



Pave the Green Way



Inventory of Hazardous Waste Generation

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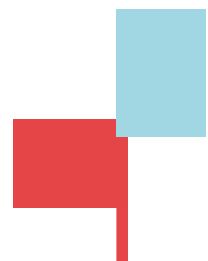
Submitted by
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Bangalore, Karnataka

Submitted to
Goa State Pollution Control Board
Saligao, Goa

#PaveTheGreenWay with Us

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INTRODUCTION

Industrialization ushers in prosperity and fuels economic development but these advantages need to be weighed against the downside as well. Industrial manufacturing activity and associated actions lead to generation of large quantity of solid and hazardous wastes which need to be managed in an environmentally sound manner. Such wastes are often generated as a side stream in the manufacturing processes or generated from the use of various media /catalysts which need to be disposed off when spent/exhausted. Such wastes contain residues of the raw materials/intermediates from the process and maybe toxic, flammable, corrosive, reactive, explosive. Initially water and air pollution were the focus areas and regulations governing environmental pollution in the country were the Air (Prevention and Control of Pollution) Act, 1981 and the Water (Prevention and Control of Pollution) Act, 1974. Subsequently a need for an umbrella legislation was felt to address other aspects of waste generation and management thereof and "The Environment (Protection) Act, 1986" was enacted. Various Rules were enacted under Environment (Protection) Act to address specific issues. Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, were formulated for management of Hazardous wastes in the country.

These Rules were amended in the year 2000 (principally to bring them in compliance with Basel convention) and further in the year 2003 (to include Environmentally Sound Technologies for recycle of Hazardous Waste). However, due to constraints like lack of reliable information pertaining to hazardous wastes, the implementation of these Rules was not satisfactory. This led to filing of a Public Interest Litigation filed by Research Foundation for Science, Technology and Natural Resource policy, pursuant to this Honourable Supreme Court passed judgement directing each State Pollution control Board to prepare a detailed inventory of Hazardous waste generation in their state and submit the same to CPCB.

Goa State Pollution control board assigned this task for Paradigm Environmental Strategies Pvt. Ltd. The Scope for the assignment was decided as under

- To evaluate information available in board files/records for each industry and assess waste generation from these industries.
- To identify waste generation based on the study of manufacture process
- To identify waste category as per Schedule-I and II of Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016
- To assess quantum of waste generated from each unit
- To identify the disposal options most suited for types of waste generated

I. State Background

Goa was under Portuguese rule for over 400 years. In 1961, the Indian armed forces took control and Goa gained independence to join Indian Republic. Goa became a union Territory along with Daman and Diu in December 1961, and then on May 30, 1987 Goa attained Statehood and was included as twenty-fifth state of India.

a) Geography

Goa covers an area of 3702 square kilometres and comprises of two districts viz North Goa and South Goa. Boundaries of Goa State are defined in the North Terekhol River which separates it from Maharashtra, East and South by Karnataka State and West by Arabian Sea. Goa lies in Western Coast of India.

Goa, for the purpose of revenue administration is divided into two districts viz. North and South Goa with headquarters at Panaji and Margao respectively. The entire State comprises of 12 talukas. Administratively the state of Goa is organized into two districts North Goa comprising of six talukas with a total area of 1736 sq. kms. & South Goa comprising of five talukas with an area of 1966 sq. kms. In all there are 383 Villages of which 233 are in North Goa district and 150 South Goa district.

b) Economy:

Goa is one of the fastest growing states in the country. The Gross State Domestic Product of Goa at current prices increased at a Compound Annual Growth Rate (CAGR) of 8.78 per cent from 2011-12 to 2016-17. Goa's net state domestic product (NSDP) was Rs 587.71 billion (US\$ 8.76 billion) in 2016-17. Goa's economic growth is driven by the strong performance of industrial sectors such as mining, tourism and pharmaceuticals. As of July 2018, Goa had a total installed power generation capacity of 549.41MW. Goa is also one of the few states in India to achieve 100 per cent rural electrification.

Goa has a well-developed social, physical and industrial infrastructure and virtual connectivity. It has an international airport that is in line with its importance as a globally-recognized leisure destination. It also has significant port infrastructure. The state has an established base for the pharmaceuticals industry and an emerging destination for knowledge-based industries such as biotechnology and IT. According to the Department of Industrial Policy & Promotion (DIPP), FDI inflows into the state of Goa, during April 2000 to June 2018, were US\$ 970 million.

c) Industry:

In order to give boost to industrial development, the Goa Daman and Diu industrial Development Cooperation (GDDIDC) was established by Government of Goa, Daman and Diu in February 1966 under provision of Goa, Daman and Diu Industrial Development Act with the aim of establishing of industries in industrial area and Industrial estate in Goa. Goa has seen a steady growth of industries in the recent years. Government of Goa, while encouraging industrial growth, is also conscious about the Environmental impacts of the industries. Thus, the Government's efforts have been targeted to ensure better compliance to environmental laws and encouraging industries which are low polluting in nature. While the problem of effluent and air pollution can be controlled through readily available & comparatively low cost in-plant treatment technologies, Hazardous waste generated needs treatment and disposal which cannot be undertaken at individual industry level, as this will result in creating pollution hot spots at multiple locations.



Figure 1: Map Showing Industrial Estates

The industrial activities encompass about 50 sub sectors which include tourism, pharmaceuticals, electrical and automobile accessories etc. As the industrial growth is increasing in the Goa state, proportionally waste generation is also increasing. At present Goa state doesn't have any CHWTSDF facility and thus there is a high demand of Hazardous waste management facility. The natural beauty of Goa attracts tourists from all over the world creating a flourishing tourism industry that is a significant source of revenue and employment generation thus to manage this large amount of hazardous waste generated through industrialization there is a need to set up a CHWTSDF to safeguard the flora and fauna of the State of Goa.

The Honorable Supreme Court of India has constituted a monitoring committee (SCMC) to ensure strict compliance of the above guidelines. This has led to various states through their Industrial Development Corporations to promote developers for Common Hazardous Waste Treatment Storage Disposal Facility (CHWTSDF) and ensure compliance of the regulations. Based on the Supreme Court Directives, Goa Chamber of Commerce has floated an SPV by the name & style of Goa Industrial Environment Management Association (GIEMA) to develop a common facility for the scientific and environmentally safe disposal of hazardous waste in the State of Goa. At present Goa State does not have common facility for the management & disposal of Hazardous Waste, the Hazardous Waste is transported & disposed of scientifically at Taloja facility Maharashtra by getting trans-boundary permission from both the States.

