. The E-waste reach to scrap vendors through rag pickers and to scrap vendors to scrap dealers.

III. Result And Discussion

E-waste data observed that in R-1 location plastic is maximum i.e. 986 kg in the month of October and minimum **was** miscellaneous i.e. 47 kg in the month of July. Similarly in R-2 location maximum was plastic i.e. 590 kg in the month of January and minimum was miscellaneous i.e. 45 kg in the month of August. In R-3 location maximum was plastic i.e. 780 kg in the month of October and minimum was miscellaneous i.e. 32 kg in the month of May. In R-4 location maximum was cable wire i.e. 680 kg in the month of October and minimum was miscellaneous i.e. 31 kg in the month of June during the year 2014-15. In the year 2015-16, the data observed in R-1 location shows that plastic is maximum i.e. 1320 kg in the month of October and minimum was miscellaneous i.e. 75 kg in the month of August. In R-2 location plastic was maximum i.e. 1120 kg in the month of October and minimum was miscellaneous i.e. 35 kg in the month of August. In R-3 location plastic was maximum i.e. 1130 kg in the month of October and minimum was miscellaneous i.e. 45 kg in the month of July. In R-4 location plastic was maximum i.e. 1345 kg in the month of February and minimum was miscellaneous i.e. 65 kg in the month of August are recorded. These are shown in Table no 1, 2, 3, 4, 5, 6, 7& 8 and graph no. 1, 2, 3, 4, 5, 6, 7 & 8. It is observed that all the location shows highest values in plastic annually because plastic is of light weight, highly electrical resistance, easy to shape and long life, more used in electrical and electronic equipment for makeup wire insulator, equipment body, Plates, switches, and many other purposes. The plastic is non-biodegradable material; its demand is increasing day by day.

Table no 1: Monthly E-waste collection in kg (Categories) in Raddi chowki 2014-15 (R-1)

S. No.	Categories	Months/ Quantity in kg												Total In Kg	Total %
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
1	Cable Wire	730	753	734	638	531	441	322	267	279	169	163	316	5343	20.47
2	Glass	562	434	427	385	491	391	125	217	316	319	126	195	3988	15.28
3	Plastic	986	896	750	787	780	642	789	640	465	153	164	519	7571	29.01
4	Metals	796	565	698	488	405	346	412	333	340	209	154	225	4971	19.15
5	Circuit Plates	310	462	315	322	318	298	275	223	246	103	134	266	3272	12.54
6	Miscellaneous	116	90	76	80	75	82	77	120	54	47	59	79	955	3.66
Total		3500	3200	3000	2700	2600	2200	2000	1800	1700	1000	800	1600	26100	100

Graph no1: Monthly variations of categories of E-waste Raddi Chowki in 2014-15 (R-1)

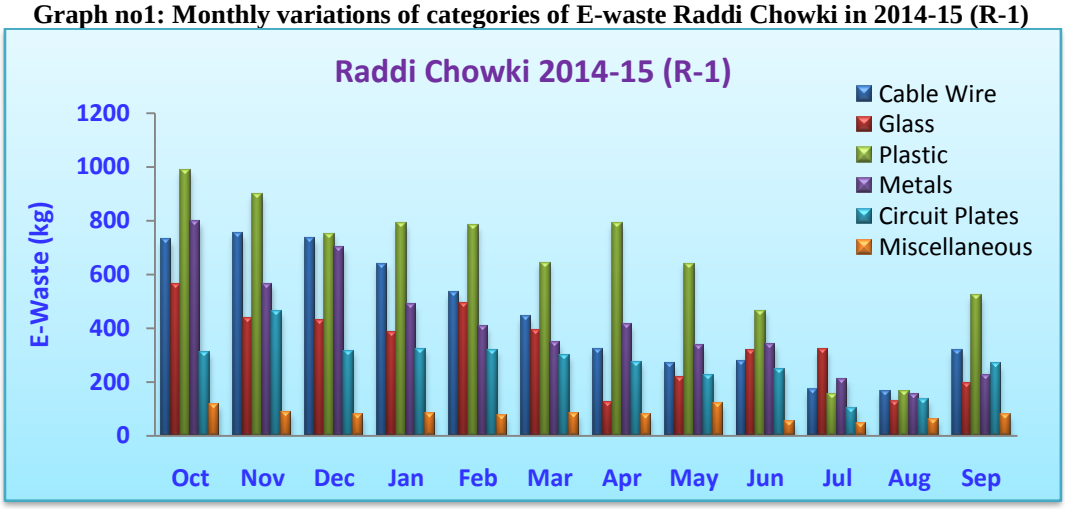


Table no 2: Monthly E-waste collection in kg (Categories) in Raddi chowki 2014-15 (R-2)

