

In sum, it is well-known that the Crude Synthetic Dyes production process is extremely complicated and rather highly polluting. No wonder, several states in India and several countries in the world discourage the production of these dyestuffs. Because the raw materials and intermediates involved in the production of Crude Synthetic Dyes are extremely reactive and corrosive; the maintenance routine should be commensurate with the propensity of rusting and evolution of fumes in the process plant.

Clearly, poor maintenance and upkeep could generate an unsafe work environment and pose higher risk to the workers' safety and environment. In addition to this, safety devices such as relief valves, process control equipment, pressure relief valves, etc. must be maintained and replaced as per the industry standards and the best-recommended practices.

The investigation team from IIT Bombay has taken a serious note of these facts and would recommend rather strongly that the housekeeping and maintenance should be improved remarkably in the nearest future. Adequate Personal Protective Equipment (PPE), uniform for all personnel, labelling of equipment, tanks and pipelines should be taken up as the first priority and serious efforts should be made to create the positive first impression.

**Constructing a New and Robust Stormwater Collection and Treatment System:** The investigation team from IIT Bombay visited Bodal Unit VII multiple times and has taken note of the fact that the stormwater collection system is inadequate in its current installation. Bodal Unit VII produces H-Acid, Vinyl Sulphone,  $\beta$ -Naphthol and crude dyestuff. It is a well-known fact that although the H-Acid final product is a greyish-white powder, H-Acid solutions in water have a dark blue to blackish colour even at low concentrations. This property of H-Acid is the primary reason that the stormwater runoff from the H-Acid plant and its surrounding areas will more often than not have a dark blue or blackish colour and some amount of COD.

A new stormwater drainage system should be constructed which will adequately intercept the surface water and stormwater runoff as per industry standards and divert the water to the ETP for treatment. Since the stormwater from this industry will have COD contributed by highly recalcitrant organic compounds, under no condition should the surface water runoff and/or stormwater runoff be let off into the channel or the environment without treatment in the ETP first. Hence, a new and robust stormwater collection and treatment system must be constructed to intercept and treat the stormwater and surface water runoff as per industry standards. This endeavour must be taken up as the first priority.

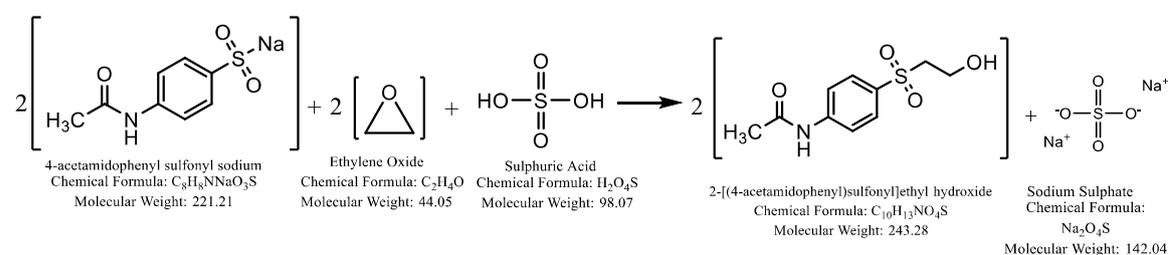
**Constructing a New and Robust Process Wastewater Conveying System:** The Crude Synthetic Dyes production processes generate dark coloured effluent with a high COD. This wastewater is then carried to the Effluent Treatment Plant (ETP) for treatment and subsequent disposal into the VECL channel. Currently, at Bodal Unit VII, the wastewater is carried to the ETP through a network of gutters (covered with removable grates / slabs). During monsoon, for ensuring the safe and uninterrupted production, the premises of production plant needs to be maintained free from any accumulation and inundation. In the events of storms and heavy rainfall, the possibility of process effluent in the gutters getting mixed with the surface runoff cannot be ruled out and may even overflow above-ground. There exists unacceptable groundwater pollution already in the region.

Hence, to exercise the abundant precaution, it is strongly recommended that the underground pipelines and open gutters must be demolished with priority and the closed-conduit networks above-ground must be established.

In summary, a new and robust process wastewater conveying system should be constructed as per industry standards – which will be a closed pipe above-ground, and divert all the wastewater to the ETP for treatment. This task must be undertaken as the first priority.

## 1.14 Critical Comments on Ethylene Glycol Generated in Condensation Step in Vinyl Sulphone Production

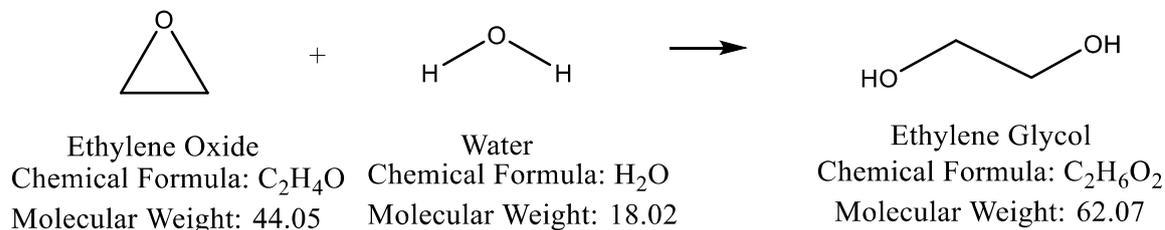
Ethylene Oxide is a reactant, used in the Condensation step which is the second to last step in Vinyl Sulphone production. This process is sometimes also referred to as Ethoxylation since an Ethyl group is added to the structure. The reaction in this step is as follows:



The Ethylene Oxide addition must be closely monitored and the excess amount must be reduced as much as possible. Although an excess is necessary to drive the reaction to completion since there is a lot of water present in the reaction mass on account of multiple

additions in the drowning and filtration steps, the excess Ethylene Oxide reacts with water present in the reaction mass and forms Ethylene Glycol as seen in the reaction below:

Ethylene Oxide and Water reaction:



It is nearly impossible to bio-degrade the resulting Ethylene Glycol – when and if it is let out to be treated in the Effluent Treatment Plant (ETP).

In fact, Bodal Unit VII has made efforts by subjecting the resulting filtrate or ‘Mother Liquor’ (separated by using Centrifuge) to Multiple Effect Evaporation (MEE) concentrator and thereby create the concentrated liquid mass containing excess salts, Ethylene Glycol, and several other by-products that could not be separated in filtration step.

Further, this concentrated liquid is subjected to a Spray Dryer followed by a Cyclone Separator and followed by a Wet Scrubber the associated moisture is removed. The resulting damp residues are shipped periodically for final disposal into landfill at CHW-TSDF (*i.e.* Common Hazardous Waste – Treatment, Storage and Disposal Facility) duly authorized by GPCB.

In the opinion of the author of this report, there are two potential sources of pollution from Bodal Unit VII – which are described one by one in the following sections.

Thus, Ethylene Glycol generated in the Condensation step could be separated and disposed of in the following two possible routes:

The first possibility is that the ‘Ethylene Glycol would end up in the MEE condensate’.

It is well known that Ethylene Glycol and Water form an azeotrope at lower mole fractions. Another complicating factor about Ethylene Glycol-water mixture lies in the fact that it vaporizes rather readily even at low temperatures when subjected to evaporative operations like MEE (Multiple Effect Evaporation) or MVR (Mechanical Vapour Recompression). Thus, Ethylene Glycol would selectively escape in the vapour phase and ultimately end up in condensate of MEE (or MVR). As a result, more likely than not, the concentrated liquid

to be purged from MEE would have an azeotropic concentration of Ethylene Glycol in the liquid. Also, the COD of condensate from MEE will be much higher.

Based on the detailed mass balance performed on Vinyl Sulphone manufacturing process in this study, the estimated Ethylene Glycol formed at the end of the Condensation reaction would be about 215 Kg per ton of Vinyl Sulphone production. It must be noted that the Ethylene Glycol will nearly entirely end up in filtrate after subjecting the reaction mass to the Centrifuge. More precisely, the filtrate (*i.e.* mother liquor), subjected to evaporative process would have approx. 5% w/w Ethylene Glycol in approx. 65% w/w water and the balance is unreacted chemicals, by-products and salts, as seen in **Table 1.18** below:

**Table 1.18** The estimated typical composition of the filtrate generated from the Centrifuge after Condensation step. The concentrations are expressed in Kg per Ton of Vinyl Sulphone production as well as % w/w. This filtrate is conventionally named as ‘Mother Liquor’ when subjected to MEE.

Sr. No.	Constituent	Kg per Ton of VS production	% w/w in Filtrate
1	Ethylene Glycol	215	4.6%
2	Unreacted NaOH	24	0.58%
3	Unconverted 'Acetamidophenyl Sulphate Sodium Salt' (AASS) & 'Acetyl Sulphonyl Chloride' (ASC)	77	1.6%
4	Precursor to VS [2-[(4-acetamidophenyl)sulfonyl]ethyl hydroxide]	62	1.32%
5	Salts (NaHSO <sub>3</sub> + Na <sub>2</sub> SO <sub>4</sub> + NaCl)	1,276	27.31%
6	Water in filtrate ( <i>i.e.</i> Mother Liquor)	3,018	64.59%
<b>Total =</b>		<b>4,672</b>	<b>100%</b>

Clearly, after subjecting the mother liquor having the composition given in Table 1.18 to MEE, the large fraction of Ethylene Glycol would escape to vapours and end up into condensate. As a result, the COD of condensate will be much higher.

The second possibility is the ‘Ethylene Glycol ends up in the Spray Dryer’.

It was repeatedly reported by Bodal Unit VII that they have been recycling the condensate from MEE back into several unit processes and also for washing filter cake in unit operations during the subsequent batches of Vinyl Sulphone production. It was clarified

that it was difficult to pinpoint which lot of condensate gets recycled / reused in which subsequent batch – because the condensate stream is typically diverted to a storage facility of utility water. Water is drawn, as and when required, from that storage facility for use in subsequent batches of Vinyl Sulphone production.

The Ethylene Glycol in the concentrate stream will finally be subjected to Spray Drying in the Zero Liquid Discharge (ZLD) system. The Spray Dryer is operated at high temperatures (approx. 640°C) which, depending on the operating conditions, will lead to partial degradation of Ethylene Glycol. The non-degraded portion of Ethylene Glycol (along with hot air and other pollutants) will further be subjected to Cyclone Separator and Wet Scrubber. The temperatures in these unit operations are not high enough to degrade Ethylene Glycol.

Reportedly, the temperature maintained in the Wet Scrubber is about 90°C which is much lower than the boiling point of Ethylene Glycol. This will result in some portion of the remaining undegraded Ethylene Glycol to end up in the solid residue obtained from the Wet Scrubber. This residue is then sent for landfilling to the authorized CHW-TSDF. Since the liquid is subjected to a multitude of physico-chemical processes with insufficient scientific data and scientific studies, the extent of Ethylene Glycol sent to CHW-TSDF could not be estimated with reliable accuracy.

In view of the above facts, the quick and targeted R&D is required to significantly reduce the high COD of the mother liquor (especially addressing Ethylene Glycol) emanating from the plant before subjecting it to MEE, and eventually disposing of the Spray Dryer Ash in CHW-TSDF. The current practice is neither acceptable from the environmental perspective, nor it is helping in attaining the goal of achieving the so-called “Zero Liquid Discharge (ZLD)”.

### **1.15 Critical Assessment of the ZLD Systems for H-Acid and Vinyl Sulphone Plants**

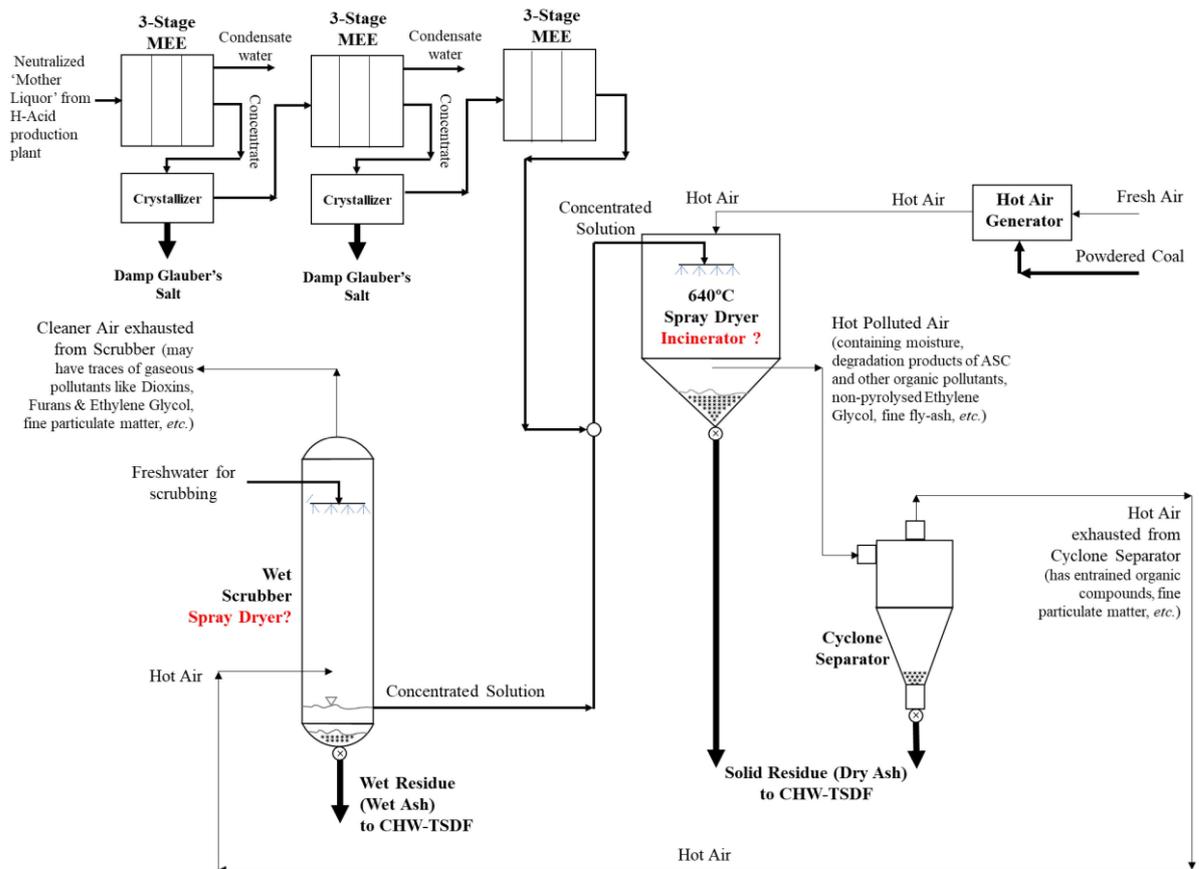
**Figure 1.15** depicts the treatment of the neutralized ‘mother liquor’ obtained from the H-Acid production process – which is aimed at achieving the goal of ‘zero liquid discharge’ (ZLD). Also, **Figure 1.16** depicts the process flow-diagram for the “ZLD system”,

installed at Bodal Unit VII, for the treatment of the effluent from the Vinyl Sulphone production process – which is aimed at achieving the goal of ‘zero liquid discharge’ (ZLD).