The state of Goa has nearly 1399 hazardous waste generating industries listed with the GSPCB. Presently there is no Common Hazardous Waste Treatment Storage and disposal Facility (CHWTSDF) within Goa state. Industries here are required to dispose their hazardous waste in

other nearby states which poses following problems:

- objections are raised by other states on being used as “dumping” ground (Annexure 15)
- uneconomical due to high transport cost.
- hazards during long distance transportation.

In view of the same, Government of Goa is taking steps to establish Common facilities for treatment and disposal of Hazardous Waste. In order to support the government initiative, Goa Industries Environment Management Association (GIEMA) took active interest and approached Government of Goa to locate a CHWTSDF in Goa.

The Goa-IDC chalked out a systematic plan to create required infrastructure in the form of industrial Estates in various parts of Goa State. The Goa-IDC has established eighteen Industrial estates in Goa as on date. These are as under:

Table 1:List of IDC in Goa State

Sl. no	Name of IDC	Sl. no	Name of IDC
1.	Corlim	10.	Canacona
2.	Margao	11.	Kundaim
3.	Sancoale	12.	Tuem
4.	Mapusa	13.	Verna
5.	Tivim	14.	Cuncolim
6.	Bicholim	15.	Pilerne
7.	Kakoda	16.	Madkaim
8.	Honda	17.	Pissurlem
9.	Bethora	18.	Colvale

Few more Industrial development estates are planned and will be developed in due course. In addition to these Goa-IDC estates a few industrial clusters also exist. Many large and medium/small scale units are functioning outside Goa-IDC industrial estates.

With the development of infrastructure, the Government of Goa offered incentives to prospective units. As a result, many industrial units, particularly pharmaceutical formulation units set up facilities in Goa along with food processing industries. Industrial development in the last 10-20 years has been rapid. In the present industrial scenario, the pharmaceutical industries have a leading stake. Other noteworthy new sectors are electronics, IT., Engineering & Metal Processing.

II. Previous Inventory:

Subsequent to the directions issued by the Honourable Supreme Court in the year 2008, the Goa State Pollution Control Board assigned task to M/s Aditya Environmental Services Pvt. Ltd. to prepared an inventory of Hazardous waste generation in the state. As per the inventory, 911 units were identified as generators of hazardous. The total generation of hazardous waste was arrived at 31,752.73 MTPA.

The total hazardous waste to be disposed by landfill was arrived at **12,834.37** MTPA. The quantity of incinerable waste was found to be **8616.23** MTPA and total quantity of recyclable waste was estimated to **10302.13** MTPA.

III. Present Inventory:

In order to establish a more accurate status of Hazardous waste generation in the state, the task was assigned to an external expert agency. M/s Paradigm Environmental Strategies Pvt. Ltd., was awarded, the task of updating the Inventorisation taking into account the changes in Industrialisation. The GIDC has a different list of Industries which may potentially generate Hazardous Waste from their operations. In addition, there are several institutions like Hospitals, Hotels, Malls etc which also generate Hazardous waste. A comprehensive audit was undertaken which covered 3340 institutions in State of Goa.

IV. Methodology:

Independent data in .xls, .pdf, hardcopy format was provided by the following agencies were used as basis to commence the study

- Goa State Pollution Control Board (GSPCB) (comprising 1399 industries)
- Goa Industrial Development Corporation (comprising 2268 industries)
- SMS Envocare Limited (comprising 861 industries)
- Aditya Environmental Services Pvt. Ltd (comprising 912 industries)

The work was carried out in special teams comprising GSPCB, GWMC, GEIMA officials and experts from Paradigm Environmental Strategies Pvt. Ltd.

The Team examined following documents

- Consent to Establish and Consent to Operate/Authorization granted by GSPCB
- Examine the records maintained in Form 3, Form 4, Form 5, Form 8 and Form10 (manifest copies) with respect to Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.
- Inspection of Hazardous waste storage site and recommendation of proper measures of storage.
- Adherence to Hazardous and Other Wastes (Management and Transboundary Movement)

Rules, 2016 with respect to Form 3, Form 4, Form 8 and Form10 & Display Board of Hazardous waste board as mentioned in CTO

Based on the site studies, discussions held with industries representatives and scrutiny of the collected documents and information, the inventory of Hazardous waste generation in the state of Goa has been prepared. The report also includes the observations made by the team during the physical verification of waste, process, storage, mode of disposal and understanding of existing system. The database was shared with the GWMC in March 2019.

Subsequently, the database has been improved based on mutual discussions with GWMC and GSPCB and correspondence with waste generators. GSPCB also shared an amended list of generators comprising 1560 industries in the Month of October 2019, which has also been updated in the database.

This comprehensive master database of authorized and actual along with approved treatment methods as per CPCB guidelines. Updation and standardisation of reported quantity and units from nos, liters (L), kiloliters(kL), kg, kg/day, kg/month to a common unit as metric tonne per annum (MTA). The major findings are detailed below discussion with all the industries representative were conducted to get the above-mentioned details.

a) Findings:

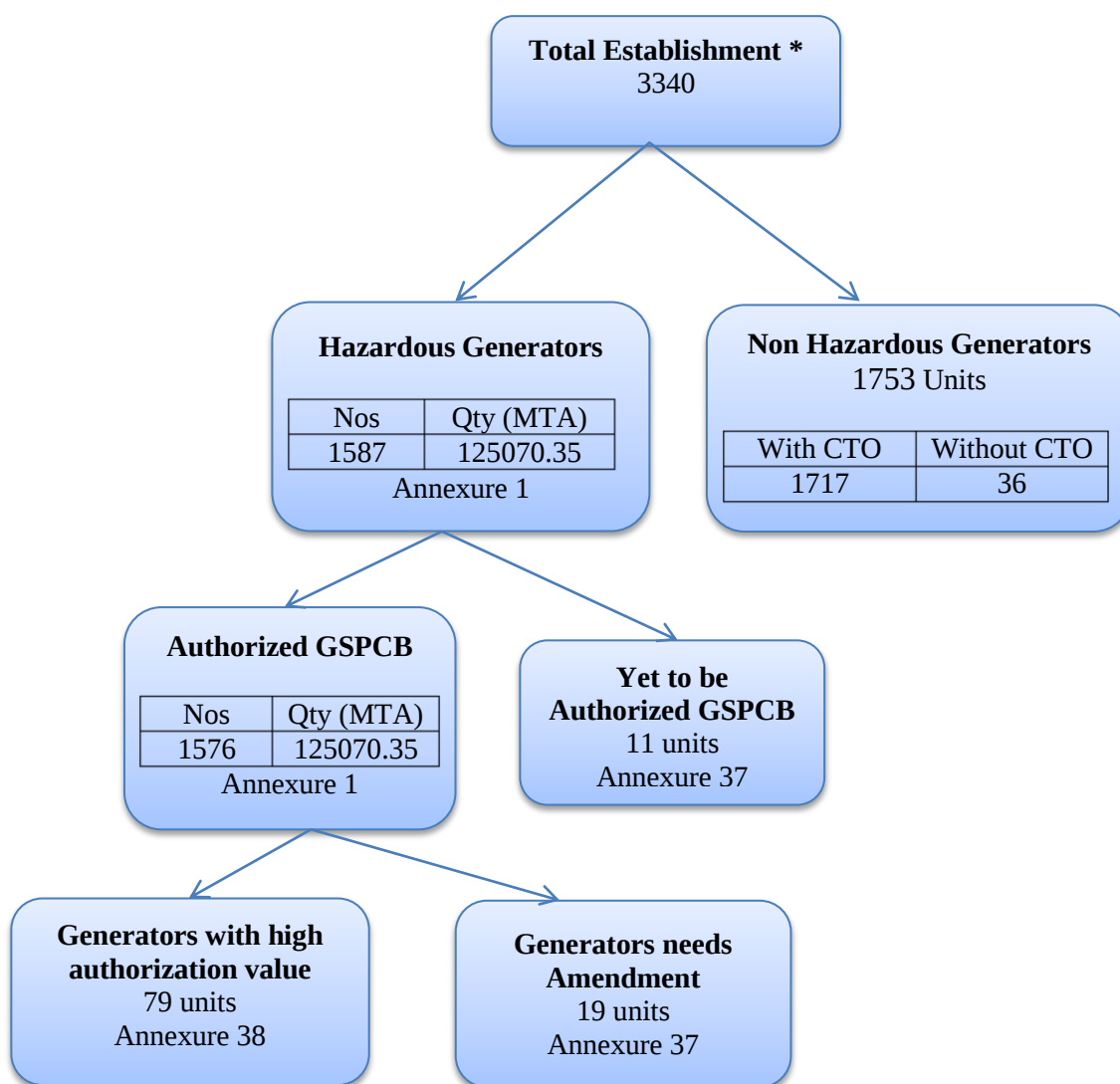
Out of 3340 potential units covered under inventory audit survey 1587 are found to be generators of hazardous wastes as defined under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. The database has been updated to reflect the actual generation as per updation with respect to Annual returns Form IV as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016

Key findings:

- Out of 1598 units covered (Annexure 1), 1587 have valid authorisation (Annexure 1), 19 requires amendment for addition of new category or change in quantity and 11 units which are currently operating without HW authorisation (Annexure 37) requires new authorization for operating as hazardous waste generators
- Wastes that have more than one approved treatment technology has been classified based on the technology suggested under the CTO.
- The database indicates that 1118 companies out of the 1587 HW generator are authorised generator of more than 20 kg of HW per annum.
- The annual returns of these companies indicate that only 155 companies out of 1118 generate more than 10 kg of HW waste

About 79 establishments had errors in authorisation such as very high value of HW quantity, which has been highlighted based on discussion with GSPCB and comparison with Annual returns (Annexure 38)

The above data is respresented pictorially represented below



* As per inventory audit survey

Table 2:Mode of disposal and quantity of authorised hazardous waste

Mode of Disposal	Authorised Qty (MTA)	Actual Qty (MTA)
Landfillable	13892.12	3385.21
Incineration	74181.15	39379.80
Recyclable	34139.23	33095.57
Utilizable	2857.85	1196.00
Total Sources	125070.35	77056.58