S. No.	Categories	Months/ Quantity in kg												Total In Kg	Total %
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
1	Cable Wire	432	355	335	250	260	260	220	145	115	196	155	288	3011	17.03
2	Glass	245	247	242	230	245	195	365	295	280	84	75	342	2845	16.09
3	Plastic	525	511	500	590	585	580	498	496	525	215	178	365	5568	31.49
4	Metals	381	356	349	340	325	250	255	244	235	125	82	178	3120	17.65
5	Circuit Plates	315	242	212	225	155	170	122	170	195	63	65	158	2092	11.83
6	Miscellaneous	102	89	112	105	110	165	70	80	50	47	45	69	1044	5.90
Total		2000	1800	1750	1740	1680	1620	1530	1430	1400	730	600	1400	17680	100

Graph no 2: Monthly variations of categories of E-waste Raddi Chowki in 2014-15 (R-2)

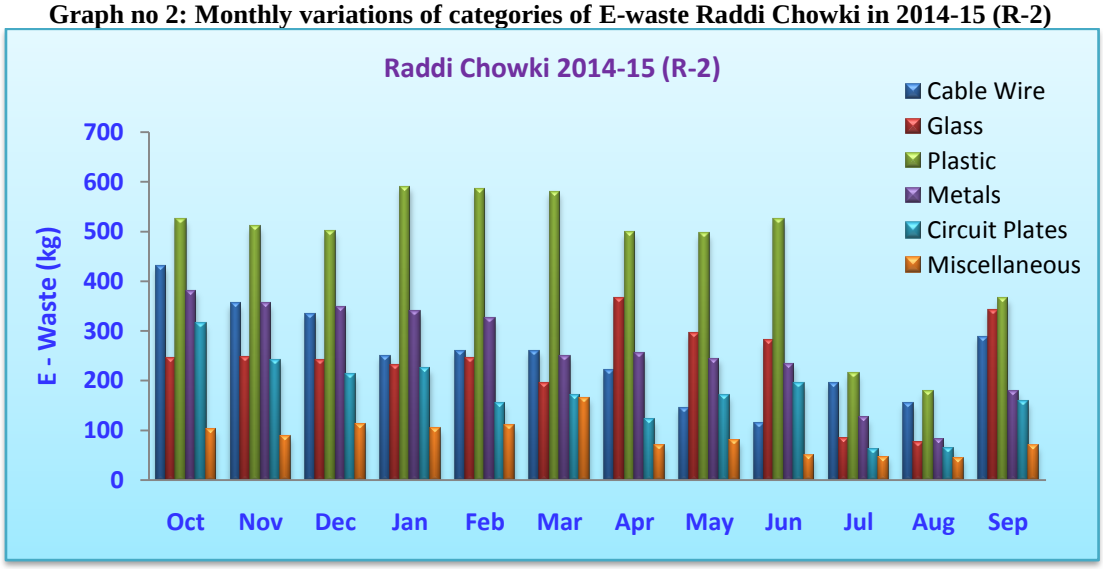


Table no 3: Monthly E-waste collection in kg (Categories) in Raddi chowki 2014-15 (R-3)

S. No.	Categories	Months/ Quantity in kg												Total In Kg	Total %
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
1	Cable Wire	503	560	598	646	435	454	266	265	196	144	165	328	4560	19.57
2	Glass	505	564	463	394	431	251	225	145	285	112	241	264	3880	16.65
3	Plastic	780	544	632	652	654	696	447	415	254	155	340	470	6039	25.92
4	Metals	467	386	376	313	365	365	367	346	115	132	255	432	3919	16.82
5	Circuit Plates	465	396	356	375	315	119	97	97	58	117	109	345	2849	12.23
6	Miscellaneous	280	350	275	220	300	115	98	32	92	40	90	161	2053	8.81
Total		3000	2800	2700	2600	2500	2000	1500	1300	1000	700	1200	2000	23300	100

Graph no 3: Monthly variations of categories of E-waste Raddi Chowki in 2014-15 (R-3)