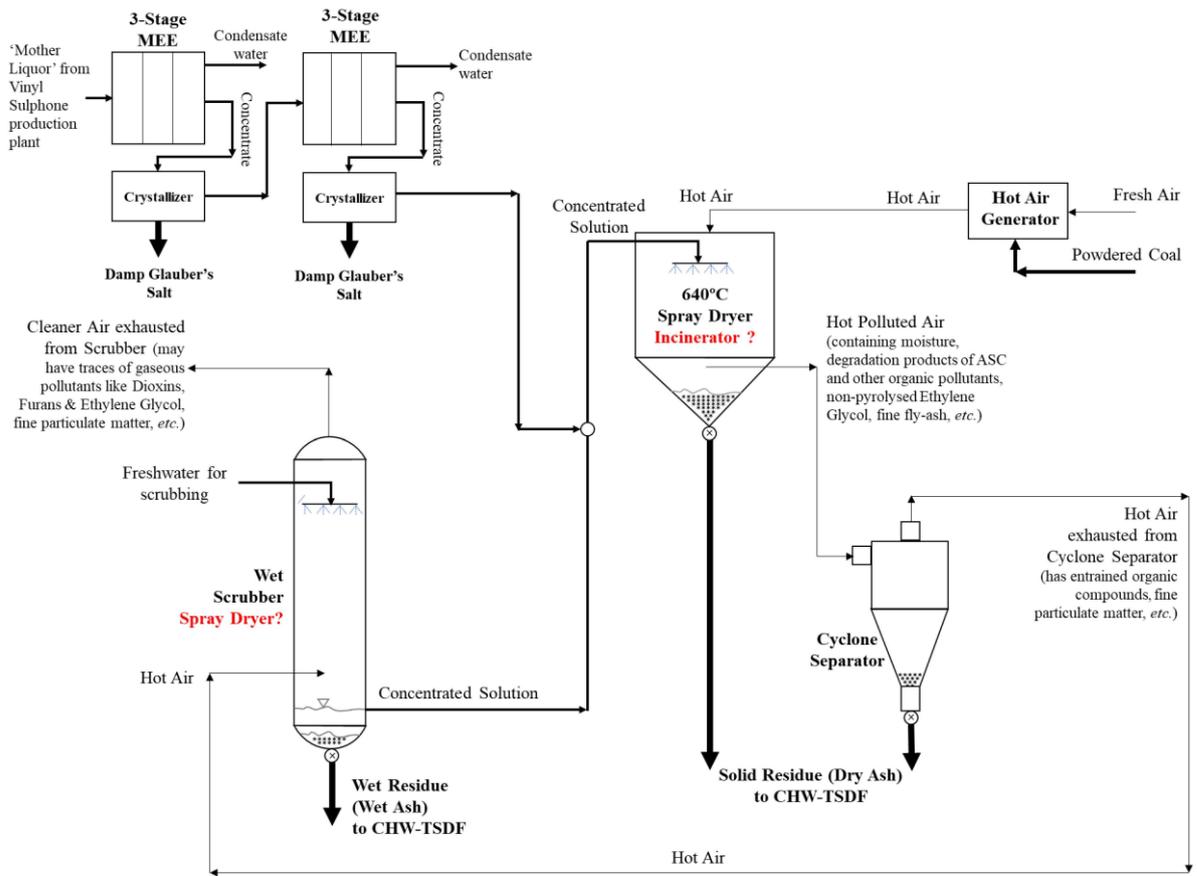
**Description of the ZLD Systems:** It must be noticed that both ZLD systems, shown in Figure 1.15 and Figure 1.16, are more or less comparable; having minor differences related to the number of MEE units. As seen from the Figures, in both the ZLD systems, the effluent from the production plant is first brought into the first 3-stage MEE. The water from the solution is evaporated along with some transfer of Ethylene Glycol along with it, and recovered as condensate. The concentrate is then sent to the Crystallizer where the Glauber’s Salt is precipitated and separated out using Pusher Centrifuge. Thus, damp Glauber’s Salt is obtained and the resulting further concentrated stream is sent to the second 3-stage MEE for evaporation of water. After recovery of water as condensate, the concentrate is sent to the second Crystallizer where the same process is repeated. For Vinyl Sulphone ZLD system, the concentrate from the second Crystallizer is sent to the inlet of the Spray Dryer. For H-Acid, there is a third 3-stage MEE from which the condensate is recovered and the further concentrated stream is sent to the inlet of the Spray Dryer.

The Hot Air Generator is devised to generate hot air at approx. 640°C and let into the Spray Dryer from the bottom. As seen from the Figure, the concentrated solution is brought from the MEE and sprayed into the Spray Dryer; to drive moisture from the fine droplets created at the top of the Spray Dryer. Apparently, as the fine droplets descend in the columnar structure of the Spray Dryer, the hot air ascending in the column helps in driving the moisture out of the fine droplets – which is sourced from the Hot Air Generator. The resulting dry powder (dry ash), collected at the bottom of the Spray Dryer, is unloaded and stored in the storage yard.

It should be noticed from the Figures, that the hot air exhausted from the Spray Dryer is let into the Cyclone Separator – which will separate the particulate matter entrained from the Spray Dryer. However, the Cyclone Separator is not capable of removing fine particulate matter and any gaseous pollutants including vapours of Acetic Acid or Ethylene Glycol. This dirty hot gas is further subjected to wet scrubbing by sparging at the bottom of the Wet Scrubber. The resulting coarse particles of dry powder (dry coarse ash), collected at the bottom of the Cyclone Separator, is unloaded and stored in the storage yard.



**Figure 1.15** The process flow-diagram for the “ZLD system”, installed at Bodal Unit VII, for treatment of the neutralized ‘mother liquor’ obtained from the H-Acid production process – which is aimed at achieving the goal of ‘zero liquid discharge’ (ZLD).



**Figure 1.16** The process flow-diagram for the “ZLD system”, installed at Bodal Unit VII, for the treatment of the effluent from the Vinyl Sulphone production process – which is aimed at achieving the goal of ‘zero liquid discharge’ (ZLD).

The freshwater for scrubbing is sprayed with the help of venturi mechanism into the Wet Scrubber; to drive moisture from the fine droplets created at the top of the Scrubber. Apparently, as the fine droplets descend in the columnar structure of the Wet Scrubber, the hot air ascending in the column helps in driving the moisture out of the fine droplets. In fact, the ascending hot air (loaded with fine particulate matter, Acetic Acid or Ethylene Glycol, *etc.*) is sourced from the outlet of the Cyclone Separator.

The resulting slurry, collected at the bottom of the Wet Scrubber, is allowed to settle for a suitable period and the supernatant liquid is further subjected to Spray Dryer. The settled mass at the bottom of the Wet Scrubber is removed and stored separately in the storage yard.

The wet slurry collected from the bottom of the Wet Scrubber is stored separately in the storage yard until free liquid oozes out of the pile. Subsequently, the damp slurry is sent periodically to the authorized CHW-TSDF for landfilling (final disposal as permitted by GPCB in the consent). Similarly, the dry ashes unloaded from the Spray Dryer and Cyclone Separator are periodically sent to the authorized CHW-TSDF for landfilling (final disposal as permitted by GPCB in the consent).

**Critical Comments on the ZLD Systems:** The effluent emitted from both the production plants is then subjected to various unit operations and unit processes in their respective Zero Liquid Discharge (ZLD) systems – which might result in their subsequent chemical transformations and most of those compounds will end up in the Spray Dryer ash.

Of all the compounds mentioned in Table 1.8, the possible transformation products of Acetyl Sulphonyl Chloride (ASC), are especially worrisome; since the chlorinated compounds such as ASC, when subjected to low temperature processes such as spray drying (conducted at 640°C) tend to form extremely toxic and hazardous gaseous pollutants known as ‘Dioxins’ and ‘Furans’. How, when and up to what extent are these extremely toxic pollutants formed in any pyrolytic unit operation (in this case the Spray Dryer) is not completely understood yet – but, they are surely synthesized (the by-products of pyrolytic action) even in the situations wherein the chlorinated pollutants in trace quantities are subjected to pyrolytic processes.

Therefore, all over the world, no regulatory agency permits the presence of chlorinated compounds in any pyrolytic unit operation – unless a longer retention time is designed in

the hot zone and the hot zone is maintained at extremely high temperature. As a result, the regulatory framework for disposing of the chlorinated organic compounds insists destruction of these compounds only in a properly designed incinerator.

As per the hazardous waste-related regulations and rules, over the past two decades, demand for use of the scientifically designed incinerator, having extremely hot incineration zone and more than adequate retention time in the hot zone.

The author of this report is surprised to notice that the so-called “Spray Dryers” (employed for the H-Acid production plant as well as for the Vinyl Sulphone production plant) in Bodal Unit VII are being operated at 640°C! Nobody noticed the presence of toxic organic pollutants in the concentrated liquids subjected to pyrolytic conditions?

The author of this report is even more concerned about permitting the use of wrong terminologies for the equipment provided in the system to achieve the so-called “Zero Liquid Discharge (ZLD)” status. In the considered opinion of this author, the “ZLD system”, “Wet Scrubber” and “Spray Dryer” are the misnomers and (in fact) are misleading!

As shown in Figure 1.15 and Figure 1.16, the so-called “Wet Scrubber” is scrubbing the hot gases having finer fly-ash particulates, chemical particulates, and gaseous pollutants exhausted from the Cyclone Separator. It is interesting to note that this “Wet Scrubber” is generating loads of oozing wet residue – which is blended with the residue from “Spray Dryer” and disposed of in the hazardous waste landfill.

Also, in the so-called “Spray Dryer”, the concentrated liquid from MEE and bottom of the “Wet Scrubber” is spray dried at 640°C. Typically, the purpose of Spray Dryer is to evaporate water at lowest possible temperatures (to achieve heat energy economy) from the concentrated liquid droplets and the resulting dry particulate matter settles at the bottom of Spray Dryer.

Classically, the Spray Drying operation is conducted only to dry out the moisture from concentrated liquid droplets. The real purpose of maintaining 640°C temperature in Spray Dryers devised in case of Bodal Unit VII, is to thermally decompose organic pollutants (*e.g.* thermal decomposition of Acetic Acid in case of H-Acid production and thermal decomposition of Ethylene Glycol in case of Vinyl Sulphone production).

Therefore, the author of this report is of the opinion that the real name for the so-called “Spray Dryer” should be the “Incinerator”. It must also be noted here that there is no provision of any air pollution control for cleaning the exhaust of “Wet Scrubber”.

In sum, the most important alteration, that must be implemented is regarding the use of the so-called “Spray Dryers” – which are operated at 640°C. Such polluting unit operations must be discontinued. Instead, the scientifically designed Dryers should be installed (if necessary) to dry the concentrated slurries obtained from the MEE and the bottom of the Spray Dryers as well as the wet residue obtained from the so-called “Wet Scrubbers”.

In addition, the misleading names of the unit operations installed as part of the so-called “ZLD system” must be corrected, both, by Bodal Unit VII as well as GPCB in their consent issued to the company. By permitting and continuing the misleading terminology, the several shortcomings in the current ZLD systems, from the perspective of environmental and work safety norms, have not been noticed for several years.

## **1.16 Critical Comments on the Management of Solid Hazardous Wastes**

As discussed earlier, many categories of hazardous wastes are generated through the H-Acid and Vinyl Sulphone production processes (refer to Sections 1.2 through 1.6). In addition, hazardous wastes are generated in the Zero Liquid Discharge (ZLD) systems of, both, H-Acid and Vinyl Sulphone production plants (as discussed above in Section 1.15) and in the Effluent Treatment Plant (refer to Section 1.17).

**Table 1.19** presents the comparison of the quantities of various Solid Hazardous Wastes generated from H-Acid and Vinyl Sulphone production plants, the Effluent Treatment Plant as well as from both the Zero Liquid Discharge (ZLD) systems. The comparison has been made between the quantities reported by Bodal Unit VII and the respective estimates made by IITB for three-year production data *i.e.* for 2018-19, 2017-18 and 2016-17. The quantities estimated by IITB are highlighted in blue text. The graphical comparison of these estimations is depicted in **Figure 1.17**.

Further, it can be observed from the Table that the categorically separate data for the hazardous waste generation (*i.e.* Gypsum from H-Acid production, Gypsum Sludge from

Neutralization in H-Acid ZLD system, and Gypsum from Neutralization in ETP) have not been provided by Bodal Unit VII – which is recorded in the Table. Instead, a grand total of the total Gypsum Sludge generation has been reported by Bodal Unit VII.

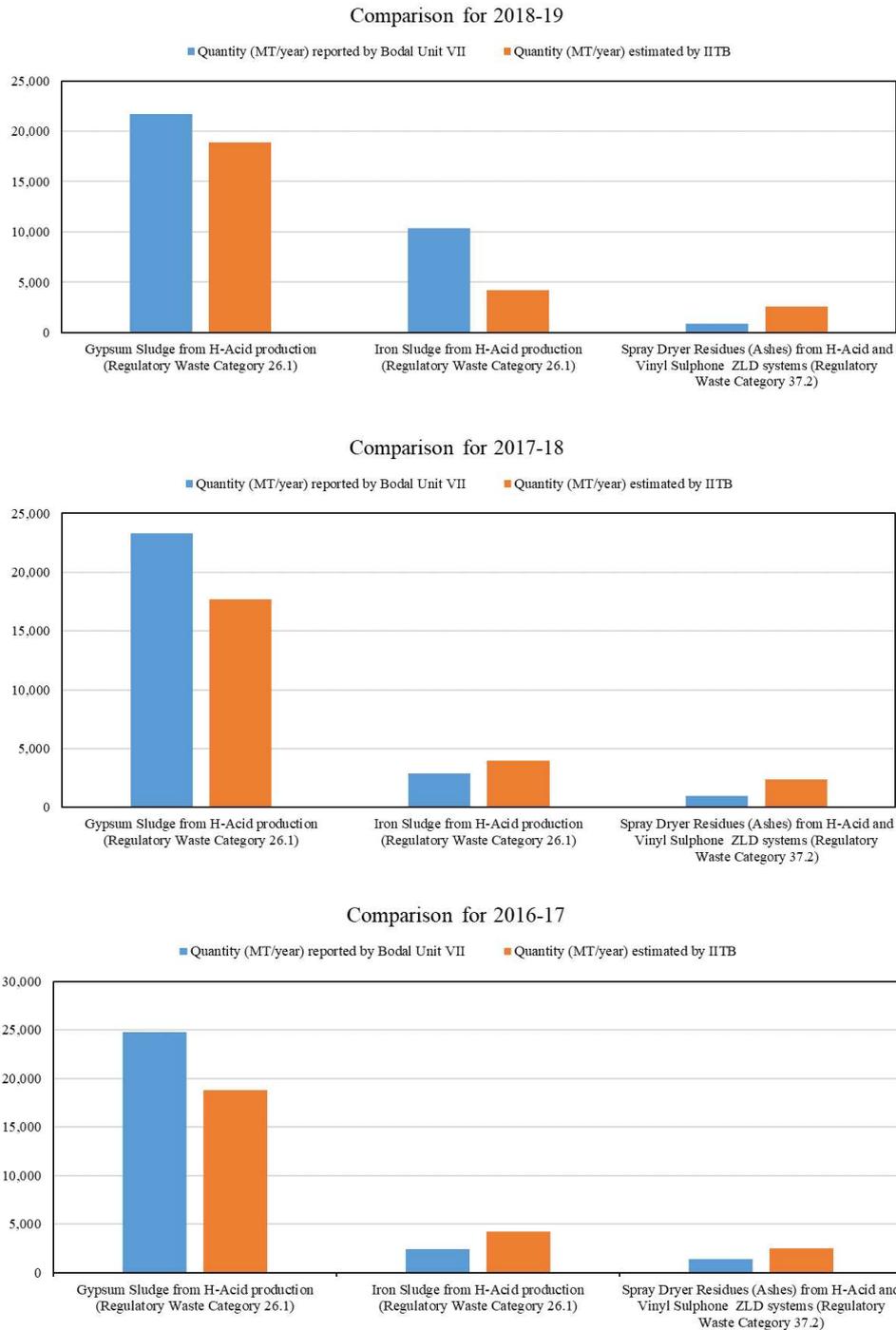
It is noteworthy (as seen from the Table) that although the production quantities of H-Acid and Vinyl Sulphone are comparable corresponding to the financial years 2018-19, 2017-18 and 2016-17; the reported variability (by Bodal Unit VII) of the respective hazardous waste quantities for the two years is remarkable. This exercise is undertaken to analyse the margin of difference between the quantities reported by Bodal Unit VII and the estimated values by IITB team.

Further, **Figure 1.18** presents the co-relation between the values of the Total Hazardous Waste generation for three years estimated by IITB and the corresponding values reported by Bodal Unit VII. The comparison has been made between the quantities reported by Bodal Unit VII and the respective estimates made by IITB for three-year production data *i.e.* for 2018-19, 2017-18 and 2016-17. It is evident from the Figure that the theoretical estimates (prepared by the author of this report) for the three years are more than those reported by Bodal Unit VII. The line having 1:1 slope, placed on the Figure, provides a visual impression of the same. In addition, the data were processed through linear regression, that yielded the slope of 0.67 for the best-fit line “ $y = mx$ ”. The exceptionally high coefficient of determination ( $R^2 = 0.99$ ) for this regression suggests that the co-relation is indeed significant.