7436 MTA can be treated in Incinerator/landfill. It has been accounted under Incineration

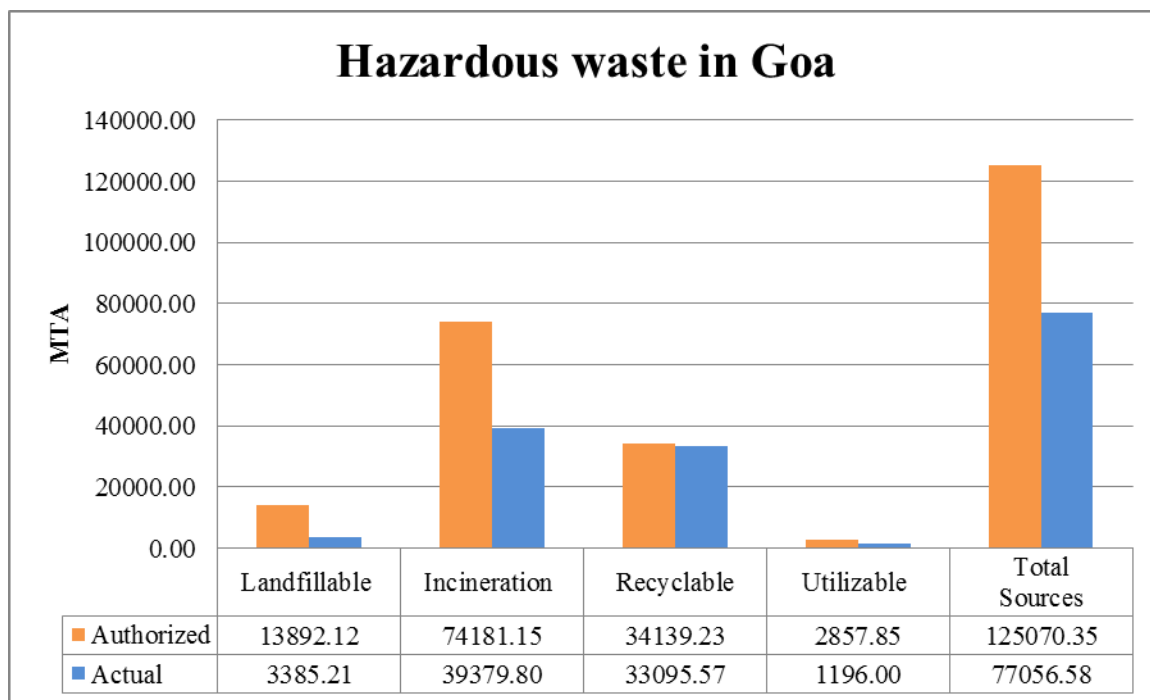


Figure 2: Quantity representation of mode of disposal of Hazardous waste

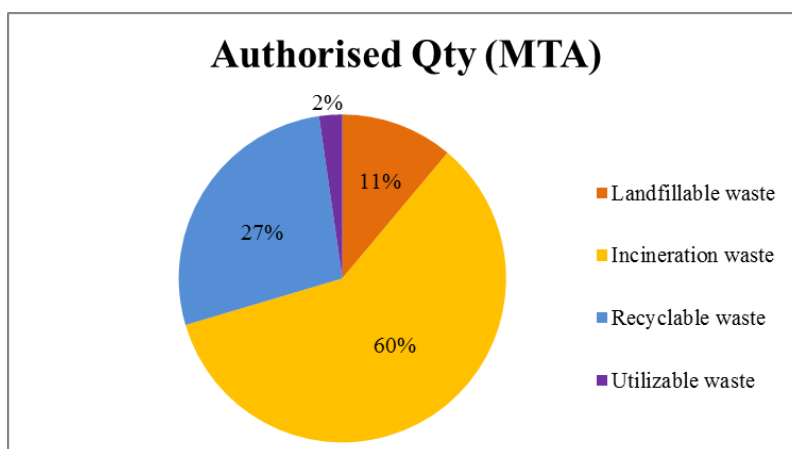


Figure 3: Percentage representation of mode of disposal of Hazardous waste

Table 3: Talukawise Hazardous Waste Generation

District	Taluka wise	Nos	Authorized Qty	Actual Qty
North Goa	Bardez	426	28411.08	28693.79
	Bicholim	49	472.11	484.05
	Pernem	30	51.57	49.12
	Ponda	201	13536.68	3520.74
	Sattari	42	845.41	642.20
	Tiswadi	198	42197.18	16517.71
Total North Goa			85514.02	49907.60
South Goa	Canacona	11	6845.30	6845.37
	Dharbandora	5	8.37	8.37
	Mormugao	104	2495.11	1910.09
	Quepem	26	44.07	24.13
	Salcete	477	30148.45	18347.16
	Sanguem	14	11.35	10.23
Total South Goa			39552.65	27145.35

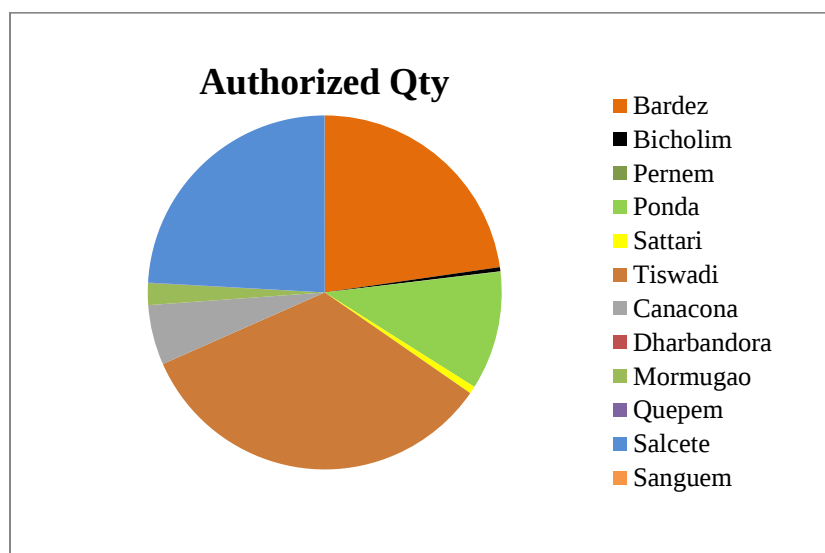


Figure 4: Talukawise Authorized Quantity in State of Goa

The above figure represents the Authorized Hazardous waste distribution with respect to Taluka in Goa State. From the Figure 4 Authorized Hazardous waste distribution are as follow, the major Authorized generator of hazardous waste consist of 34% in Tiswadi, 24% in Salcete 23 % in Bardez , 11% in Ponda, 5% and 2% Canacona and Mormugao respectively.

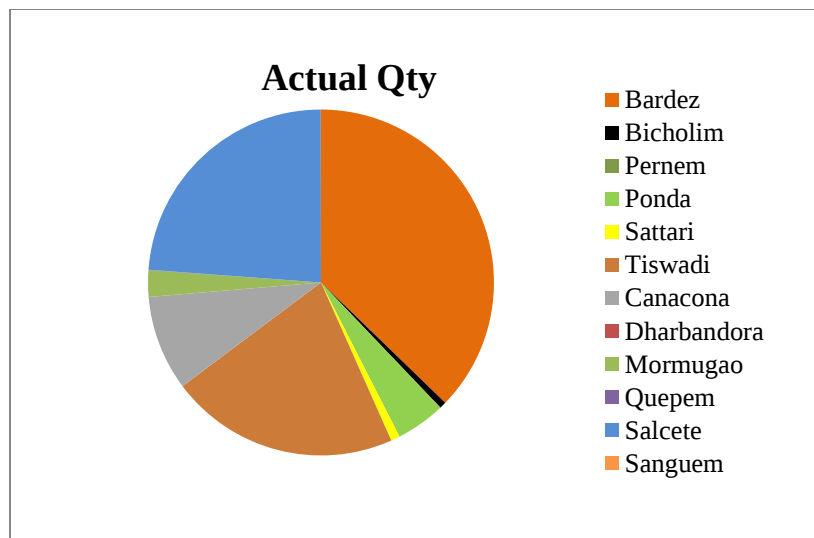


Figure 5: Talukawise Actual Quantity in State of Goa

The above figure represents the Actual Hazardous waste distribution with respect to Taluka in Goa State. From the Figure 4 Actual Hazardous waste distribution are as follow, the major actual generator of hazardous waste consist of 37% in Bardez, 24% in Salcete 21 % in Salcete , 5% in Ponda and 2% in Mormugao.