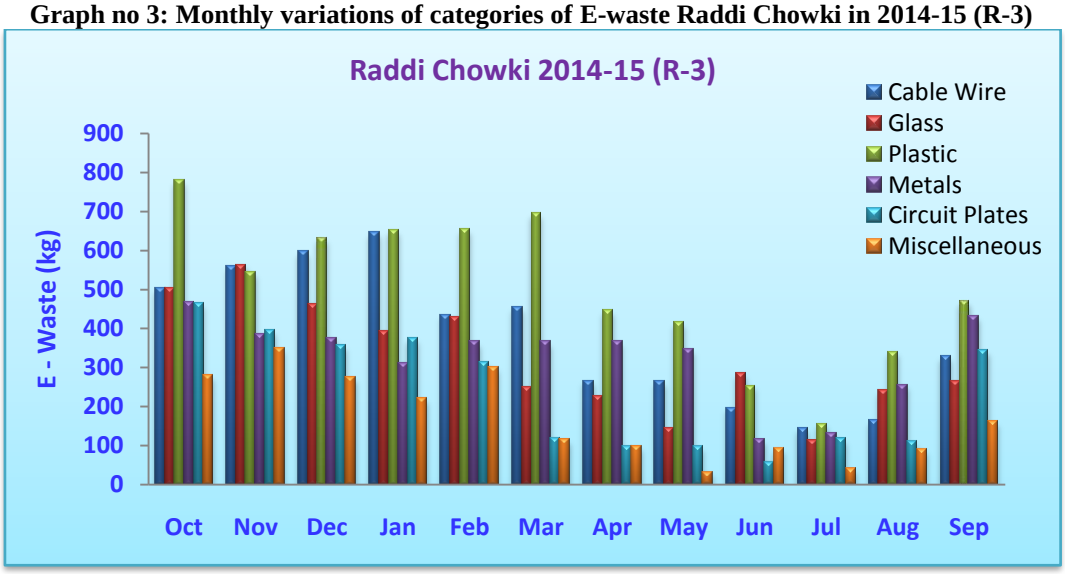


Table no 4: Monthly E-waste collection in kg (Categories) in Raddi chowki 2014-15 (R-4)

S. No.	Categories	Months/ Quantity in kg												Total In Kg	Total %
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
1	Cable Wire	680	565	540	546	470	460	345	163	234	274	97	254	4628	21.26
2	Glass	480	462	256	368	335	245	268	242	165	164	94	164	3243	14.90
3	Plastic	580	570	594	515	647	680	542	356	310	125	132	640	5691	26.14
4	Metals	560	576	660	545	354	255	245	214	214	105	120	245	4093	18.80
5	Circuit Plates	350	332	205	339	300	148	125	235	146	102	96	130	2508	11.52
6	Miscellaneous	170	245	345	187	194	112	75	90	31	30	61	67	1607	7.38
Total		**2820**	**2750**	**2600**	**2500**	**2300**	**1900**	**1600**	**1300**	**1100**	**800**	**600**	**1500**	**21770**	**100**

Graph no 4: Monthly variations of categories of E-waste Raddi Chowki in 2014-15 (R-4)