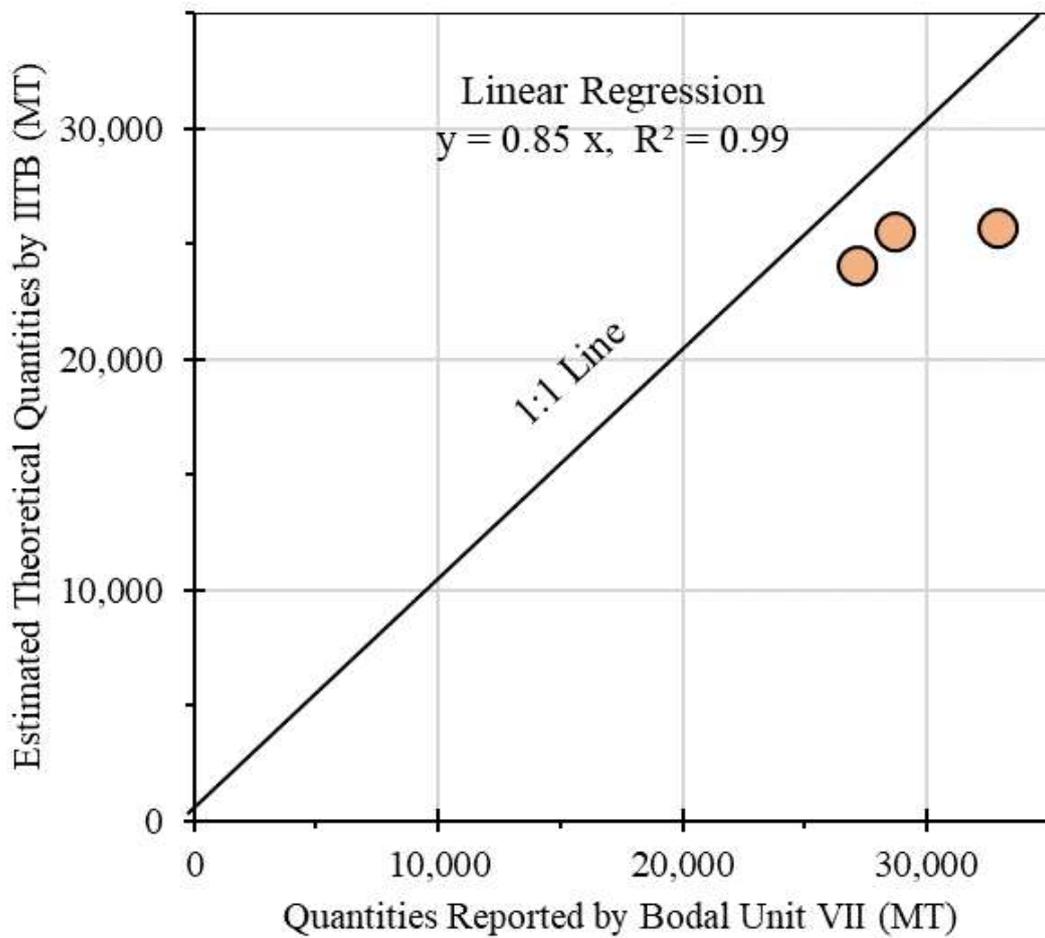
Upon the closer inspection of Table 1.19, it appears that the Spray Dryer ashes from, both, Zero Liquid Discharge systems (cumulative values for H-Acid and Vinyl Sulphone) have been systematically reported on the lower side. For example, the production quantities of both H-Acid and Vinyl Sulphone in 2018-19 are comparable with those reported in 2017-18 by Bodal Unit VII. However, the quantity of cumulative Spray Dryer ashes in the year 2018-19 is approx. 55% lower than the theoretical quantity estimated by the IITB team! There is no logical reason to explain this discrepancy (refer to Table 1.19).

**Table 1.19** Comparison of the quantities of various Solid Hazardous Wastes generated from H-Acid and Vinyl Sulphone production plants, the Effluent Treatment Plant as well as from both the Zero Liquid Discharge (ZLD) systems. The comparison has been made between the quantities reported by Bodal Unit VII and the respective estimates made by IITB for three-year production data *i.e.* for 2018-19, 2017-18 and 2016-17.

Sr. #	Product-wise Description of Hazardous Wastes	Quantity reported by Bodal Unit VII for 2018-19 (MT)	Quantity estimated by IITB for 2018-19 (MT)	Quantity reported by Bodal Unit VII for 2017-18 (MT)	Quantity estimated by IITB for 2017-18 (MT)	Quantity reported by Bodal Unit VII for 2016-17 (MT)	Quantity estimated by IITB for 2016-17 (MT)	Current Route for Final Disposal
<b>1</b>	<b>H-Acid production</b>	1,783		1,670		1,777		
<b>1.1</b>	Gypsum Sludge from H-Acid production (Regulatory Waste Category 26.1)	21,677 (Combined of 1.1 + 1.2 + 2.1)	<b>11,526</b>	23,313 (Combined of 1.1 + 1.2 + 2.1)	<b>10,794</b>	24,801	<b>11,485</b>	Cement Industry
<b>1.2</b>	Gypsum Sludge from Neutralization in H-Acid ZLD system (Regulatory Waste Category 35.3)	Not provided separately	<b>1,904</b>	Not provided separately	<b>1,783</b>	Not provided	<b>1,897</b>	CHW-TSDF and / or Cement Industry
<b>1.3</b>	Iron Sludge from H-Acid production (Regulatory Waste Category 26.1)	10,334	<b>3,222</b>	2,867	<b>3,017</b>	2,440	<b>3,210</b>	Cement Industry
<b>2</b>	<b>Vinyl Sulphone production</b>	2,376		2,239		2,267		
<b>2.1</b>	Gypsum from Neutralization in ETP (Regulatory Waste Category 35.3)	NA	NA	NA	NA	NA	NA	NA
<b>2.2</b>	Spray Dryer Residues (Ashes) from H-Acid and Vinyl Sulphone ZLD systems (Regulatory Waste Category 37.2)	902	<b>2,007</b>	958 (Incinerator + Spray Dryer)	<b>1,886</b>	1,410 (Only Incinerator)	<b>1,952</b>	CHW-TSDF
<b>Total Haz. Waste Generation (MT)</b>		<b>32,914</b>	<b>18,659</b>	27,138	<b>17,480</b>	28,650	<b>18,544</b>	



**Figure 1.17** Graphical representation of the co-relation between the values of the Total Hazardous Waste generation for three years estimated by IITB and corresponding the values as reported by Bodal Unit VII. The Total Hazardous Waste generation consists of the yearly quantities of the Hazardous Wastes generated from H-Acid and Vinyl Sulphone production plants, the Effluent Treatment Plant as well as from both the Zero Liquid Discharge (ZLD) systems (as seen in Table 1.19). The comparison has been made between the quantities reported by Bodal Unit VII and the respective estimates made by IITB for three-year production data *i.e.* for 2018-19, 2017-18 and 2016-17.



**Figure 1.18** The co-relation between the values of the total hazardous waste generation for two years estimated by IITB and the corresponding values reported by Bodal Unit VII. The comparison has been made for two-year production data *i.e.* for 2018-19 and 2017-18.

The production quantities of H-Acid and Vinyl Sulphone in 2017-18 were 1,670 MT and 2,239 MT, respectively; whereas the production quantities of H-Acid and Vinyl Sulphone in 2016-17 were 1,777 MT and 2,267 MT, respectively. With approx. 100 MT more H-Acid production and a comparable Vinyl Sulphone production in 2016-17 than in 2018-19, how did the Spray Dryer ash generation increase by approx. 500 MT in 2016-17?

Further, there is an erratic trend in reporting of the Iron Sludge Generation from H-Acid production process. For example, the production quantities of H-Acid and Vinyl Sulphone in 2018-19 were 1,783 MT and 2,376 MT, respectively; whereas the production quantities of H-Acid and Vinyl Sulphone in 2017-18 were 1,670 MT and 2,239 MT, respectively. For very comparable production of H-Acid and Vinyl Sulphone in the two years, the generation of Iron Sludge is reported as 2,867 MT in 2017-18 and a surprising 10,334 MT in 2018-19. There is no logical reasoning explaining this ,almost 3.6 times, over-reporting of the generation of Iron Sludge for a very comparable production quantities!

**Critical Comments on the Generation of Distillation Residue:** The distillation residue is the “distillation bottoms” which is produced in the purification stage in the  $\beta$ -Naphthol production process. This residue is stored temporarily on-site and eventually disposed of at the authorized CHW-TSDF. It is subjected to incineration at the CHW-TSDF.

The production of  $\beta$ -Naphthol during the three years, 2018-19, 2017-18, and 2016-17, were 4034 MT, 3,182 MT, and 4,460 MT respectively. As seen from the detailed mass balance in Figure 1.8, an estimated 4 Kg of distillation bottoms / residue is generated per Ton of  $\beta$ -Naphthol production. Thus, the theoretical estimates for the distillation bottoms / residue generated in the three years, 2018-19, 2017-18, and 2016-17, were 16 MT, 13 MT, 18 MT respectively. In contrast the values reported by Bodal Unit VII for 2018-19, 2017-18 were 41 MT and 14 MT respectively.

Although the theoretical estimate and reported value for 2017-18 are comparable, the reported value in 2018-19 is 2.5 times higher than the theoretical estimates! In addition to this, no value for distillation bottoms / residue is reported for 2016-17. Was distillation not performed in 2016-17?

The whole scenario expressed in the above paragraphs paints a grim and worrisome image about the management of the solid hazardous wastes by Bodal Unit VII.

**Concluding Remarks:** The author of this report would like to express his appreciation for the efforts made by Bodal Unit VII in providing the inputs requested by IITB team from time to time and have always cooperated in answering the doubts and queries of IITB team. However, the author of this report is disappointed while noticing that the production processes as well as ZLD systems and ETP have not been operated by Bodal Unit VII as per the best practices expected of them.

As stated earlier, the most important alteration, that must be implemented is regarding the use of the so-called “Spray Dryers” – which are operated at 640°C. Such polluting unit operations must be discontinued. Instead, the scientifically designed Dryers should be installed (if necessary) to dry the wet residue.

In addition, the misleading names of the unit operations installed as part of the so-called “ZLD system” must be corrected, both, by Bodal Unit VII as well as GPCB in their consent issued to the company. By permitting and continuing the misleading terminology, the several shortcomings in the current ZLD systems, from the perspective of environmental and work safety norms, have not been noticed for several years.

In summary, in the light of the recommendations made at the end of the preceding section (Section 1.15) on improvements and alterations in the ZLD systems for H-Acid and Vinyl Sulphone plants, the scenario with respect to the generation and disposal of hazardous wastes, too, will alter. This aspect should be understood and acted upon by Bodal Unit VII as well as GPCB and VECL. **Table 1.20** depicts the highlights of the desired actions recommended for alterations and improvements in the H-Acid and Vinyl Sulphone production processes as well as their respective ZLD Systems aimed at minimization of quantities and impacts of hazardous wastes.

**Table 1.20** The highlights of the desired actions recommended for alterations and improvements in the H-Acid and Vinyl Sulphone production processes as well as their respective ZLD Systems aimed at minimization of quantities and impacts of hazardous wastes.

Sr. No.	Source & Description of Solid Hazardous Waste	Present Fraction and Current Disposal Route	Future Desired Scenario based on the Recommended Alterations & Improvements in Production Processes & ZLD Systems
<b>1</b>	<b>H-Acid production</b>		
<b>1.1</b>	Gypsum Sludge from H-Acid production (Regulatory Waste Category 26.1)	59% w/w  Cement Industry	<u>Recommendation:</u> Implement the Solvent Extraction and Distillation technology in place of the existing Neutralization step in the production process (Long Term) <u>Effect:</u> Elimination of Gypsum Sludge generation from H-Acid production.
<b>1.2</b>	Gypsum Sludge from Neutralization in H-Acid ZLD system (Regulatory Waste Category 35.3)	15% w/w  CHW-TSDF and / or Cement Industry	<u>Recommendation:</u> The H <sub>2</sub> SO <sub>4</sub> -bearing filtrate (mother liquor) generated after Isolation step is neutralized. Filter the resulting Gypsum Sludge and concentrate the filtrate in MVR / MEE (in the modified ZLD system). This concentrated liquid must be further processed in the Spray Dryers operated at much lower temperature in the modified ZLD system. The resulting solids (dry salt and / or slurry), thus obtained, should be sent for incineration in authorized CHW-TSDF. Alternately, the possibility of sending the concentrated liquid obtained from MVR / MEE to the incinerator in CHW-TSDF may be explored and implemented; subject to the techno-economic considerations. (Short Term) <u>Effect:</u> The concentrated effluent from H-Acid production will now be processed in the modified ZLD system.
<b>1.3</b>	Iron Sludge from H-Acid production (Regulatory Waste Category 26.1)	16% w/w  Cement Industry	<u>Recommendation:</u> Implement the Catalytic Reduction technology in place of the existing Reduction step which currently utilizes Bechamp reduction in the production process (Long Term) <u>Effect:</u> Elimination of Iron Sludge generation from H-Acid production.
<b>2</b>	<b>Vinyl Sulphone production</b>		
<b>2.1</b>	Gypsum from Neutralization in ETP (Regulatory Waste Category 35.3)	N.A.	N.A.
<b>2.2</b>	Spray Dryer Residues (Ashes) from H-Acid and Vinyl Sulphone ZLD systems (Regulatory Waste Category 37.2)	10% w/w  CHW-TSDF	<u>Recommendation:</u> The use of existing Spray Dryers operated at 500°C in the ZLD systems of H-Acid and Vinyl Sulphone production plants should be discontinued with priority. Instead, the concentrated liquid must be further processed in the Spray Dryers operated at much lower temperature in the modified ZLD system. The resulting solids (dry salt and / or slurry), thus obtained, should be sent for incineration in authorized CHW-TSDF. Alternately, the possibility of sending the concentrate obtained from MVR / MEE to the incinerator in CHW-TSDF may be explored and implemented; subject to the techno-economic considerations. (Short Term) <u>Effect:</u> Discontinue the operation of the Spray Dryers in the existing ZLD systems operated at 500°C.
		<b>100%</b>	All the above recommendations, when implemented, will lead to a decrease of the total hazardous waste generation in the range of <b>40-80%</b> .

## 1.17 Assessment of the Effluent Treatment Plant

**The Technical Details on the ETP:** The Effluent Treatment Plant (ETP) at Bodal Unit VII has a capacity of treating 474 KLD of industrial effluent generated in the plant as well as from various housekeeping and maintenance activities (such as reactor washing, floor washing, *etc.*). The schematic flow diagram of the Effluent Treatment Plant (ETP) operated in the batch-wise mode is presented in **Figure 1.19**.

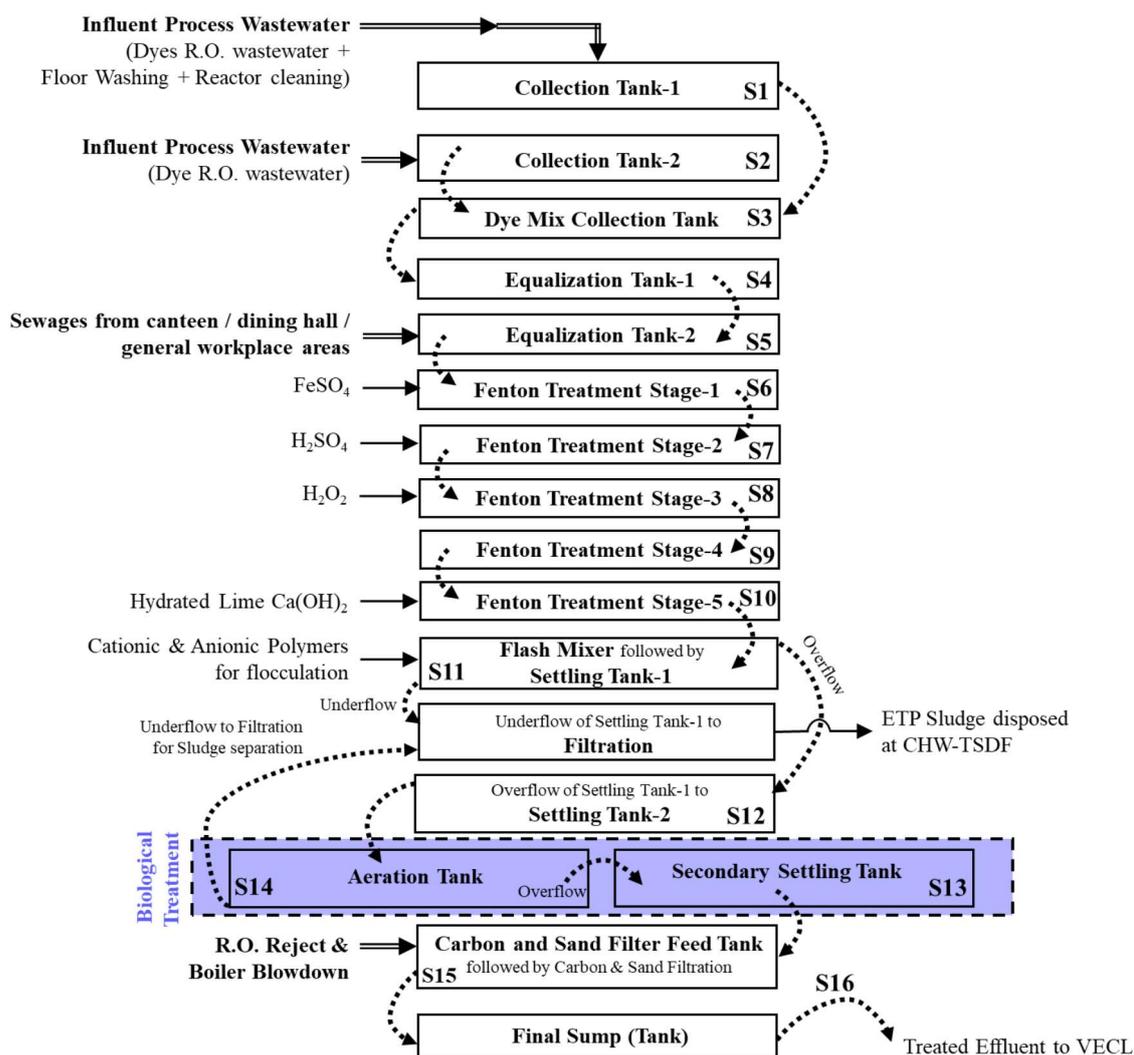
**Description of the Effluent Treatment Plant (ETP):** As seen in Figure 1.19, the ETP has physico-chemical as well as biological treatment units for treating the effluent. The waste effluent from the Dyes production plants from three sources (Dyes Inlet 1, Dyes Inlet 2, and Dyes Inlet 3) is collected in the Dye mix collection tank. This also includes the floor flushing and reactor washing wastewaters from the Dye production units.