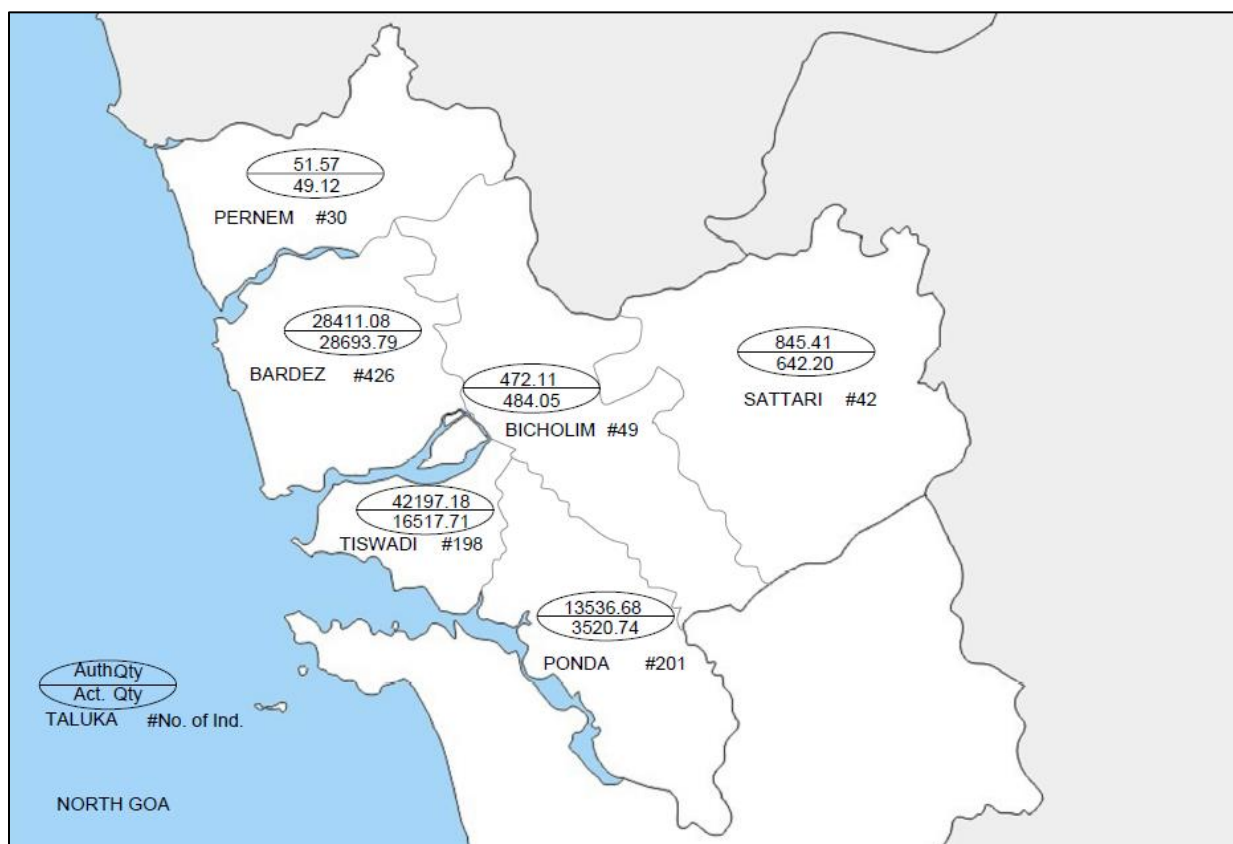


Figure 6: Talukawise Spatial distribution of hazardous waste in North Goa District

The figure 6 represents the Talukawise Spatial distribution of Hazardous waste in North Goa District.