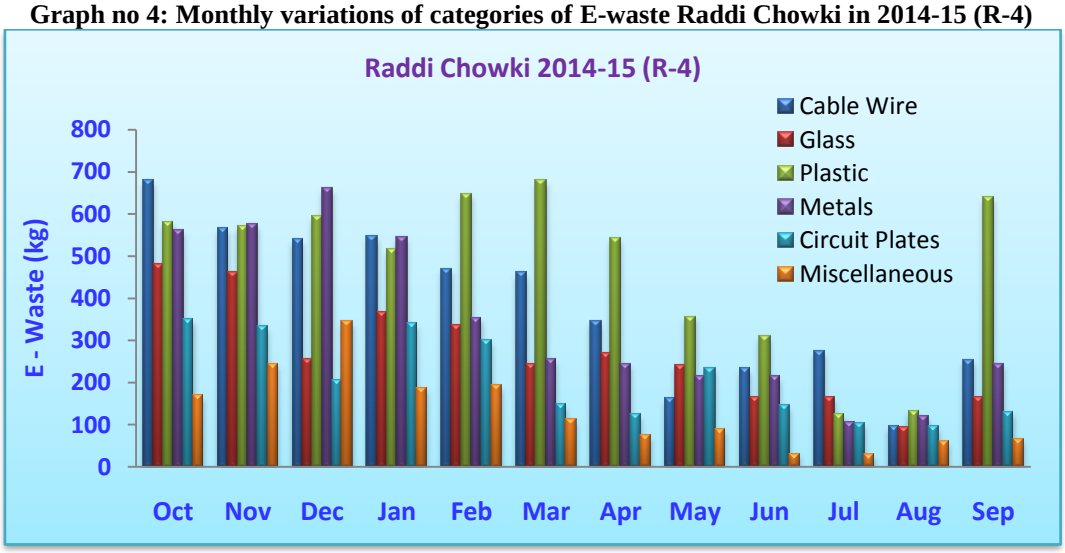


Table no 5: Monthly E-waste collection in kg (Categories) in Raddi chowki 2015-16 (R-1)

S. No.	Categories	Months/ Quantity in kg												Total In Kg	Total %
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
1	Cable Wire	700	615	465	335	415	396	340	340	240	235	185	376	4642	15.13
2	Glass	640	730	833	652	315	345	255	305	300	240	142	340	5097	16.61
3	Plastic	1320	1140	1000	978	1020	758	800	710	512	340	276	640	9494	30.95
4	Metals	791	690	892	630	405	486	390	265	240	238	140	364	5531	18.03
5	Circuit Plates	535	630	562	410	315	375	200	210	250	195	232	285	4199	13.69
6	Miscellaneous	244	205	198	145	130	110	135	140	98	92	75	145	1717	5.60
Total		**4230**	**4010**	**3950**	**3150**	**2600**	**2470**	**2120**	**1970**	**1640**	**1340**	**1050**	**2150**	**30680**	**100**

Graph no 5: Monthly variations of categories of E-waste Raddi Chowki in 2015-16 (R-1)

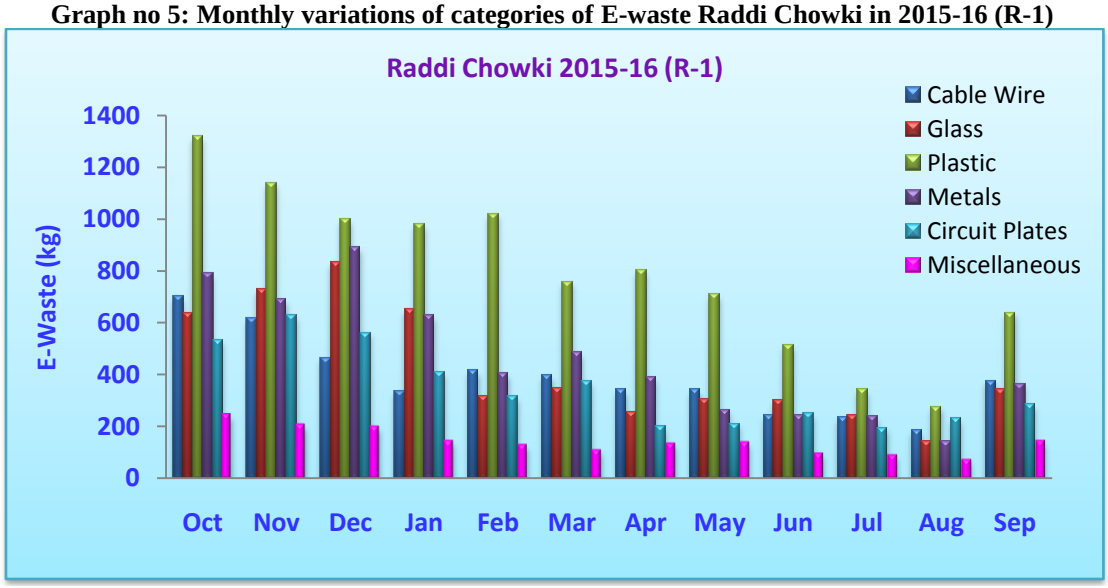


Table no 6: Monthly E-waste collection in kg (Categories) in Raddi chowki 2015-16 (R-2)

S. No.	Categories	Months/ Quantity in kg												Total In Kg	Total %
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
1	Cable Wire	960	685	670	490	540	498	265	340	235	240	195	490	5608	16.64
2	Glass	650	740	690	705	510	377	345	367	340	160	185	365	5434	16.13
3	Plastic	1120	990	1050	970	885	765	870	652	670	340	270	755	9337	27.21
4	Metals	740	970	740	880	540	345	496	381	335	370	490	485	6772	20.10
5	Circuit Plates	630	680	540	365	245	545	256	145	180	315	385	370	4656	13.82
6	Miscellaneous	270	185	200	230	265	230	78	65	90	95	35	145	1888	5.60
Total		4370	4250	3890	3640	2985	2760	2310	1950	1850	1520	1560	2610	33695	100