This is followed by Equalization Tank-1 and Equalization Tank-2 for equalization of the flowrates. The sewages from the canteen / dining hall / general workplace areas are let into the Equalization Tank-2.

The Equalization Tank-2 is followed by a '5-stage Fenton-based Treatment system', or simply, 'Fenton Treatment system' for destruction of COD and removal of colour from the Dye wastewaters. In the first stage of the Fenton Treatment system, Ferrous Sulphate ( $\text{FeSO}_4$ ) is added to the reactor with continuous aeration. The Ferrous Sulphate is a part of the 'Fenton Reagent' and acts as the catalyst for efficient oxidation, and subsequent destruction, of the organic matter and the azo bonds leading to removal of colour.

The second stage of the Fenton Treatment system is dosing the solution with Sulphuric Acid ( $\text{H}_2\text{SO}_4$ ) to maintain the *pH* between 4 and 4.5. The third stage introduces the other part of the Fenton Reagent *i.e.* Hydrogen Peroxide ( $\text{H}_2\text{O}_2$ ) which acts as the oxidizing agent. The fourth stage is an intermediate stage provided with continuous stirring to ensure completion of the reaction. The fifth and final stage of the 'Fenton Treatment system' is the neutralization of the excess acidity by using hydrated lime. After neutralization, the effluent is sent to the Flash Mixer.

In the Flash Mixer, cationic and anionic polymers are added for coagulation and flocculation followed by rapid mixing. Thus, the suspended particles are removed from the effluent. The effluent is then sent to the Settling Tank.



**Figure 1.19** Flow diagram of the Effluent Treatment Plant at Bodal Unit VII operated in the batch-wise mode

The underflow of the Settling Tank-1 is sent for Filtration of the settled solids. The sludge so obtained from the Filtration is then sent to CHW-TSDF for final disposal. The overflow of the Settling Tank-1 is sent to the Settling Tank-2. This is the beginning of the Biological Treatment System.

The overflow of the Settling Tank-2 is then sent to the first part of the Biological Treatment System which is the Aeration Tank. In the Aeration Tank, the effluent is treated with a bacterial consortium with continuous aeration for the purpose of colour removal and COD degradation. The underflow of the Aeration Tank is sent back to the Filtration unit for removal of the biological sludge. The sludge thus obtained is sent to the CHW-TSDF for final disposal. The overflow of the Aeration Tank is sent to the Secondary Settling Tank.

The overflow of the Secondary Settling Tank is then sent to the Holding Tank before Sand and Carbon Filtration. In this tank, the high TDS wastewaters such as boiler blowdown and R.O. reject are added. This is followed by Carbon and Sand Filtration for removal of odour or remaining colour.

Finally, the treated wastewater is transferred to the final holding tanks from where it is discharged into the VECL channel.

#### **Performance Assessment of the ETP:**

**Table 1.21** shows the results of the of water quality analysis of samples collected stage-wise from the Effluent Treatment Plant of Bodal Unit VII collected on 22 October, 2019 during 14:08 and 14:27 hours. The stage-wise analysis of the water quality based on multiple relevant parameters was performed in order to study the changes in water quality stage-by-stage. The water quality analysis parameters in this study are: pH, Chemical Oxygen Demand (COD), Ammonia Nitrogen (NH<sub>3</sub>-N), Total Suspended Solids (TSS), and Total Dissolved Solids (TDS). The discharge norms set by GPCB and VECL are also mentioned at the bottom of the table for each parameter.

The sampling points for the stage-wise analysis of the ETP which are mentioned in the schematic flow diagram in Figure 1.19 are concurrent with the Sr. No. of the particular treatment unit in the ETP as mentioned in Table 1.21 (e.g. Sr. No. 1 in Table 1.21 corresponds to sampling point S1 as shown in Figure 1.19).

**Table 1.21** The results of the of water quality analysis of samples collected stage-wise from the Effluent Treatment Plant of Bodal Unit VII collected on 22 October, 2019 during 14:08 and 14:27 hours.

Sr. No.	Treatment Unit in ETP	pH	COD (mg/L)	NH <sub>3</sub> N AN (mg/L)	TSS (mg/L)	TDS (mg/L)	Colour (Pt Co)
S1	Dye 1 & 2 mix inlet (acid)	7.08	2,324	7.84	40	-	3,196
S2	Dye 3 inlet (acid)	8.53	2,388	6.72	42	-	Over limit
S3	Dye 1,2 & 3 mix	8.4	2,499	7.28	46	-	3,485
S4	Equalization tank - 1	7.64	2,977	19.04	316	6,904	3,397
S5	Equalization tank - 2	7.52	1,814	10.08	144	7,512	3,299
S6	Fenton - F1 Add FeSO <sub>4</sub>	6.77	1,878	42.56	-	-	3,341
S7	Fenton - F2 Add H <sub>2</sub> SO <sub>4</sub>	2.11	4,776	25.2	-	-	3,282
S8	Fenton - F3 Add H <sub>2</sub> O <sub>2</sub>	2.13	3,629	55.44	-	-	1,257
S9	Fenton - F4 Aeration	2.21	1,830	53.2	-	-	1,448
S10	Fenton - F5 Add Ca(OH) <sub>2</sub>	6.61	1,480	56.56	-	-	3,028
S11	Flash mixer	7.01	-	-	-	-	-
S12	Primary settling tank	6.84	274	43.12	18	-	262
S13	AIS overflow	7.18	-	-	-	-	-
S14	AIS aeration	7.35	-	-	-	-	-
S15	Carbon & Sand Filter Feed Sump	7.33	113	42	12	-	110
S16	Final sump	7.55	166	38.08	14	-	142
	GPCB Emission Limit	6.5 - 8.5	250	50	100	5,000	100

\* The Final sump is leading to the effluent discharge point into the VECL channel.

The IIT Bombay team visited Bodal Unit VII during the VECL channel shut down for maintenance and upkeep. This is a once-yearly activity undertaken by VECL wherein the entire channel is opened up, cleaned and other operational and maintenance activities are undertaken over a period of 4-5 days. Hence, the industries cannot discharge their treated effluent into the VECL channel during this time, and must store the effluent inside the premises of the plant until the channel is back in operation. During this VECL channel shutdown period, Bodal Unit VII shut down production after the first two days of the shutdown in order to perform their own maintenance activities.

Reportedly, the Effluent Treatment Plant was not operational during this shutdown period. Thus, the only samples obtained from the ETP of Bodal Unit VII during this visit was from the ‘Equalization Tank-1’ and ‘Final Sump’. **Table 1.22** shows the results of the analysis of wastewater sample (selected parameters) collected on 27 February, 2020 from ‘Equalization Tank-1’ and ‘Final Sump’ at the Effluent Treatment Plant of Bodal Unit VII during the shutdown period (24 – 28 February, 2020). It was reported that the stored wastewater was the raw wastewater stream collected during the first two days of the shutdown period – while completing the ongoing batches in the beginning of shutdown period.

It can be observed that the values of the parameters in Table 1.22 are comparable with the ones reported in Table 1.21 – which were the values of the salient water quality parameters observed during the course of normal operation of the production plants.

Further, **Table 1.23** presents the comparison of the results of analyses of the wastewater samples collected at selected stages from the Effluent Treatment Plant (ETP). Bodal Unit VII collected samples on three different dates and VECL collected samples on 22 October, 2019.

**Table 1.22** The results of the analysis of wastewater sample (selected parameters) collected on 27 February, 2020 from ‘Equalization Tank-1’ and the ‘Final Sump’ at the Effluent Treatment Plant of Bodal Unit VII during the shutdown period (24 – 28 February, 2020). It was reported that the stored wastewater was the raw wastewater stream collected during the first two days of the shutdown period – while completing the ongoing batches in the beginning of shutdown period.

Treatment Unit in ETP	Date	Time	pH	COD (mg/L)	TSS (mg/L)	Colour (pt.co)	NH <sub>3</sub> -N (mg/L)
Equalization Tank-1	27/02/2020	17:16	8.98	2,726	123	3,696	15.12
Final Sump	27/02/2020	17:16	8.06	238	20	89	12.32
GPCB Emission Limit			6.5 - 8.5	250	100	100	50

**Table 1.23** The comparison of the results of analyses of the wastewater samples collected at selected stages from the Effluent Treatment Plant (ETP). Bodal Unit VII collected samples on three different dates and VECL collected samples on 22 October, 2019.

Samples collected & analysed by:		Bodal Unit VII	Bodal Unit VII	Bodal Unit VII	VECL
Date of Sampling:		19/10/2019 Shift II	20/10/2019 Shift II	21/10/2019 Shift II	22/10/2019 Shift II
Sr. No.	Treatment Unit in ETP	Colour (Pt. Co. / Hazen)			
1	Equalization tank	65,000	72,000	60,000	3,397
2	Primary Clarifier Outlet	-	-	-	262
3	Aeration Tank	-	-	-	-
4	Secondary Clarifier Outlet	-	-	-	-
5	Carbon & Sand Filter Feed Sump	180	180	160	110
6	Final Holding Tank	90	80	85	142
7	GPCB Emission Limit	100	100	100	100
Sr. No.	Treatment Unit in ETP	COD (mg/L)			
1	Equalization tank	3,360	2,880	2,120	2,499
2	Primary Clarifier Outlet	576	542	416	274
3	Aeration Tank	-	-	-	-
4	Secondary Clarifier Outlet	432	464	368	-
5	Carbon & Sand Filter Feed Sump	368	300	336	113
6	Final Holding Tank	176	176	160	166
7	GPCB Emission Limit	250	250	250	250
Sr. No.	Treatment Unit in ETP	TDS (mg/L)			
1	Equalization tank	5,810	5,630	5,310	6,904
2	Primary Clarifier Outlet	5,630	5,410	5,110	-
3	Aeration Tank	-	-	-	-
4	Secondary Clarifier Outlet	5,410	5,220	5,010	-
5	Carbon & Sand Filter Feed Sump	5,110	5,110	4,980	-
6	Final Holding Tank	4,890	4,890	4,430	-
7	GPCB Emission Limit	5,000	5,000	5,000	5,000

**Critical Comments on the Discrepancies between the Claims & Performance of ETP:**

**Comment 1:** The R.O. units transfer the entire TDS to ETP: As stated earlier, the dyestuff manufacturing processes at Bodal Unit VII make use of R.O. systems to separate the product (dye) from the other dissolved entities and unreacted reactants. The product dyes (in the form of corresponding salts) are organic compounds typically having high molecular weight whereas the other salts have lower molecular weights. The concentrated stream from the R.O. system, thus, contains the product dye and the permeate stream contains the dissolved salts (mostly NaCl) which contribute to TDS. The permeate stream from the R.O. units is subsequently sent to the ETP for further treatment and disposal.

This has further implications in the context of interpretation of the performance data of ETP. For the sake of completeness and in order to provide a ready reference, Table 1.17 has been reproduced below. The first part of Table 1.17 presents the theoretically estimated stream-wise contributions of the various sources of wastewaters received in the Equalization Tank of ETP.

Also, the theoretically estimated stream-wise contributions of the wastewater streams received at the Final Tank in the ETP (before disposal) are presented in the second part of the Table. In both parts of the Table, the estimated composite concentrations are compared and contrasted with the data reported by Bodal Unit VII corresponding to the selected water quality parameter.

It is the considered opinion of the author of this report that the information reported by Bodal Unit VII on the performance of R.O. units in dyestuff production plants was either not accurate or the R.O. units provided in the production plants are not designed properly and also not operated in a scientific manner.

Neither the R.O. units can generate the so-called “permeate stream” having TDS in the neighbourhood of 20,000 mg/L (as reported by Bodal Unit VII to IITB); nor the R.O. units will produce the concentrated stream free from undesirable unreacted reactants.

In sum, frankly, the author has not understood the operation of R.O. units in the production process for dye manufacturing (the way it was reported to IITB team). In any case, something is seriously wrong with reported performance as well as the reported composition of permeate stream.

**Table 1.17** The theoretically estimated stream-wise contributions of the various sources of wastewaters received in the Equalization Tank of ETP. Also, the theoretically estimated stream-wise contributions of the wastewater streams received at the Final Tank in the ETP (before disposal) are presented in the second part of the Table. The estimated composite concentrations are compared and contrasted with the data reported by Bodal Unit VII corresponding to the selected water quality parameter.

Sr. No.	Source of Wastewater Received in ETP Equalization Tank	Production Limit as per GPCB consent (MT/M)	Average Daily Permissible Production (TPD)	Estimated Source-wise Daily Maximum Wastewater to ETP Equalization Tank (KLD)	Estimated Source-wise TDS (mg/L)	Remarks
1	RB-5 production	1,250	41.10	35	43,100	Estimated
2	RR-195 production	500	16.44	18	62,300	Estimated
3	AB-210 production	1,250	41.10	182	119,000	Estimated
4	Boiler Blowdown	-	-	10	2,500	Estimated
5	Sewage	-	-	20	400	Estimated
	<b>Estimated in Equalization Tank</b>	<b>-</b>	<b>-</b>	<b>384</b>	<b>84,333</b>	<b>Estimated</b>
	<b>Reported by Bodal Unit VII in Equalization Tank (21/10/2019)</b>				<b>4,510</b> <b>This is 18 times lower than the estimated value!</b>	<b>Reported</b>
6	Treated stream from ETP brought to the Carbon and Sand Filter Feed Tank			384	84,333	Estimated
7	Reject stream from Boiler R.O.			60	94,600	Estimated
8	Reject stream from Sulphur Plant R.O.			0	0	Assumed
	<b>Estimated at the outlet of the ETP</b>	<b>474</b>		<b>444</b>	<b>85,719</b>	<b>Estimated</b>
	<b>Reported by Bodal Unit VII at the outlet of ETP (21/10/2019)</b>				<b>3,750</b> <b>This is 22 times lower than the estimated value!</b>	<b>Reported</b>

**Comment 2: The existing ETP has no capability of removing TDS:**

It must be noted that, based on the principles of wastewater treatment engineering<sup>1</sup>, the total dissolved salts (TDS, mg/L) is a conservative parameter of wastewater quality. In other words, physico-chemical and biological treatments would typically denature, degrade, remove, or decrease COD (not TDS easily). The specific operations required for removal (or minimization) of TDS are not employed in the ETP of Bodal Unit VII.

In summary, the author of this report cannot hide his astonishment regarding the claims made by Bodal Unit VII on the progressive treatment for TDS when it is clear that the technology employed for treatment of wastewaters in the existing ETP cannot possibly give such remarkable results.