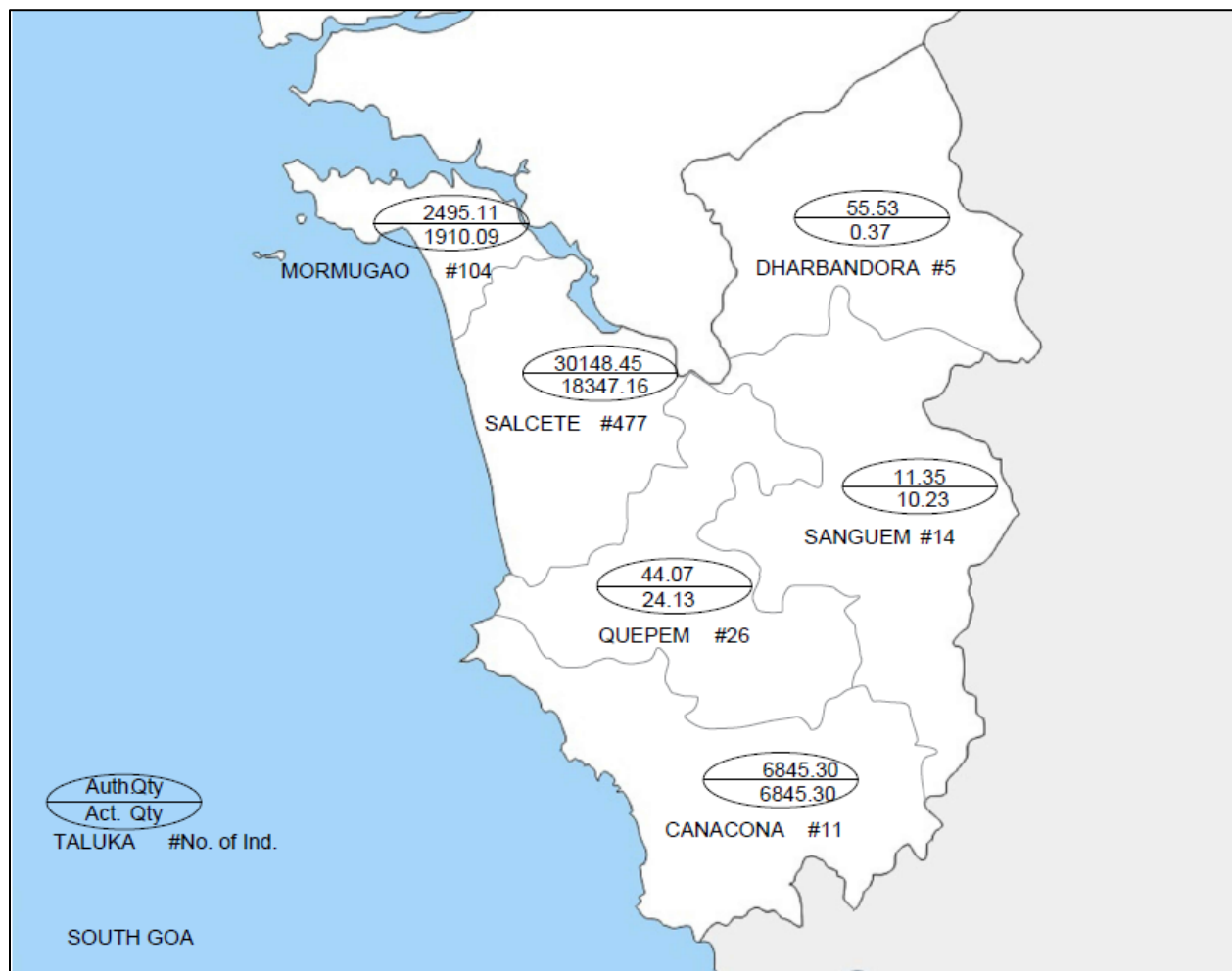


Figure 7: Talukawise Spatial distribution of hazardous waste in South Goa District

The figure 7 represents the Talukawise Spatial distribution of Hazardous waste in North Goa District.

Table 4: IDC wise Hazardous Waste Generation

IDC wise	Nos	Authorized Qty (MTA)	Actual Qty (MTA)
Bethora	21	148.43	25.12
Bicholim	17	46.54	88.39
Canacona	6	6844.47	6844.47
Colvale	12	4003.90	4765.47
Corlim	17	33.13	29.91
Cuncolim	40	10459.01	3811.18
Honda	11	283.95	271.10
Kakoda	13	40.98	21.04
Kundaim	81	7848.37	739.24
Madkaim	26	2254.11	583.87
Mapusa	6	8.62	8.62
Margao	33	39.59	52.95
Outside IDC	1051	50300.69	23020.12
Pilerne	36	954.63	359.65
Pissurlem	13	353.39	103.22
Sancoale	24	39.98	39.98
Sanguem	2	1.45	1.45
Thivim	35	22690.63	22736.67
Tuem	9	14.44	11.99
Verna	132	18700.43	13538.58

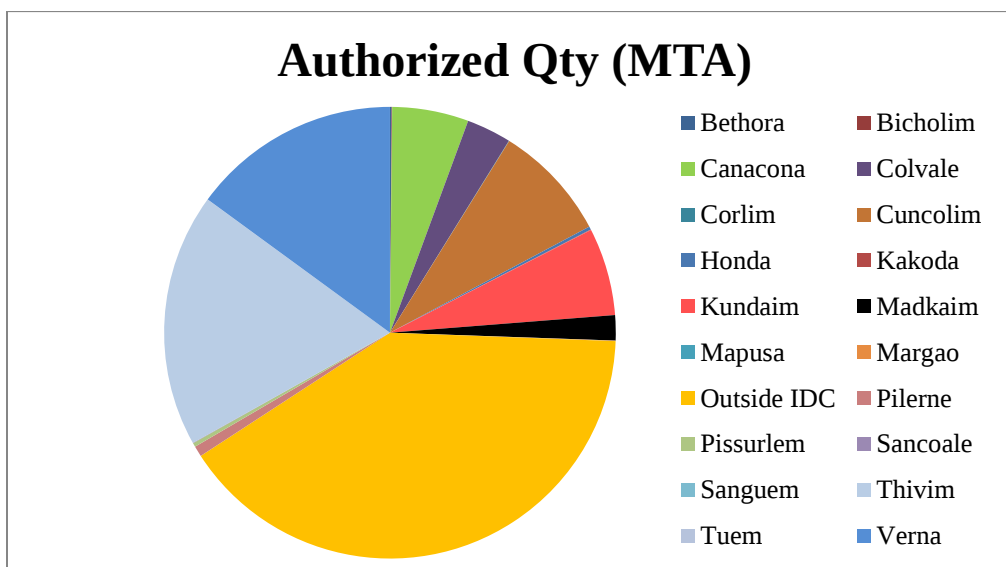


Figure 8: IDC wise Authorized hazardous waste in State of Goa

The above figure represents the Authorized Hazardous waste distribution with respect to IDC in Goa State. From the figure 8 Authorized Hazardous waste distribution are as follow, the major authorized generator of hazardous waste consist of 40% from Outside IDC, 18% in Thivim

15% Thivim 8% in Cuncolim ,6% Kundaim and 5% in Canacona 3% and 2% in Colvale and Madkaim respectively.

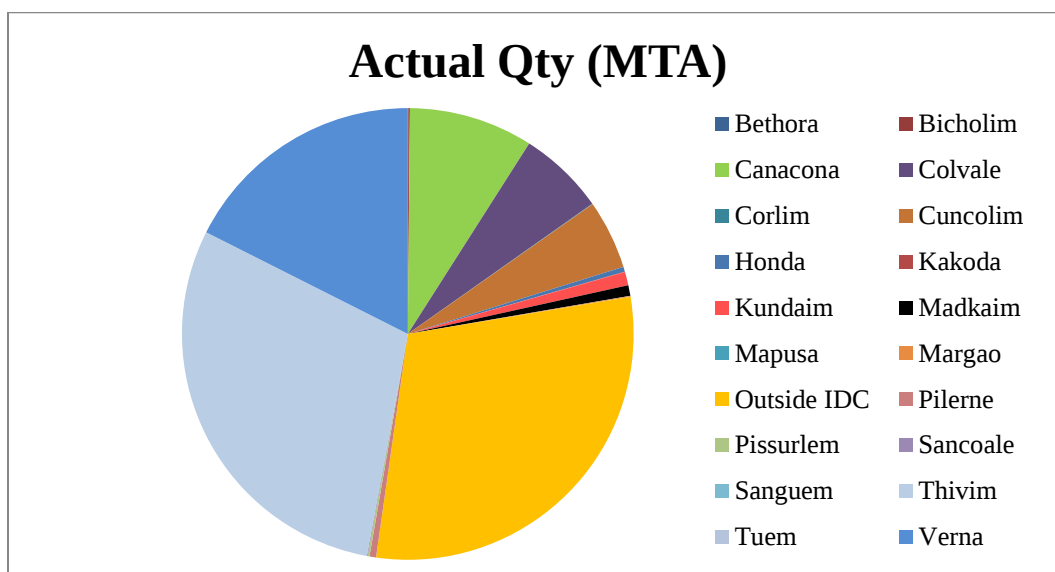


Figure 9:IDC wise Actual hazardous waste in State of Goa

The above figure represents the Actual Hazardous waste distribution with respect to IDC in Goa State. From the figure 9 Actual Hazardous waste distribution are as follow, the major actual generator of hazardous waste consist of 30% in both Thivim and Bardez, 18% in Verna, 9% in Canacona, 6% in Colvale and 5% in Cuncolim and 1% in both Madkaim and Kundaim