Graph no 6: Monthly variations of categories of E-waste Raddi Chowki in 2015-16 (R-2)

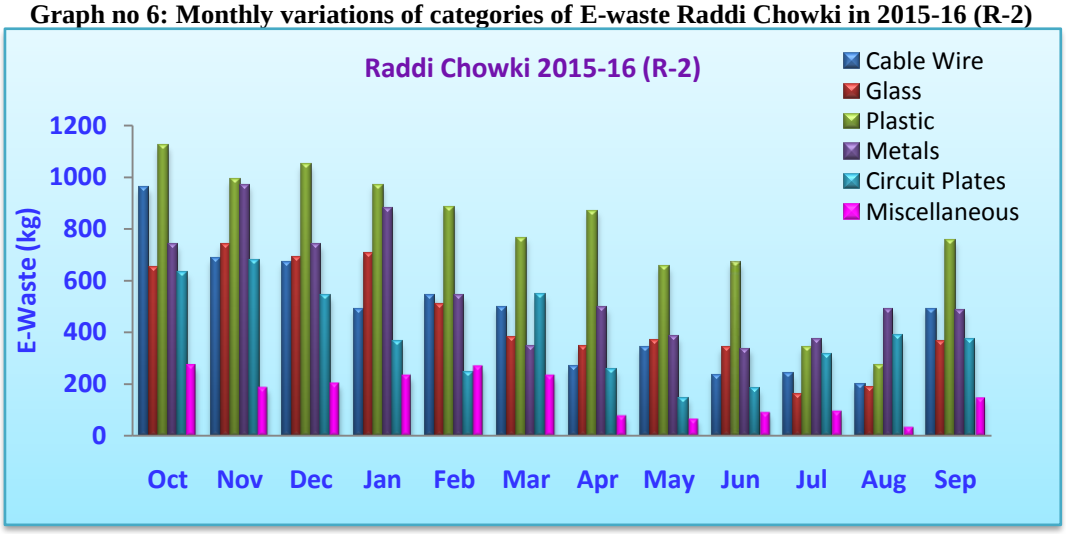


Table no 7: Monthly E-waste collection in kg (Categories) in Raddi chowki 2015-16 (R-3)

S. No.	Categories	Months/ Quantity in kg												Total In Kg	Total %
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
1	Cable Wire	670	885	975	545	425	430	340	140	185	210	145	440	5390	16.33
2	Glass	690	775	751	750	542	560	450	320	242	190	210	160	5640	17.09
3	Plastic	1130	980	995	972	965	998	660	755	540	460	350	585	9390	28.45
4	Metals	805	820	422	976	618	587	450	390	360	340	281	530	6579	19.93
5	Circuit Plates	655	460	487	387	350	140	360	260	323	165	132	310	4029	12.21
6	Miscellaneous	310	350	260	130	240	125	90	75	120	45	82	155	1982	6.00
Total		**4260**	**4270**	**3890**	**3760**	**3140**	**2840**	**2350**	**1940**	**1770**	**1410**	**1200**	**2180**	**33010**	**100**

Graph no 7: Monthly variations of categories of E-waste Raddi Chowki in 2015-16 (R-3)