**Comment 3: The capability of Fenton Treatment for dye wastewater is questionable:**

The Fenton Treatment makes use of the combination of  $\text{Fe}^{2+}$  and  $\text{H}_2\text{O}_2$  (Fenton's Reagent) for achieving decolourization along with COD reduction through oxidation of the toxic organic pollutants – which in this case are the dye molecules. At Bodal Unit VII, the  $\text{Fe}^{2+}$  is supplied through Ferrous Sulphate ( $\text{FeSO}_4$ ) salt. For the action of Fenton Treatment, the pH needs to be maintained between 3 and 3.5. This is achieved by addition of Sulphuric Acid.  $\text{FeSO}_4$  is added to acidified wastewater and subsequently  $\text{H}_2\text{O}_2$  is added to the batch reactor for oxidation of the organic pollutants. The performance of the Fenton Treatment, typically, is governed by the interplay of a variety of parameters including the inlet concentration of dyes, pH, concentration of  $\text{FeSO}_4$ , and concentration of  $\text{H}_2\text{O}_2$ .

It is well known that the decolorization efficiency of the Fenton Treatment decreases with the increasing inlet concentration of dyes. The complexity of the system is known to be extremely high when one is addressing a “mixture of dyes”. Although it is claimed by Bodal Unit VII that the dosage of the Fenton Reagent is decided batch-by-batch, it must be noted that this system is highly sensitive. As seen in Table 1.21, there is little to no removal of colour throughout the Fenton Treatment. For example, the colour decreases from F1 to F3 by nearly 50%, but by the end of the treatment at F5, it returns close to the original value

---

<sup>1</sup> Arceivala, S. J. and Asolekar, S. R. (2006). “Wastewater Treatment for Pollution Control” (3<sup>rd</sup> Edition, 14<sup>th</sup> Reprint), McGraw Hill Education (India) Pvt. Ltd., New Delhi

at the inlet of F1! This is evidence of the fact that there is improper design and handling of the treatment system.

Further, another serious issue to be addressed is the lack of calibration of addition of quantity of H<sub>2</sub>O<sub>2</sub>. It is known that excessive addition of H<sub>2</sub>O<sub>2</sub> actually leads to an increase in the COD. In fact, this is the precise observation, as seen in Table 1.21, that COD increases as treatment progresses from S8 to S10!

Different dyes need a different concentration of reagents in order to efficiently remove the colour and COD. Thus, it is evident from the data that the reagents are being added in an improper and unscientific manner. It appears that there is “over-addition” of Fenton Reagents – which leads to increase in the COD. Interestingly, the five batch reactors provided for Fenton Treatment in the ETP of Bodal Unit VII, in the end, do not seem to achieve any decolourization (refer to Table 1.21)!

To say the least, the Fenton Treatment is known to be a complex web of inorganic and organic reactions taking place in a batch reactor – the outcome of which can be vouched for (up to some extent) after conducting a thorough treatability study and sizing the batch operations as well as planning and sequencing them carefully. Even if the Fenton Treatment works successfully, as explained earlier, the net result would at best be the destruction of substitution on the organic molecules (referred to as the ‘chromophores’) resulting in decolourization of the wastewater. The residual COD, however, of such treated wastewater would most likely than not have a substantial residual COD – which may or may not get degraded through a combination of anaerobic and aerobic treatment.

Hence, at Bodal Unit VII, the immediate upgradation of the Fenton Treatment system needs to be taken up as the first priority. Further, the dye wastewater streams must be separated at the respective sources and those segregated streams need to be given the Fenton Treatment on the one-on-one basis by devising the dedicated monitoring facilities. It is the considered opinion of the author of this report that the dyes manufacturing segment of Bodal Unit VII, too, must be made Zero Liquid Discharge with priority.

In the light of the monitoring results presented in earlier in this section and taking into consideration the science and technology of degradation of a mixture of dyes, dye intermediates and a huge load of dissolved salts; to make Fenton Treatment work successfully and also hoping that the Aerobic Biological Treatment to render further

treatment is going to be a lost cause. It will be best to make this section of production plant Zero Liquid Discharge and rule out the possibility of inadequate treatment.

**Comment 4:** The Aerobic Biological Treatment for dye wastewater is questionable: As stated earlier, it is well-known that the bacteria-mediated degradation of dyes (for example, Reactive Black-5, Reactive Red-195, or Acid Black-210) is possible to an extent in presence of the so-called anaerobic process. Dyes do not degrade in aerobic environment to the appreciable extent. However, upon degradation in anaerobic conditions, the further degradation of the products of anaerobic reaction and the fragments of the colour-causing entities can be made possible in aerobic conditions.

In other words, a properly designed anaerobic reactor followed by aerobic reactor, both, having suitable microbial cultures will be able to degrade the wastewaters having Reactive Black-5, Reactive Red-195, and Acid Black-210. It must be kept in mind, though, the efficiencies of decolourization as well as degradation of fragments and degradation products of such dyes are rather low. After best possible efforts, the leftover concentrations of the colour causing entities will not only leave behind the objectionable colour in the treated wastewater, but also are likely to result in high residual COD.

**Summary Comment on ETP:** It is the considered opinion of the author of this report that the information reported by Bodal Unit VII on the performance of R.O. units in dyestuff production plants was either not accurate or the R.O. units provided in the production plants are not designed properly as well as are not operated in a scientific manner.

The author of this report has failed in understanding the processes in the ETP *vis a vis* the performance data after each step (as presented in Table 1.21, Table 1.22, and Table 1.23). One thing is, however, clear that this existing ETP is neither scientifically designed nor it is capable of giving the desired performance, as prescribed by the GPCB in their consent.

The application of Fenton Treatment followed by Aerobic Biological degradation is neither justifiable on the basis of the known Environmental Engineering Science nor the treatment strategy established by Bodal Unit VII is scientifically designed or operated. It is understood that the 'aerobic biological wastewater treatment segment' of the ETP is an Activated Sludge Process; which cannot possibly treat the complex pollutant molecules in presence of rather extremely high TDS with the help of the aerobic microbial culture.

In the light of the monitoring results presented in earlier in this section and taking into consideration the science and technology of degradation of a mixture of dyes, dye intermediates and a huge load of dissolved salts; to make Fenton Treatment work successfully and also hoping that the Aerobic Biological Treatment to render further treatment is going to be a lost cause. It will be best to make this section of production plant Zero Liquid Discharge and rule out the possibility of inadequate treatment.

The existing ETP should be superseded by building a new scientifically designed ETP. All the process modifications suggested in the section on “Recommendations” at the end of this report should be implemented and the resulting altered wastewater generated from the modernized production plant must be subjected to the new ETP. The said modernized newly constructed ETP shall treat the wastewaters generated by: R.O. Reject from Boiler feed, blowdown from Boiler and Cooling Towers, Stormwater. All other flows shall be treated in the ZLD systems for H-Acid production, Vinyl Sulphone production or Dye manufacturing.

These recommendations pertaining to ETP should be implemented with priority because the water in VECL channel has a dark colour and has rather high TDS and has several other pollutants. If the pollution of the ocean is to be stopped, the stringent measures will have to be implemented in each process plant, especially the ones that are engaged in the manufacturing of H-Acid, Vinyl Sulphone, and other dyestuff and dye intermediates.

## **1.18 Assessment of the Sewage Treatment Plant**

The IIT Bombay team visited Bodal Unit VII, it was given to understand that there is no dedicated Sewage Treatment Plant (STP). Frankly, this is not at all acceptable! The task of constructing new STP shall be undertaken with the utmost priority – which shall be based on the modern technology. Dilution of the sewages (*i.e.* wastewaters generated from toilets, bathrooms, and canteen / mess / dining hall) or percolating sewages into soak-pits after giving some partial treatment or using partially treated sewages for irrigation / gardening cannot be tolerated. There is huge amount of groundwater pollution, already existing in the region including Dudhwada, Piludra, and Karakhadi.

In summary, a new STP must be constructed immediately using the modern technology.

## **1.19 Significance of Modernization and Implementation of Preventive Environmental Management**

### **The International and Indian Scenarios:**

Worldwide, it has been recognized over the past 3-4 decades that the production of dye intermediates, especially H-Acid and Vinyl Sulphone, is extremely complex, inherently polluting, and having several potential occupational health and safety hazards. Having recognized this, many nations in the world (especially all the developed countries), by and large, have banned the production of certain dye intermediates and dyestuff compounds 3-4 decades back. In fact, many State Pollution Control Boards (SPCBs) in India have also traditionally discouraged the manufacturing of dye intermediates and amino-naphthalene sulphonic acid compounds, especially H-Acid and Vinyl Sulphone.

In fact, most dye intermediates, and specifically H-Acid, have been included in Europe's 'European Chemical Agency – ECHA' (which was founded on 1 June, 2007) and the USA's chemical database issued under the 'Toxic Substances Control Act – TSCA' (which was enacted on 11 October, 1976). Such declarations have had the great impact on the choices made by the large and technologically advanced multi-national chemical manufacturers. For example, BASF Colors & Effects GmbH, Germany, ceased manufacturing of H-Acid in 2017.

Most H-Acid and Vinyl Sulphone production units in Europe and the USA were either shut down or have decreased their production significantly in the recent years; in spite of their categorical efforts of improving their work safety and environmental impacts. The pressure from community and discouragement by the regulatory agencies have been typically the drivers for diminishing the dyestuff and dye intermediates sector in Europe and the USA. As a consequence, Asian countries, especially India and China, have emerged as the world's largest players in the dye intermediates and dyestuff compounds industry. This industry, in its current form, has thrived in these Asian countries due to the comparatively lax Environment Protection and Occupational Health & Safety laws.

### **The Issues Associated with the Indian Dyestuff and Dye Intermediates Sector:**

In India, it is not a coincidence that the dyestuff and dye intermediates sector historically flourished in the coastal regions because ocean, creek or estuary are the designated

“receiving bodies” for final disposal (permitted by the respective State Pollution Control Board). It is also observed that the regulatory agencies readily authorize the industries to send their hazardous wastes for landfilling – as though the final disposal in landfill or incinerator is the logical and environmentally defensible “final disposal” strategy for hazardous wastes. It is the considered opinion of the author of this report that the situation is indeed worrisome! Neither the industry would want to use the first-rate technology and modernize the production facility nor the State Pollution Control Board would insist on implementation of cleanest possible technologies and waste minimization.

The complexity of the H-Acid and Vinyl Sulphone production processes, and the resulting environmental pollution due to the various unit operations and unit processes have been outlined in this report. It is clear that these processes are inherently polluting since they involve multiple reactions, wherein the complex structures of H-Acid and Vinyl Sulphone are synthesized with the help of several organic compounds. As a result, several by-products in significant quantities are generated – which must be separated and disposed of. All the separation operations (unit operations) in these processes generate solid or liquid pollution bearing a variety of toxic organic pollutants and some of the production steps even generate gaseous pollution in the form of toxic gases.

Several studies have been conducted worldwide, and also in India, focussing the so-called “terrestrial ecosystems” (*i.e.* natural land-based ecosystems) as well as “aquatic ecosystems” (*i.e.* natural water-based ecosystems); which have documented the irreversible damages caused by the indiscriminate and chronic pollution. It is well understood now, that the natural ecosystems on land and in water are delicately balanced – which can be spoiled permanently due to the action of chronic pollution experienced by the respective systems over a prolonged period. Clearly, sending the huge volumes of the treated wastewaters having trace quantities of those toxic pollutants to aquatic and terrestrial ecosystems (*e.g.* oceans, creeks, estuaries, rivers, lakes, or land application for irrigation) cannot be considered the sustainable and environmentally defensible management action.

### **Comprehensive Actions for Minimizing the Health and Environmental Implications:**

The health impacts associated with working in a dye intermediate manufacturing industry are numerous, but are often shrugged off as being an ‘occupational hazard’. The major known health impact on workers in the modern dye intermediate and dyestuff industry are Contact Dermatitis and respiratory complications. Contact Dermatitis is mainly caused by

handling chemicals capable of being an allergen / skin irritant – such as Naphthalene based compounds, strong acids and strong alkalis.

The occurrence of respiratory complications in the dyestuff and dye intermediate sector is common on account of highly acidic unit processes such as Sulphonation and Nitration. These batch operations usually take a few hours to complete and the emission of sulphur and noxious gases takes place during almost the entire batch time. Moreover, this sector is mostly dependent on manual labour for operations like addition of chemicals, cleaning the filters, and bagging of the final product. Involvement in these operations is the main reason for developing health issues such as Contact Dermatitis and respiratory complications.

It is the considered opinion of the author of this report that the current production processes of H-Acid and Vinyl Sulphone have several work-safety, health, and environmental implications. For example, on the basis of the detailed mass-balance performed in this study for the production process of H-Acid (refer to Figure 1.2), the author of this Report arrives at a shocking conclusion that the “Filter Loss” happens to be comprising of 299 Kg of H-Acid per Ton production of H-Acid. It is neither believable nor economically and environmentally sustainable. This reported loss of product is apparently sent eventually to the landfill in CHW-TSDF. If this is the fact, the production process of H-Acid employed by Bodal Unit VII is indeed a primitive and unacceptable process and provides enough ground for considering banning it. This extremely polluting and wasteful process must not be practiced!

Such polluting, dangerous and toxic production processes should not be allowed to continue unless modernization of production plants for all products involving major process innovations must be undertaken at once. In other words, as far as the chemical production plants are concerned, the production processes must be genuinely ‘Zero Liquid Discharge’.

Also, some additional necessary measures must be implemented including sophistication in measurement and control of vital reaction parameters, installation of a new modern Effluent Treatment Plant (ETP) to take care of surface runoff and stormwater treatment as well as installation of a new modern Sewage Treatment Plant (STP) for the treatment of sewages. Finally, it must be emphasized that the interventions related to indoor air quality and work-safety must be made the first priority while modernizing the production plants.

## 1.20 Recommendations for Improvement

All the recommendations listed below are equally important. However, they are arranged under several sub-headings for the sake of communication and for improving the clarity.

### Short-term Recommendations for H-Acid plant:

- 1 In view of the kinetics-related issues as mentioned in the previous sections, the automatic temperature control is strongly recommended. Process control upgradation could lead to improvement of the process efficiency, and therefore, will improve the profitability of the process. Further, it will also minimize environmental pollution loads arising from the process.
- 2 In view of the thermodynamic and kinetics-related issues as mentioned in the previous sections, installation of the sophisticated digital *pH* control instrumentation as well as automated systems for acid / alkali addition are strongly recommended. Not only it improves the product yield and profits, but it also improves the process safety and decreases pollution.
- 3 The targeted short-term R&D will need to be conducted to assess the relative benefits of using Acetic Acid over Sulphuric Acid in the Reduction process and switch to Acetic Acid. This issue is important because it has, both, environmental and commercial implications.
- 4 The targeted R&D will need to be taken up with high priority to evaluate how the process of recycling of acidic effluent from Nitration step to Isolation step (and filtrate used in the Reduction step) can be applied to the prevailing H-Acid production process. The benefits of this alternate process are numerous and the ultimate reduction of the environmental load bolsters the case for its applicability. Along with this, the costs of purchasing the patent must be taken into consideration if any.

### Long-term Recommendations for H-Acid plant:

- 1 The targeted R&D will need to be conducted in order to determine whether the application of a Thin Film Reactor will prove to be beneficial to the H-Acid production process. The R&D of the proposed 'separation, concentration, and reuse

of the excess Sulphuric Acid' must be taken up to determine the various technological options and their applicability. Comprehensive laboratory experiments need to be conducted and the scientific evidence should be used to make a decision.

- 2 Targeted R&D efforts are required in order to ascertain the application of the Solvent Extraction and Distillation technology in the H-Acid production process.
- 3 Targeted R&D efforts are required in order to arrive at a cost-effective catalytic reduction system catering to the scale of operation prevailing in this industry. These efforts will not only increase the present yield and quality of H-acid production but also eliminate the pollution problem due to high chloride and sulphate contaminate wastewater streams generated from these reaction steps.

#### **Short-term Recommendations for VS plant:**

- 1 The targeted R&D must be performed to evaluate the relative benefits of using the 'Falling Film Absorber' in place of the current scrubbing system.
- 2 The targeted R&D, thus, will need to be performed in order to evaluate the application of the technique of 'contacting the reaction mass with cold H<sub>2</sub>SO<sub>4</sub> before the Drowning step'.
- 3 The targeted R&D and trials must be conducted to determine the suitability of using a centrifugal pump to transfer Ethylene Oxide from the tanker to storage tank and a condenser to recover the Ethylene Oxide vapours.
- 4 The discharge to VECL can be completely stopped by sending the 'Dilute Stream from VS' to the ZLD System and recovering water from the 'Dilute VS stream' and also from the 'Housekeeping water' that is currently sent to the ETP.

#### **Long-term Recommendations for VS plant:**

- 1 The targeted R&D, therefore, will need to be conducted to evaluate the relative benefits of increased selectivity by using Oleum and subsequent changes in mass balance as well as cover the costs of purchasing the patent.