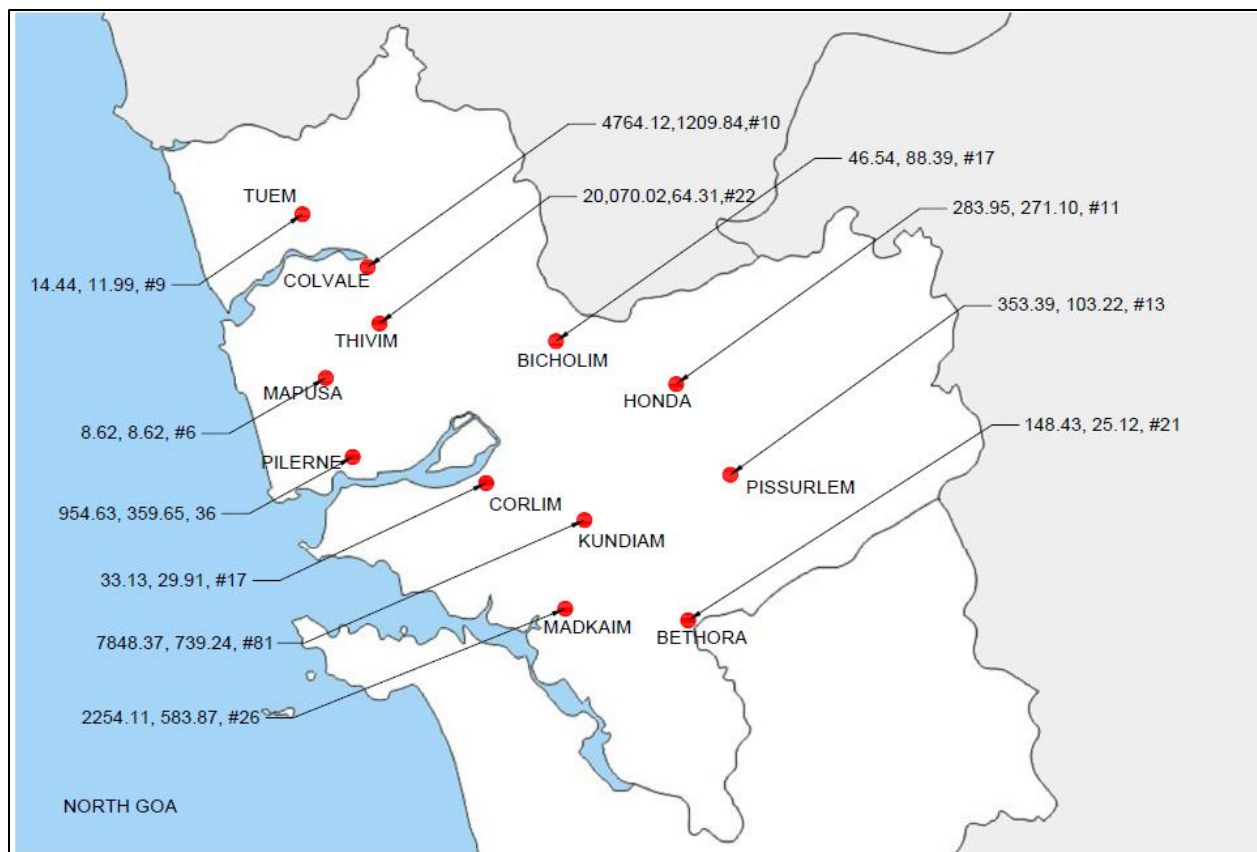


Figure 10: IDC wise Spatial distribution of hazardous waste in North Goa District

The Figure 10 represents the Spatial distribution of Hazardous waste in North Goa District with respect to each IDC, the legends indication are as follows: **Authorized Qty(MTA), Actual Qty (MTA), No. of Industries (Ex:123, 456, #7).**