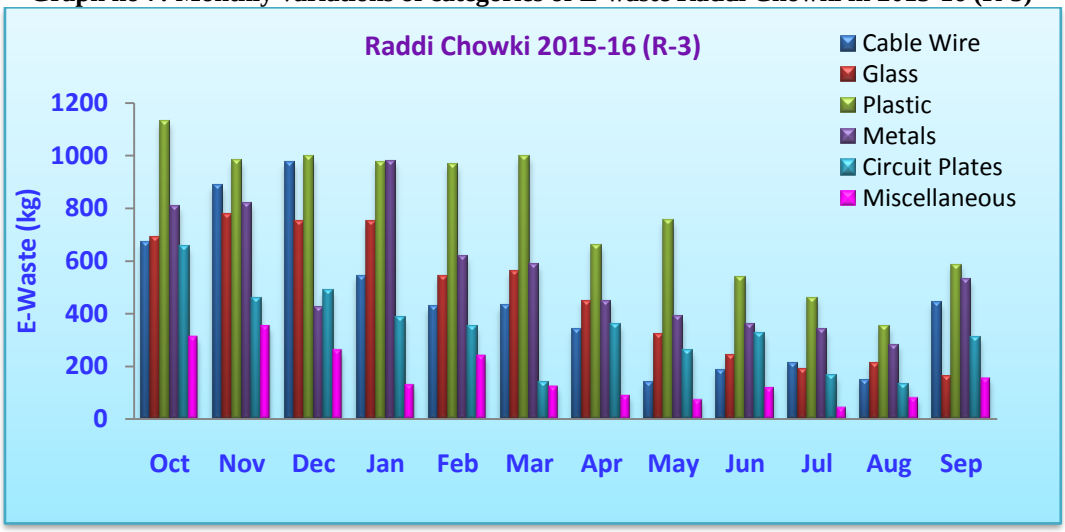
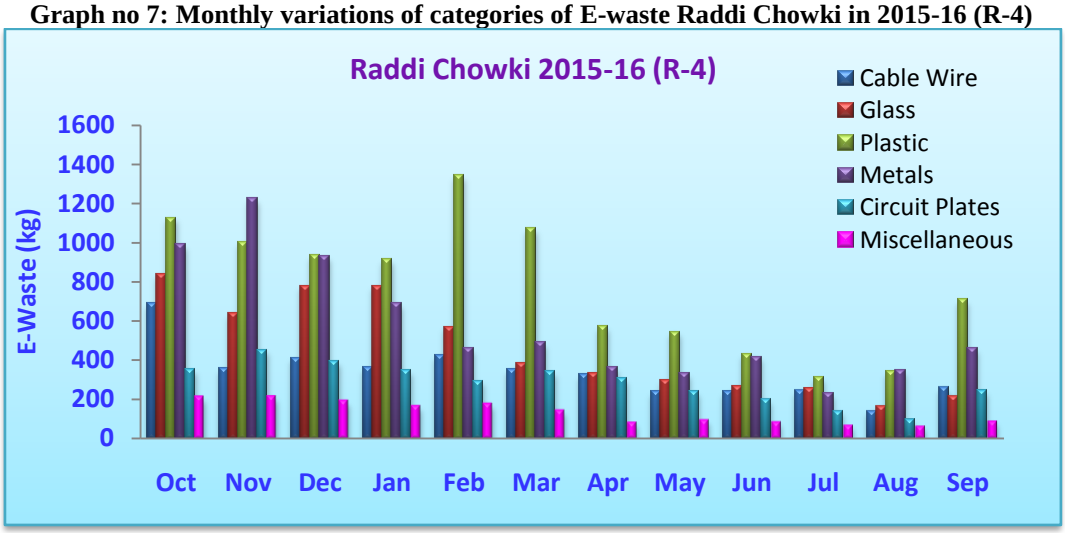


Table no 8: Monthly E-waste collection in kg (Categories) in Raddi chowki 2015-16 (R-4)

S. No.	Categories	Months/ Quantity in kg												Total In Kg	Total %
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
1	Cable Wire	690	356	410	360	425	352	325	240	240	242	140	261	4041	13.12
2	Glass	840	640	780	780	570	385	330	298	267	255	164	213	5522	17.93
3	Plastic	1128	1005	935	917	1345	1075	573	545	432	312	340	711	9318	30.25
4	Metals	990	1225	930	690	460	490	362	331	417	231	346	462	6934	22.51
5	Circuit Plates	352	452	395	348	294	340	306	240	198	140	95	243	3403	11.05
6	Miscellaneous	210	212	190	165	176	143	84	96	86	70	65	90	1587	5.15
Total		**4210**	**3890**	**3640**	**3260**	**3270**	**2785**	**1980**	**1750**	**1640**	**1250**	**1150**	**1980**	**30805**	**100**

Graph no 7: Monthly variations of categories of E-waste Raddi Chowki in 2015-16 (R-4)



IV. Conclusion

In Jabalpur, the amount of E-waste generated is rising rapidly with the increasing dependence on electrical and electronic equipment, the rising of E- waste generation is well expected in the city. Problems due to E-waste are likely to become serious in near future in Jabalpur. Monthly variations of E-waste found as maximum of 28390 kg in the month of October and minimum as 8160 kg in the month of August in Raddi chowki during two year study.

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