- 2 The targeted R&D will need to be conducted to evaluate the applicability of the novel technology and the particular modified Chlorosulphonation reactor in the Vinyl Sulphone production process, as well as cover the costs of purchasing the patent.
- 3 The targeted R&D will need to be conducted to evaluate the relative benefits of the alternate processes of Vinyl Sulphone using different raw materials and the subsequent reduction of the environmental load as well as the costs of purchasing the patent.
- 4 It is clear that the mother liquor is subjected to several physico-chemical processes in the so-called “ZLD system” installed in the Vinyl Sulphone production plant. Bodal Unit VII has rather insufficient scientific data and scientific studies related to the extent of Ethylene Glycol (or its derivatives) sent to Spray Dryer (and ultimately to CHW-TSDF). Therefore, the accurate estimates of Ethylene Glycol (or its derivatives) sent to Spray Dryer could not be estimated with reliable accuracy.

In view of the above facts, the quick and targeted R&D is required to significantly reduce the high COD of the mother liquor (especially addressing Ethylene Glycol) emanating from the plant before subjecting it to MEE, and eventually disposing of the Spray Dryer Ash in CHW-TSDF. The current practice is neither acceptable from the environmental perspective, nor it is helping in attaining the goal of achieving the so-called “Zero Liquid Discharge (ZLD)”.

#### **Short-term Recommendations for $\beta$ -Naphthol plant**

- 1 In view of the kinetics-related issues as mentioned in the previous sections, the automatic temperature control is strongly recommended. Process control upgradation could lead to improvement of the process efficiency, and therefore, will improve the profitability of the process. Further, it will also minimize environmental pollution loads arising from the process.
- 2 In view of the thermodynamic and kinetics-related issues as mentioned in the previous sections, installation of the sophisticated digital *pH* control instrumentation as well as automated systems for acid / alkali addition are strongly

recommended. Not only it improves the product yield and profits, but it also improves the process safety and decreases pollution.

- 3 The targeted R&D will need to be conducted to evaluate the applicability of using Solvent Extraction followed by concentration and distillation technology in the  $\beta$ -Naphthol production process, as well as cover the costs of purchasing the patent.

#### **Long-term Recommendations for $\beta$ -Naphthol plant**

- 1 The targeted R&D will need to be conducted to evaluate the relative benefits of the alternate processes using different raw materials and the subsequent reduction of the environmental load as well as cover the costs of purchasing the patent.

#### **Short-term Recommendations for Crude Synthetic Dyes**

- 1 It is evident that the R.O. systems in the production facilities for dyes will have to be upgraded to ensure that the permeate stream would not have high concentrations of dissolved salts (TDS). This can be achieved by subjecting the permeate stream to a dedicated ZLD facility in dye manufacturing plant.
- 2 In view of the kinetics-related issues as mentioned in the previous sections, the automatic temperature control is strongly recommended. Process control upgradation could lead to improvement of the process efficiency, and therefore, will improve the profitability of the process. Further, it will also minimize environmental pollution loads arising from the process.
- 3 In view of the thermodynamic and kinetics-related issues as mentioned in the previous sections, installation of the sophisticated digital *pH* control instrumentation as well as automated systems for acid / alkali addition are strongly recommended. Not only it improves the product yield and profits, but it also improves the process safety and decreases pollution.
- 4 A new and robust dye manufacturing process wastewater conveying system should be constructed as per industry standards – which will be a closed pipe above-ground, and divert all the wastewater to the ETP for treatment. This task must be undertaken as the first priority.

**Recommendations Applicable to the Entire Production Plant:**

- 1 The most important alteration, that must be implemented is regarding the use of the so-called “Spray Dryers” – which are operated at 640°C. Such polluting unit operations must be discontinued. Instead, the scientifically designed Dryers should be installed (if necessary) to dry the wet residue obtained from the so-called “Wet Scrubbers” (which in fact are the Spray Dryers). Pollution control measures to treat the exhaust of the “Wet Scrubber” must be installed.
- 2 The misleading names of the unit operations installed as part of the so-called “ZLD system” must be corrected, both, by Bodal Unit VII as well as GPCB in their consent issued to the company. By permitting and continuing the misleading terminology, the several shortcomings in the current ZLD systems, from the perspective of environmental and work safety norms, have not been noticed for several years.
- 3 The investigation team from IIT Bombay has taken a serious note of the current state of housekeeping and maintenance and would recommend rather strongly that the housekeeping and maintenance should be improved remarkably in the nearest future. Adequate Personal Protective Equipment (PPE), uniform for all personnel, labelling of equipment, tanks and pipelines should be taken up as the first priority and serious efforts should be made to create the positive first impression.
- 4 The use of digital flowmeters at all the places in the plant where water is used is recommended. The planning and implementation of this recommendation should be expedited and taken up as the first priority.
- 5 A new stormwater drainage system should be constructed which will adequately intercept the surface water and stormwater runoff as per industry standards and divert the water to the ETP for treatment. Since the stormwater from this industry will have COD contributed by highly recalcitrant organic compounds, under no condition should the surface water runoff and/or stormwater runoff be let off into the channel or the environment without treatment in the ETP first. Hence, a new and robust stormwater collection and treatment system must be constructed to intercept and treat the stormwater and surface water runoff as per industry standards. This endeavour must be taken up as the first priority.

- 6 The storage area of fly ash and sludge must be covered and must have a concrete base surrounded by a leak-proof dike to collect the oozing water and any leachate. The dike should be devised with pumping facility to transfer the liquid collected in the dike to ETP for further treatment before disposal in the VECL channel. This effort must be taken up as the first priority.
  
- 7 In the light of the recommendations made regarding the alterations in the ZLD systems for H-Acid and Vinyl Sulphone plants, the scenario with respect to the generation and disposal of hazardous wastes, too, will alter. This aspect should be understood and acted upon by Bodal Unit VII as well as GPCB and VECL. **Table 1.20** is reproduced here for ready reference – which depicts the highlights of the desired actions recommended for alterations and improvements in the H-Acid and Vinyl Sulphone production processes as well as their respective ZLD Systems aimed at minimization of quantities and impacts of hazardous wastes.

**Table 1.20** The highlights of the desired actions recommended for alterations and improvements in the H-Acid and Vinyl Sulphone production processes as well as their respective ZLD Systems aimed at minimization of quantities and impacts of hazardous wastes.

Sr. No.	Source & Description of Solid Hazardous Waste	Present Fraction and Current Disposal Route	Future Desired Scenario based on the Recommended Alterations & Improvements in Production Processes & ZLD Systems
<b>1</b>	<b>H-Acid production</b>		
<b>1.1</b>	Gypsum Sludge from H-Acid production (Regulatory Waste Category 26.1)	59% w/w  Cement Industry	<u>Recommendation:</u> Implement the Solvent Extraction and Distillation technology in place of the existing Neutralization step in the production process (Long Term) <u>Effect:</u> Elimination of Gypsum Sludge generation from H-Acid production.
<b>1.2</b>	Gypsum Sludge from Neutralization in H-Acid ZLD system (Regulatory Waste Category 35.3)	15% w/w  CHW-TSDF and / or Cement Industry	<u>Recommendation:</u> The H <sub>2</sub> SO <sub>4</sub> -bearing filtrate (mother liquor) generated after Isolation step is neutralized. Filter the resulting Gypsum Sludge and concentrate the filtrate in MVR / MEE (in the modified ZLD system). This concentrated liquid must be further processed in the Spray Dryers operated at much lower temperature in the modified ZLD system. The resulting solids (dry salt and / or slurry), thus obtained, should be sent for incineration in authorized CHW-TSDF. Alternately, the possibility of sending the concentrated liquid obtained from MVR / MEE to the incinerator in CHW-TSDF may be explored and implemented; subject to the techno-economic considerations. (Short Term) <u>Effect:</u> The concentrated effluent from H-Acid production will now be processed in the modified ZLD system.
<b>1.3</b>	Iron Sludge from H-Acid production (Regulatory Waste Category 26.1)	16% w/w  Cement Industry	<u>Recommendation:</u> Implement the Catalytic Reduction technology in place of the existing Reduction step which currently utilizes Bechamp reduction in the production process (Long Term) <u>Effect:</u> Elimination of Iron Sludge generation from H-Acid production.
<b>2</b>	<b>Vinyl Sulphone production</b>		
<b>2.1</b>	Gypsum from Neutralization in ETP (Regulatory Waste Category 35.3)	N.A.	N.A.
<b>2.2</b>	Spray Dryer Residues (Ashes) from H-Acid and Vinyl Sulphone ZLD systems (Regulatory Waste Category 37.2)	10% w/w  CHW-TSDF	<u>Recommendation:</u> The use of existing Spray Dryers operated at 500°C in the ZLD systems of H-Acid and Vinyl Sulphone production plants should be discontinued with priority. Instead, the concentrated liquid must be further processed in the Spray Dryers operated at much lower temperature in the modified ZLD system. The resulting solids (dry salt and / or slurry), thus obtained, should be sent for incineration in authorized CHW-TSDF. Alternately, the possibility of sending the concentrate obtained from MVR / MEE to the incinerator in CHW-TSDF may be explored and implemented; subject to the techno-economic considerations. (Short Term) <u>Effect:</u> Discontinue the operation of the Spray Dryers in the existing ZLD systems operated at 500°C.
		<b>100%</b>	All the above recommendations, when implemented, will lead to a decrease of the total hazardous waste generation in the range of <b>40-80%</b> .

**Recommendations for ETP & STP:**

- 1 Taking into consideration the science and technology of degradation of a mixture of dyes, dye intermediates and a huge load of dissolved salts; to make Fenton Treatment work successfully and also hoping that the Aerobic Biological Treatment to render further treatment is going to be a lost cause. It will be best to make this section of production plant Zero Liquid Discharge and rule out the possibility of inadequate treatment.

The existing ETP should be superseded by building a new scientifically designed ETP. All the process modifications suggested in the section on “Recommendations” at the end of this report should be implemented and the resulting altered wastewater generated from the modernized production plant must be subjected to the new ETP. The said modernized newly constructed ETP shall treat the wastewaters generated by: R.O. Reject from Boiler feed, blowdown from Boiler and Cooling Towers, Stormwater. All other flows shall be treated in the ZLD systems for H-Acid production, Vinyl Sulphone production or Dye manufacturing.

These recommendations pertaining to ETP should be implemented with priority because the water in VECL channel has a dark colour and has rather high TDS and has several other pollutants. If the pollution of the ocean is to be stopped, the stringent measures will have to be implemented in each process plant, especially the ones that are engaged in the manufacturing of H-Acid, Vinyl Sulphone, and other dyestuff and dye intermediates.

- 2 A new STP must be constructed immediately using the modern technology.

oxo - oiOio - oxo

(The Last Page)



**True Copy**

549  
o/c



To,  
Unit Head Vadodara,  
Gujarat Pollution Control Board,  
"Paryavaran Bhawan", Sector-10A,  
Gandhinagar (Gujarat)

PCB ID: 21752  
Dated: 21/04/2022

Dear Sir,

Kind Attn: Mrs. D.P.Shah Mam  
Sub: Reply to Direction Notice dated 08/04/2022  
Ref: Outward No.: 658508 dated 08/04/2022

*Handwritten:* 21/04/22  
Gujarat Pollution Control Board  
Head Office  
Sector No.-10-A,  
Gandhinagar-382010

In continuance with your letter as mentioned above we would like to put our response into your kind consideration. We have upgraded our APCM in past as per your guidance; also decided to upgrade even more to favor best environment practices. We would like to put into your notice one-by-one machineries for your knowledge please. Wherein it is clear that we are now going to add few new wet scrubbers, bag filters, ESP into our unit. Purchase Order copies is attached herewith as Annexure-A for your kind preview. Also same will be installed at earliest:

Sr. No.	Stack Attached To	Fuel details		Stack Height	APCM as per CCA	APCM upgraded at actual	APCM Final after Proposed			
		Fuel type	Consumption							
1	IBR steam boiler - 1 [8 MTH]	Lignite/coal	1.25 MT/hr.	37 M	Multyclone	Presently under replacement stage because of maintenance issues. APCM will be upgraded once it is reinstalled.				
2	IBR steam boiler - 2 [8 T/hr.]	Lignite/coal	1.25 MT/hr.		Multyclone					
3	Thermic fluid heater [15 Lac kcal/hr]	Lignite/coal	0.5 MT/hr.		Multyclone			Multyclone+	Bag Filter+	Wet scrubber
4	IBR steam boiler - 3 [15 T/hr]	Coal	100 MT/D	30 M	Multyclone	Multyclone+	Bag filter	ESP system+	Wet scrubber	
5	TFH [15 Lac kcal/hr.]	Lignite/coal	8 MT/D	30 M	Multyclone	Multyclone+	Alkali Wet scrubber	Multyclone+	Bag Filter+	Alkali Wet scrubber

HEAD OFFICE :  
Plot No. 123-124, Phase-1,  
G.I.D.C, Vatva, Ahmedabad-382 445.  
Gujarat, India.

Tel : +91 - 99099 50855  
+91 - 99099 50856  
E-mail : info@bodal.com

PLANT OFFICE :  
UNIT - VII  
Plot No. 804, Village : Dudhwada,  
Ta. : Padra - 391450.

Tel : +91 - 99099 50852  
+91 - 99099 50853  
E-mail : info@bodal.com



6	TFH [6 Lac kcal/hr.]	Lignite/coal	3.5 MT/D		Multi cyclone	Multicyclone	Multicyclone + Alkali wet scrubber
7	IBR steam boiler- for MEE of dyes – [6TPH]	Coal	1 MT/Day	30 M	Multicyclone	Multicyclone	Multicyclone+ Bag Filter+ Alkali Wet scrubber
8	IBR steam boiler [50 T/hr] For 5 mw cogeneration captive power plant	LDO/FO (For start up)	2 KL/hr	70 m	4 stage ESP	4 stage ESP +Auto Lime dosing system	4 stage ESP + Auto Lime dosing system+ Wet scrubber

Yours truly,  
For: Bodal Chemicals Limited

*For*  
*D. P. Mehta*  
Director/Authorized Signatory

Enclosure: As mentioned above

CC: Regional Officer, GPCB-Vadodara, Gujarat

Enclosures:

Annexure – A: PO copies of new scrubber, bag filter and ESP systems

*Booth*

**True Copy**

HEAD OFFICE :  
Plot No. 123-124, Phase-1,  
G.I.D.C, Vatva, Ahmedabad-382 445.  
Gujarat, India.

Tel : +91 - 99099 50855  
+91 - 99099 50856  
E-mail : info@bodal.com

PLANT OFFICE :  
UNIT - VII  
Plot No. 804, Village : Dudhwada,  
Ta. : Padra - 391450.

Tel : +91 - 99099 50852  
+91 - 99099 50853  
E-mail : info@bodal.com



**Bodal Chemicals Ltd.**  
 COLBURS. INTEGRATION. INNOVATION.

O/C

HO - Vadodara copy

PCB ID: 21752  
 Dated: 04/05/2022

To,  
 ✓ **Unit Head Vadodara,**  
**Gujarat Pollution Control Board,**  
**"Paryavaran Bhawan", Sector-10A,**  
**Gandhinagar (Gujarat)**

*25/5/2022*  
 Gujarat Pollution Control Board  
 Head Office  
 Sector No.-10-A,  
 Gandhinagar-382010

Dear Sir,

Kind Attn: Mrs. D.P.Shah Mam

Sub: Submission of Undertaking for Revocation application for Closure Direction Notice dated 08/04/2022 and its extension letter dated 28/04/2022  
 Ref: Outward No.: 658506 dated 08/04/2022, Outward No.: 660661 dated 28/04/2022

In continuance with your letter as mentioned above we would like to reply as following for your-kind consideration please:

- As per your precious guidance we are submitting detailed undertaking attached herewith as **Annexure-A** for your ready reference. We would like to mention here that we have previously submitted time bound action plan. Wherein few of scrubbers have arrived early so we have installed them already. Its compliance status is updated in attached undertaking.
- Also we are attaching water balance for particularly H-Acid & V.S. manufacturing as **Annexure-B** for your reference. Photographs of installed upgraded APCM are attached as **Annexure-C**. We have discussed with Kadam Enviro regarding remediation concern. We are attaching its reply letter for revised scheme as **Annexure-D**. That please take a note.
- We have updated our APCM proposal status as following for your quick reference:

Sr. No.	Stack Attached To	Fuel details		Stack Height	APCM as per CCA	APCM upgraded at actual	APCM Final after Proposed	Status
		Fuel type	Consumption					
1	IBR steam boiler - 1 [8 MTH]	Lignite/coal	1.25 MT/hr.	37 M	Multicyclone	Presently under replacement stage because of maintenance issues. APCM will be upgraded once it is reinstalled.		
2	IBR steam boiler - 2 [8 T/hr.]	Lignite/coal	1.25 MT/hr.		Multicyclone			
3	Thermic fluid heater [15 Lac kcal/hr]	Lignite/coal	0.5 MT/hr.		Multicyclone			

## HEAD OFFICE :

Plot No. 123-124, Phase-1,  
 G.I.D.C, Vatva, Ahmedabad-382 445.  
 Gujarat, India.