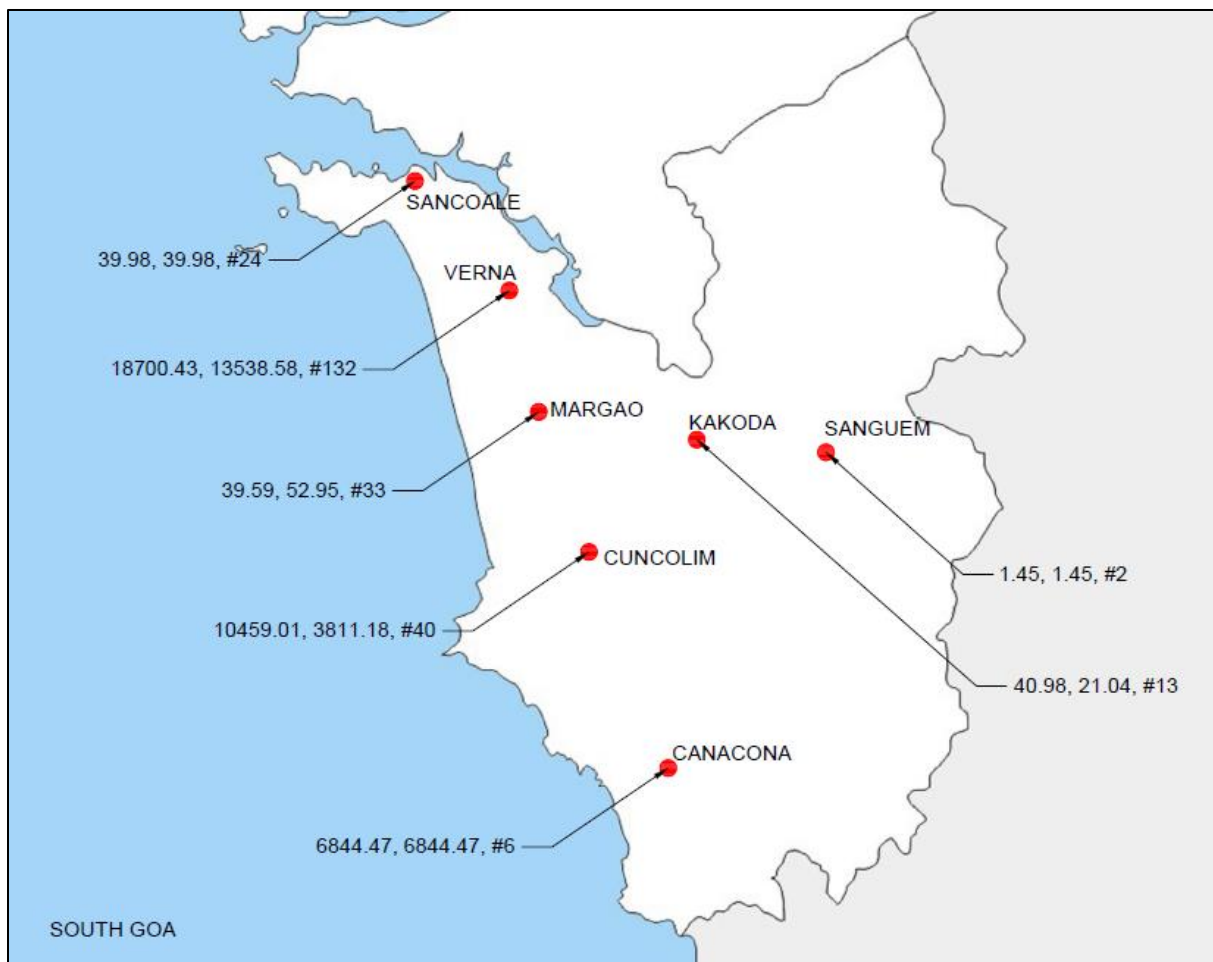


Figure 11: IDC wise Spatial distribution of hazardous waste in South Goa District

The Figure 11 represents the Spatial distribution of Hazardous waste in North Goa District with respect to each IDC, the legends indication are as follows: **Authorized Qty(MTA), Actual Qty (MTA), No. of Industries (Ex:123, 456, #7).**

Database is presented in Annexure and submitted to GSPCB in .xls file

Annexure1: List of hazardous waste generators authorized by GSPCB

This annexure consist inventory data of 1587 hazardous waste generators in State of Goa. The hazardous waste generation as per assesment (MTA) is updated as per authorization provided by GSPCB. Out of 1587, around 1029 establishments generating major hazardous waste covered physically during inventory audit survey. The rest 558 establishments been minor units such as Fabrication, Hotels and Restuarant, Residential complex, Hospitals, Shopping units etc are updated documentary from GSPCB list.

Annexure 2: List of hazardous waste generators with actual generation of hazardous waste

This annexure consist, inventory data of 1587 hazardous waste generators in State of Goa. The hazardous waste generation as per assesment (MTA) is updated per Annual returns (Form IV)

District wise

Annexure 3: List of hazardous waste generators in North Goa District

Annexure 4: List of hazardous waste generators in South Goa District

Annexure 5-16 consist list of hazardous waste generator Taluka wise

North Goa

Annexure 5: List of hazardous waste generators in North Goa District Taluka wise - Bardez

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Annexure 17-36 consist list of hazardous waste generator IDC wise

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Annexure 33: List of hazardous waste generators in Sanguem IDC
Annexure 34: List of hazardous waste generators in Thivim IDC
Annexure 35: List of hazardous waste generators in Tuem IDC
Annexure 36: List of hazardous waste generators in Verna IDC

Annexure 37: List of hazardous waste generators requires amendment and new authorization

In this annexure, 66 establishment are listed as follows

Sheet1:Amendment Required (19 establishments)

Sheet2:New Authorization for Hazardous waste generators (11 establishments)

Sheet3:List of Company operating without CTO (Non Hazardous waste generators - 36 establishments)

Annexure 38: List of hazardous waste generators with error in authorization values

This annexure includes 79 establishments with high authorized value ,but in practice these establishments generates comparatively less quantity of hazardous waste.

VI. Discussions and Recommendations

At present, there is no Common Hazardous Waste Storage Treatment & Disposal Facility in the state of Goa. Generators of Landfillable waste are presently storing waste in their own premises and generator of Incinerable wastes are transported to Mumbai Waste Management Facility through authorized dealers. The Recyclable wastes are being collected by authorized collectors and recyclers, these are partially recycled in the state and a major portion is transported for recycling. With Hazardous waste been transported via Transboundary Movement to other state, it was observed during the auditing of Industries there was no proper maintainances of manifest system (7 copies) as prescribed in Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. Other Statutory requirement as per the rules are neglected by few of the industries.

Few companies have their own captive landfills and inhouse incinerators. Syngenta India Ltd. for example has inhouse facility for incineration of Hazardous waste. This facility is utilized only for the waste generated in their own plants. The incinerable waste from other generators is transported to the Common Hazardous Waste Treatment & Disposal Facility at Taloja, Maharashtra. Nicomet has its own captive landfill for handling Hazardous waste generated within the factory. The legacy waste was not included in the scope of the survey.

The proposed CHWTSDF has to be designed considering the present and prospective generation of waste. The economics and sustainability of the functioning is affected by the waste received.

- An inventory can be said to be a dynamic state and needs updation on a regular basis as various factors such as setting up of new units, expansions/modernisation/advancement of existing units as well as setting up new technology, change in the product mix will change the profile of hazardous waste generation. In view of these factors, updating of the inventory shall be carried out on a quarterly basis.
- It is recommended that periodic visit shall be made to non hazardous establishment to check if they would need authorization for operating as hazardous waste generators.
- Training programme shall be organized for board officers to impart necessary knowledge for understanding manufacturing processes and activities leading to generation of hazardous waste.
- Sector wise specialised training programme shall be conducted at and industrial estates to minimize the waste generation and to handle the waste safely and efficiently.
- Industries while applying for consents/authorization shall be asked to submit complete information in respect of raw materials, catalyst, intermediates and finished products. Material balance in respect of chemical processes will also be asked to verify information pertaining to waste generation.
- The master database has been created which would be collate all the information mandated under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

Observation:

- 36 industries needs valid consent to operate
- 11 industries needs Hazardous waste authorisation
- 19 industries needs category/ quantity ammendment as per the process reported
- 79 industries needs amendment after verification of actual generation