Tel: +91 - 99099 50855

+91 - 99099 50856

E-mail : info@bodal.com

## PLANT OFFICE :

UNIT - VII  
 Plot No. 804, Village : Dudhwada,  
 Ta. : Padra - 391450.

Tel: +91 - 99099 50852

+91 - 99099 50853

E-mail : info@bodal.com



4	IBR steam boiler – 3 [15 T/hr]	Coal	100 MT/D	30 M	Multicyclone	Multicyclone+ Bag filter	ESP system+ Wet scrubber	Will be complied as per submitted timeline or earlier possible
5	TFH [15 Lac kcal/hr.]	Lignite/coal	8 MT/D	30 M	Multicyclone	Multicyclone+ Alkali Wet scrubber	Multicyclone+ Bag Filter+ Alkali Wet scrubber	Complied
6	TFH [6 Lac kcal/hr.]	Lignite/coal	3.5 MT/D		Multi cyclone	Multicyclone	Multicyclone + Alkali wet scrubber	Will be complied within 1 week
7	IBR steam boiler- for MEE of dyes – [6TPH]	Coal	1 MT/Day	30 M	Multicyclone	Multicyclone	Multicyclone+ Bag Filter+ Alkali Wet scrubber	Will be complied as per submitted timeline or earlier possible
8	IBR steam boiler [50 T/hr] For 5 mw cogeneration captive power plant	LDO/FO (For start up) Coal	2 KL/hr	70 m	4 stage ESP	4 stage ESP +Auto Lime dosing system	4 stage ESP + Auto Lime dosing system	Complied

We would like to humbly request your good-self to kindly take a note of above clarifications and be humble to us. Please consider this reply in a positive & hopeful way and consequently consider our explanations on your higher side and oblige us by providing us revocation order at earliest and be humble to us.

Yours truly,  
For: Bodal Chemicals Limited

*for*  
*D.P. Nasa*  
Director/Authorized Signatory

Enclosure: As mentioned above  
CC: Regional Officer, GPCB-Vadodara, Gujarat

HEAD OFFICE :  
Plot No. 123-124, Phase-1,  
G.I.D.C, Vatva, Ahmedabad-382 445.  
Gujarat, India.

Tel : +91 - 99099 50855  
+91 - 99099 50856  
E-mail : info@bodal.com

PLANT OFFICE :  
UNIT - VII  
Plot No. 804, Village : Dudhwada,  
Ta. : Padra - 391450.

Tel : +91 - 99099 50852  
+91 - 99099 50853  
E-mail : info@bodal.com



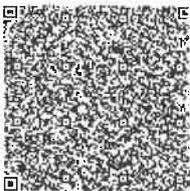
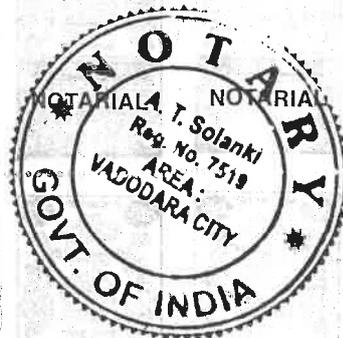
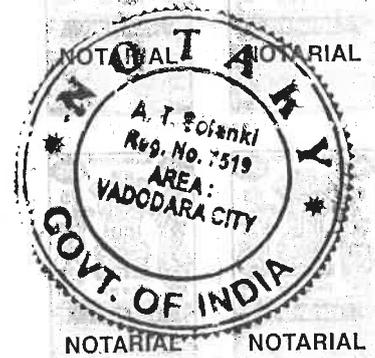
सत्यमेव जयते

# INDIA NON JUDICIAL Government of Gujarat

## Certificate of Stamp Duty

Regd.No.: 3617  
Date: 04/05/2022  
A. T. SOLANKI  
NOTARY, VADODARA

Certificate No. : IN-GJ09363697785079T  
Certificate Issued Date : 25-Aug-2021 02:33 PM  
Account Reference : CSCACC (GV)/ gjcsceg07/ GJ-AHVAI0071/ GJ-AH  
Unique Doc. Reference : SUBIN-GJGJCSCEG0753476284667231T  
Purchased by : BODAL CHEMICALS LTD  
Description of Document : Article 14 Bond  
Description : Not Applicable  
Consideration Price (Rs.) : 0  
(Zero)  
First Party : BODAL CHEMICALS LTD  
Second Party : Not Applicable  
Stamp Duty Paid By : BODAL CHEMICALS LTD  
Stamp Duty Amount(Rs.) : 300  
(Three Hundred only)



NOTARIAL

NOTARIAL

NOTARIAL

KIC

0010513746

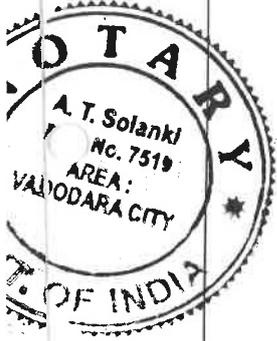
### Statutory Alert:

1. The authenticity of this Stamp certificate should be verified at 'www.shclilestamp.com' or using e-Stamp Mobile App of Stock Holding.
2. Any discrepancy in the details on this Certificate and as available on the website / Mobile App renders it invalid.
3. The onus of checking the legitimacy is on the users of the certificate.
3. In case of any discrepancy please inform the Competent Authority.

UNERTAKING

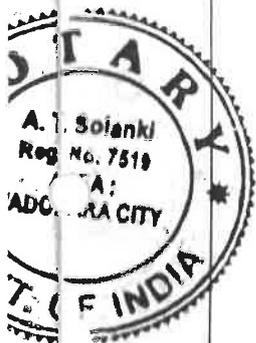
I Mr. Rakesh Patel in the capacity of CEO of M/s. Bodal Chemical Ltd, Block No. 804, Village: Dudhwada Ta: Padra Dist: Vadodara, Gujarat State do hereby solemnly affirm and declare as follow:

Sr. No.	Direction Points	Compliance status under section 33-A of the Water Act-1974	Required details	Time Limit
1.	Unit is not having Flow measurement at source of effluent generation and strategic stages of EMS and therefore no data at various stages are maintained.	Unit has provided flow meter at effluent mete generation source i.e. H acid plant, VS plant, Dyes Plant - 1, 2 & 3 and B naphthol plant, inlet and outlet of effluent treatment unit i.e. ETP, MEE, spray drier and unit has started to maintain the record of the same.  Unit is instructed to maintained record in hard bound printed registered/logbook having page nos.	--	Complied
2.	Gap of 1214.65 KL/month observed in effluent generation recorded from H-acid manufacturing. This indicates that 44% of effluent generation is not recorded	Unit has submitted that, they are reducing the wastewater generation by reutilizing the wash water however there is no any supporting document, quantitative study, records furnished during the visit which support this claim.	Required proper mass balance & water balance with technical justification. (with time limit)	Complied  <b>Annexur e-B</b>
3.	Gap of 72.63 KL/month observed in effluent generation recorded from VS manufacturing. This indicates that about 2.8 % of effluent generation is not recorded.	Unit has provided flow meter at H-acid and VS plant on effluent transfer pipeline so that the actual effluent generation can be known.	Required proper mass balance with technical justification. (with time limit)	Complied  <b>Annexur e-B</b>
4.	Unit is not having flow meter at feedline of spray dryer hence exact quantity of concentrated ML spray dried could not be calculated.	Unit has provided flow meter at spray dryer and started to maintain the records of the same.	--	Complied



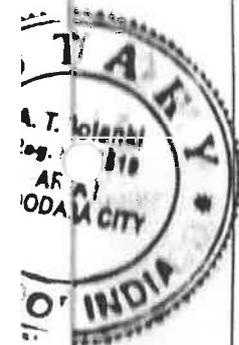
*Handwritten signature/initials*

5.	Unit is not having flow measurement at intermediate effluent storage tank to MEE feed line, hence exact quantity of B-Naphthol effluent treatment could not be calculated.	Unit has provided flow meter at B-naphthol plant on effluent transfer pipeline to intermediate storage at MEE plant so that exact quantity of effluent generation from b-naphthol plant can be known.		Complied
6.	Unit has discharged more effluent than the consented quantity in month of OCT-2021-13891 KL, NOV-2021-14487 KL and DEC 2021-15517 KL. (CCA Quantity-452 KL/day i.e. 13560 KL/Month)	Unit has submitted that effluent (475 KLD) from the sister concern unit M/s. Bodal Chemical Ltd Unit VII Sulphur Division (PCB ID: 33329) is transferred to this unit (PCB ID: 21752) and ultimately discharged into VECL as per CCA of M/s. Bodal Chemical Ltd Unit VII Sulphur Division (PCB ID: 33329). However, it is not mentioned in existing CCA of this unit.	Required CCA-Amendment	Submitted request letter already and will apply for Amendme nt along with CCA-Renewal shortly.
7.	3 way valve system provided at OCMS to return back non-conforming effluent is having pipe connected to final disposal tank of treated effluent, which should actually be connected to collection tank for retreating such effluent.	Unit has now connected the return line of non-conforming effluent from 3-way valve provided at OCMS to collection tank before primary treatment in ETP for re-treating such effluent.	--	Complied
8.	Unit has provided OCMS for measuring quality of effluent being discharged into VECL, however, flexible pipeline & open tray type arrangement connected to sensor box is provided, which is not temper proof & false/misleading, results might be shown by diluting effluent manually in open tray.	Unit submitted that the OCMS and its related machinery are provided, operated and maintained by VECL.  During visit, open tray type arrangement connected to sensor box is still provided as observed earlier, which is not temper proof and false/misleading results might be shown by diluting effluent in open	Required compliance with coordination with VECL.	Will be complied within 25-30 days.



*(Handwritten signature)*

		tray. Hence, unite is instructed to get/make it temper proof so that the manual intervention can be avoided.		
9.	Unit has not provided OCMS facility before and after their discharge point into VECL as per Directions of the board.	Unit has still not provided the OCMS facility on VECL channel at upstream and downstream of their unit to monitor effluent quality variation in VECL.  Unity instructed to submit the time bound action plan to install OCMS facility on VECL at upstream and downstream of the unit.	Undertaking with the time bound. (location factor)	Will be complied within 75-80 days.
10.	Provided Auto sampler with OCMS was found idle during visit.	Unit has submitted that Auto sampler provided and operated by VECL for monitoring quality of effluent being discharged into VECL channel. However, unit is yet not maintaining the records of sample collected by VECL from the Auto sampler.	Required compliance with coordination with VECL.	Complied
11.	IOT valve provided on final treated effluent discharge line into VECL is not observed to be tamper proof and it can be operated /manipulated by member unit also.	Not applicable as the unit has membership of VECL for 24-hour effluent discharge so that IOT valve is not installed.	--	Not applicable
12.	Above ground pipeline network with colour coding, nomenclature & flow direction.	Unit has now provided above ground pipeline for effluent conveyance, except effluent return line from 3-way valve to collection tank. Colour coding with flow directions mentioned on above ground effluent conveyance lines.	Undertaking with the time limit.	Complied
13.	Ground water quality in the premises of the		Undertaking for not to utilize fresh	Reply letter as



	unit is highly contaminated after remediation process and unit has not provided dedicated treatment system for contaminated ground water.		water for industrial purpose with time limit.	Annexure-D.
14.	Required steam meter		Also required steam meter for steam measuring.	Will be complied within 180 days.

COD Load: Over and above we agree to contain production within consented limits and will carry out efficient treatment by way of ZLD, ETP & ground water remediation as per the prescribed norms for maintaining the norms of effluent in Zone-3.

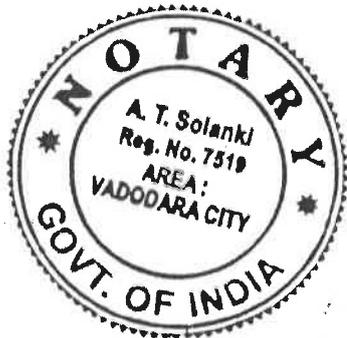
APCM: For APCM, PO copies are already submitted and will be upgraded-installed within 150 days. However, based on supply from supplier and availability we will try our best to install at earliest.

It is verified that contents of my above statement are correct and true to the best of my knowledge & belief and nothing has concealed therein.

Place: Padra

Dated: 02/05/2022

  
Mr. Rakesh Patel  
CEO



BEFORE ME

*Amr 4/5/2022*  
A. T. SOLANKI  
NOTARY, VADODARA

*Path*

True Copy



**Bodal Chemicals Ltd.**  
COLOURS. INTEGRATION. INNOVATION.

O/c

PCB ID: 21752  
Dated: 29/08/2022

To,  
Unit Head Vadodara,  
Gujarat Pollution Control Board,  
"Paryavaran Bhawan", Sector-10A,  
Gandhinagar (Gujarat)

30/08/2022

Gujarat Pollution Control Board  
Head Office  
Sector No.-10-A,  
Gandhinagar-382010

Dear Sir,

Kind Attn: Mrs. D.P.Shah Mam  
Sub: Permanent Revocation application for Closure Direction Notices

Ref.: Notice No. :

1. Outward No. 674003, dated 02/06/2022
2. Outward no. 660661, dated 28/04/2022 and
3. Outward No. 658506, dated 08/04/2022.

In continuance with your letters as mentioned above references.

We would like to inform you that we have complied all the conditions of direction order & CCA. We have already done all corrective measure as per all conditions of Undertaking. We have herewith attached Action plan with all corrective measures as Annexure-A for your ready reference. We have already submitted valid bank guarantees & EDC. So, we herewith request your goodself to kindly scrutinize our case & issue us permanent revocation order.

Thanking You,  
Yours truly,  
For: Bodal Chemicals Ltd

*[Signature]*  
Director/Authorized Signatory

Enclosures: As mention above

Copy to: Gujarat Pollution Control Board, Regional Office, Race course circle, Vadodara

HEAD OFFICE :  
Plot No. 123-124, Phase-1,  
G.I.D.C, Vatva, Ahmedabad-382 445.  
Gujarat, India.

Tel : +91 - 99099 50855  
+91 - 99099 50856  
E-mail : info@bodal.com

PLANT OFFICE :  
UNIT - VII  
Plot No. 804, Village : Dudhwada,  
Ta. : Padra - 391450.

Tel : +91 - 99099 50852  
+91 - 99099 50853  
E-mail : info@bodal.com

Annexure A: Updated status as per our undertaking reply as submitted to your good office on 04/05/2022, 16/06/2022, 02/07/2022 & 08/07/2022 and meeting held at HO, GPCB dated 26/07/2022 and online meeting held on 17/08/2022

Sr. No.	Direction Points	Compliance status under section 33-A of the Water Act-1974	Required details	Time Limit	Updated status as on 16/06/2022	Updated status as on 02/07/2022	Updated status as on 08/07/2022	Updated status as on 06/08/2022	Updated status as on 29/08/2022
1.	Unit is not having Flow measurement at source of effluent generation and strategic stages of EMS and therefore no data at various stages are maintained.	Unit has provided flow meter at effluent mete generation source i.e. H acid plant, VS plant, Dyes Plant - 1, 2 & 3 and B naphthol plant, inlet and outlet of effluent treatment unit i.e. ETP, MEE, spray drier and unit has started to maintain the record of the same.  Unit is instructed to maintained record in hard bound printed registered/logbook having page nos.	--	Complied	Complied	Complied	Complied	Complied. Photographs provided.	Complied. Photographs provided in Annexure 1.

Sr. No.	Direction Points	Compliance status under section 33-A of the Water Act-1974	Required details	Time Limit	Updated status as on 16/06/2022	Updated status as on 02/07/2022	Updated status as on 08/07/2022	Updated status as on 06/08/2022	Updated status as on 29/08/2022
2.	Gap of 1214.65 KL/month observed in effluent generation recorded from H-acid manufacturing. This indicates that 44% of effluent generation is not recorded.	Unit has submitted that, they are reducing the wastewater generation by reutilizing the wash water however there is no any supporting document, quantitative study, records furnished during the visit which support this claim.	Required proper mass balance & water balance with technical justification. (with time limit)	Complied Details submitted	Complied. Details submitted on 04/05/2022	Complied. Details provided in Annexure 2.			
3.	Gap of 72.63 KL/month observed in effluent generation recorded from VS manufacturing. This indicates that about 2.8 % of effluent generation is not recorded.	Unit has provided flow meter at H-acid and VS plant on effluent transfer pipeline so that the actual effluent generation can be known.	Required proper mass balance with technical justification. (with time limit)	Complied Details submitted	Complied. Details submitted on 04/05/2022	Complied. Details submitted on 04/05/2022	Complied. Details submitted on 04/05/2022	Complied. Details submitted.	Complied. Details provided in Annexure 3.
4.	Unit is not having flow meter at feedline of spray	Unit has provided flow meter at spray dryer and started to	--	Complied	Complied	Complied	Complied	Complied. Photograph provided.	Complied. Photograph

Sr. No.	Direction Points	Compliance status under section 33-A of the Water Act-1974	Required details	Time Limit	Updated status as on 16/06/2022	Updated status as on 02/07/2022	Updated status as on 08/07/2022	Updated status as on 06/08/2022	Updated status as on 29/08/2022
	dryer hence exact quantity of concentrated ML spray dried could not be calculated.	maintain the records of the same.							provided in Annexure 4.
5.	Unit is not having flow measurement at intermediate effluent storage tank to MEE feed line, hence exact quantity of B-Naphthol effluent treatment could not be calculated.	Unit has provided flow meter at B-naphthol plant on effluent transfer pipeline to intermediate storage at MEE plant so that exact quantity of effluent generation from b-naphthol plant can be known.		Complied	Complied	Complied	Complied	Complied. Photographs provided.	Complied. Photographs provided in Annexure 5.
6.	Unit has discharged more effluent than the consented quantity in month of OCT-2021- 13891 KL, NOV-2021-14487 KL and DEC 2021-15517 KL.	Unit has submitted that effluent (475 KLD) from the sister concern unit M/s. Bodal Chemical Ltd Unit VII Sulphur Division (PCB ID: 33329) is transferred	Required CCA-Amendment	Submitted request letter already and will apply for Amendme nt along	Will apply for Amendmen t along with CCA-Renewal shortly.	Complied	Complied	CCA Amendment applied. Details provided.	CCA Amendment applied. CCA of Bodal Chemicals Limited Unit VII (SPD) along with

Sr. No.	Direction Points	Compliance status under section 33-A of the Water Act-1974	Required details	Time Limit	Updated status as on 16/06/2022	Updated status as on 02/07/2022	Updated status as on 08/07/2022	Updated status as on 06/08/2022	Updated status as on 29/08/2022
	(CCA Quantity-452 KL/day i.e. 13560 KL/Month)	to this unit (PCB ID: 21752) and ultimately discharged into VECL as per CCA of M/s. Bodal Chemical Ltd Unit VII Sulphur Division (PCB ID: 33329). However, it is not mentioned in existing CCA of this unit.		with CCA-Renewal shortly.					relevant pages from CCA Amendment application provided in <b>Annexure 6.</b>
7.	3 way valve system provided at OCMS to return back non-conforming effluent is having pipe connected to final disposal tank of treated effluent, which should actually be connected to collection tank for	Unit has now connected the return line of non-conforming effluent from 3-way valve provided at OCMS to collection tank before primary treatment in ETP for re-treating such effluent.	--	Complied	Complied	Complied	Complied	Complied. Photographs provided.	Complied. Photographs provided in <b>Annexure 7.</b>

Sr. No.	Direction Points	Compliance status under section 33-A of the Water Act-1974	Required details	Time Limit	Updated status as on 16/06/2022	Updated status as on 02/07/2022	Updated status as on 08/07/2022	Updated status as on 06/08/2022	Updated status as on 29/08/2022
	retreating such effluent.								
8.	Unit has provided OCMS for measuring quality of effluent being discharged into VECL, however, flexible pipeline & open tray type arrangement connected to sensor box is provided, which is not temper proof & false/misleading results might be shown by diluting effluent manually in open tray.	<p>United submitted that the OCMS and its related machinery are provided, operated and maintained by VECL.</p> <p>During visit, open tray type arrangement connected to sensor box is still provided as observed earlier, which is not temper proof and false/misleading results might be shown by diluting effluent in open tray. Hence, unite is instructed to get/make it temper proof so that the</p>	Required compliance with coordination with VECL.	Will be complied within 25-30 days.	We are arranging to put our OCMS outside our premises, which will be handed over to VECL. Work is under progress. Photograph of the same provided on 16/06/2022.	We have received new drawings for RTOM room from VECL on 28/06/2022 . Civil work is started accordingly . We will complete it by 30/07/2022 .	Civil work is ongoing. Photographs provided on 08/07/2022. We will complete it by 30/07/2022.	Complied on 03/08/2022. We have shifted our OCMS in temper proof room outside our premises. Photographs & Report from IESPL & VECL are submitted.	Complied. OCMS is shifted in temper proof room outside our premises. Photographs are attached as <b>Annexure 8</b> & Report from IESPL & VECL are attached as <b>Annexure 8A</b> .

Sr. No.	Direction Points	Compliance status under section 33-A of the Water Act-1974	Required details	Time Limit	Updated status as on 16/06/2022	Updated status as on 02/07/2022	Updated status as on 08/07/2022	Updated status as on 06/08/2022	Updated status as on 29/08/2022
		manual intervention can be avoided.							
9.	Unit has not provided OCMS facility before and after their discharge point into VECL as per Directions of the board.	Unit has still not provided the OCMS facility on VECL channel at upstream and downstream of their unit to monitor effluent quality variation in VECL.  Unity instructed to submit the time bound action plan to install OCMS facility on VECL at upstream and downstream of the unit.	Undertaking with the time bound.  (location factor)	Will be complied within 75-80 days.	OCMS is dispatched and is in transit. Copy of LR provided on 16/06/2022.  Once, we receive, as per you guidelines, we will install it in upstream.	We have received new OCMS system for upstream. Civil work is started accordingly. We will complete it by 30/07/2022.	Civil work is ongoing. Photographs provided on 08/07/2022. We will complete it by 25/07/2022.	Civil work is 95% completed. Photographs were provided on 06/08/2022. We will shift the system by 13/08/2022.	Complied.  We have shifted the system. Configuration was done by VECL team. Photographs are provided in <b>Annexure 9</b> .
10.	Provided Auto sampler with OCMS was found idle during visit.	Unit has submitted that Auto sampler provided and operated by VECL for monitoring quality of effluent being discharged into	Required compliance with coordination with VECL.	Complied	Complied	Complied	Complied	Complied. Auto sampler with OCMS shifted outside our premises.	Complied.  Auto sampler with OCMS shifted outside our premises. Photographs

Sr. No.	Direction Points	Compliance status under section 33-A of the Water Act-1974	Required details	Time Limit	Updated status as on 16/06/2022	Updated status as on 02/07/2022	Updated status as on 08/07/2022	Updated status as on 06/08/2022	Updated status as on 29/08/2022
		VECL channel. However, unit is yet not maintaining the records of sample collected by VECL from the Auto sampler.						Photographs were provided.	are attached as Annexure 8 & 10.
11.	IOT valve provided on final treated effluent discharge line into VECL is not observed to be tamper proof and it can be operated /manipulated by member unit also.	Not applicable as the unit has membership of VECL for 24-hour effluent discharge so that IOT valve is not installed.	--	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
12.	Above ground pipeline network with colour coding, nomenclature & flow direction.	Unit has now provided above ground pipeline for effluent conveyance, except effluent return line from 3-way valve to collection tank. Colour coding with	Undertaking with the time limit.	Complied	Complied	Complied	Complied	Complied. Photographs provided.	Complied. Photographs are provided in Annexure 12.

Sr. No.	Direction Points	Compliance status under section 33-A of the Water Act-1974	Required details	Time Limit	Updated status as on 16/06/2022	Updated status as on 02/07/2022	Updated status as on 08/07/2022	Updated status as on 06/08/2022	Updated status as on 29/08/2022
		flow directions mentioned on above ground effluent conveyance lines.							
13.	Ground water quality in the premises of the unit is highly contaminated after remediation process and unit has not provided dedicated treatment system for contaminated ground water.		Undertaking for not to utilize fresh water for industrial purpose with time limit.	Reply letter provided.	Complied. Details submitted on 04/05/2022.	Complied. Details submitted on 04/05/2022	Review recommendation letter from Consultant was provided on 08/07/2022. As per the recommendation , we have started abstraction from 07/07/2022. Ground water remediation data for May 2022 to June 2022 was provided on 08/07/2022.	As per the consultant's recommendation, we have started abstraction from 07/07/2022.	Complied. We have sufficient capacity of Ground water remediation plant. CE certificate and report are provided in Annexure 13.

Sr. No.	Direction Points	Compliance status under section 33-A of the Water Act-1974	Required details	Time Limit	Updated status as on 16/06/2022	Updated status as on 02/07/2022	Updated status as on 08/07/2022	Updated status as on 06/08/2022	Updated status as on 29/08/2022
14.	Required steam meter		Also required steam meter for steam measuring.	Will be complied within 180 days.	We have ordered it. It will be installed within 130 days.	We are expecting deliveries of steam meters. Since, there are too many meters, we will complete installation by end of August, 2022.	We have received steam meters. These are installed at our plant inlet. Photographs were provided on 08/07/2022.	Complied. Photographs provided.	Complied. Photographs provided in Annexure 14.

Apart from the above details, Certificate from Chartered Engineer w.r.t Capacity & Status of operability of MEE & Spray dryer are attached as **Annexure 15**.



**True Copy**

**568****Bodal Chemicals Ltd.**  
COLOURS. INTEGRATION. INNOVATION.

PDF\_000

**Purpose of Application**

- We, M/s. Bodal Chemicals Ltd., Unit-VII-Dudhwada (21752) located at plot No. 804, Village: Dudhwada, Padra -394116 is holding a valid Consent No:- AWH-88988 dated 26.07.2017 which is valid up to 30.06.2022, for manufacturing of H-acid, Vinyl Sulphone and other consented products. Hence, we are applying for CCA Renewal + Amendment. Details are furnished herewith.
- The unit has also obtained CCA Amendment Outward Order No. 492228 dated 24.01.2019 from GPCB which is valid up to 30.06.2022 to setup and operate Cogeneration Power Plant (5 MW) and also addition of intermediate product Acetanilide Chloro Sulphonated mass as well as change in product quantity with reference to EC obtained.
- With reference to said CCA Amendment Outward Order No. 492228 dated 24.01.2019, the unit has obtained permission for manufacturing of Acetanilide Chloro Sulphonated mass. @ 500 MT/Month and from this 300 MT/Month ACS mass will be utilized on captive basis for manufacturing of Vinyl sulphone (ASC based) @300 MT/Month.
- With reference to said CTE Amendment Outward Order No. 587023 dated 26/03/2021, M/s. Appollo Dye-Chem Private Limited will be added/ transferred to M/s. Bodal Chemicals Ltd., unit-Vii, Dudhwada. Consent order.
- M/s. Appollo Dye-Chem Private Limited is for operation and maintenance of Multiple Effect Evaporator (MEE) and Effluent Treatment Plant (ETP) for the effluent generating from M/s. Bodal Chemicals Ltd ( Unit VII) (ID-21752) & M/s. Bodal Chemicals Ltd ( Unit VII- Sulphur division) (ID-33329).

HEAD OFFICE :

Plot No. 123-124, G.I.D.C, Vatva, Ahmedabad-382 445.  
Gujarat, India.

Tel : +91 - 99099 50855

E-mail : info@bodal.com

PLANT OFFICE :

UNIT - VII  
Plot No. 804, Village : Dudhwada,  
Ta. : Padra - 391450.

Tel : +91 - 99099 50852

+91 - 99099 50853

E-mail : info@bodal.com



As per granted CCA for Bodal Chemicals Ltd. Unit-VII (Sulphur Product Division) Annexure-A, Board permits us to treat effluent of both Bodal Chemicals Ltd. Unit-VII and Unit-VII (Sulphur Product Division) together at Unit-VII and discharge as per prescribed norms into VECL Channel. That is missed out during amendment of Consent.

- Unit has upgraded APCM, These changes are uploaded in PDF\_APC.
- Unit is utilizing and selling various Hazardous Wastes (described below) under rule-9 as per Haz Wastes Rules-2016. So the purpose of this CCA – Amendment application is for utilization or sells off below Hazardous Waste under Rule-9 as per Haz Waste Rules-2016.

**Utilization of SBS Solution in manufacturing of Synthetic Organic Dyes (for which SOP is already available by CPCB).**

- During manufacturing of ACS mass and H-acid, around @800 MT/Month sodium bi sulphide solutions is generated. Among this, @ 430.0 MT/Month of SBS solution is utilized for manufacturing of vinyl Sulphone during reduction step on captive basis and balance @ 370 MT/Month SBS solution is being sold out to actual end users outside the premises having rule-9 permission as per Haz waste rules-2016.
- The unit has executed MOU with actual end users having Rule -9 permission and valid consent order under Haz waste rules -2016 for selling of SBS solution.
- The SOP for utilization of spent acid, SBS Solution (Under category 26.3 of schedule-1 of HW rules,2016 and inorganic acids mentioned at S.NO.15 at foot note of HWM rules,2016) generated from dyes and dyes intermediate industries in production of dye and dyes intermediates is already granted by CPCB on September,2020.
- Based on above explanation, now the unit is applying for CCA Amendment application for addition of hazardous waste for disposal mode of SBS solution to

HEAD OFFICE :  
Plot No. 123-124, Phase-I,  
G.I.D.C, Vatva, Ahmedabad-382 445. Gujarat, India.  
E-mail : info@bodal.com

CCA - Renewal + Amendment, June - 2022  
Tel : +91 - 99099 50855  
+91 - 99099 50856

ANT OFFICE :  
UNIT - VII  
Plot No. 804, Village : Dudhwada,  
Ta. : Padra - 391450.  
Tel : +91 - 99099 50852  
+91 - 99099 50853  
E-mail : info@bodal.com



- sell actual end users under rule-9 under Haz waste rules-2016
- All the relevant documents are uploaded in relevant tags.

**Reuse/Utilization/Sell of Spent Hydrochloric Acid under Rule-9 as per Haz waste rules-2016 in manufacturing of Synthetic Organic Dyes (for which SOP is already available by CPCB)**

- Spent HCL @810-975 MT/Month will be generated from scrubbing system from manufacturing process of ASC Mass.
- The generated Spent HCL is utilized on captive basis in the manufacturing process of different crude synthetic dyes.
- We have already obtained authorization for reuse of Hydrochloric acid 810-975 MT/Month on captive basis for dyes manufacturing vide consent Amendment order No. 492228 dated 24/01/2019.
- Now, we are applying herewith for CC&A Amendment for authorisation for Reuse for captive consumption for dyes manufacturing and/or purchase, receive outside from GPCB authorized potential generator under Rule-9 and utilization for dyes manufacturing process and/or Sell to actual end users who obtained permission under Rule-9 under Hazardous Rules-2016.
- The reasons for requirement for above authorisation are following
- In absence of production of any of the consented product from which the spent acid (HCL- 20 to 30 %) is generated, we have to purchase required spent HCL from outside under rule-9 for manufacturing of consented dyes products.
- In absence of production of synthetic dyes products, the generated spent HCL from scrubbing process has to be sold out to actual end users under rule-9.
- The unit has executed MOU with actual end users for selling of spent HCL as well as actual authorized generator for purchase and utilization of spent HCL having Rule -9 permission under Haz waste rules -2016 and having GPCB valid consent order.

HEAD OFFICE: **CCA - Renewal + Amendment, June - 2022**  
 Plot No. 123-124, Phase-1,  
 G.I.D.C, Vatva, Ahmedabad-382 445. Tel : +91 - 99099 50855  
 +91 - 99099 50856  
 E-mail : info@bodal.com  
 Gujarat, India.

PLANT OFFICE :  
 UNIT - VII  
 Plot No. 804, Village : Dudhwada,  
 Ta. : Padra - 391450.

Tel : +91 - 99099 50852  
 +91 - 99099 50853  
 E-mail : info@bodal.com



**Bodal Chemicals Ltd.**  
 COLOURS. INTEGRATION. INNOVATION.

- The SOP for utilization of spent acid, hydrochloric acid (Under category 20 B schedule-1 of HW rules,2016 and inorganic acids mentioned at S.NO.15 at foot note of HWM rules,2016) generated from dyes and dyes intermediate industries in production of dye and dyes intermediates is already granted by CPCB on September,2020.
- Based on above explanation, now the unit is applying for **CCA Amendment** application for change in disposal mode of HCL and obtain authorization for Reuse for captive consumption for dyes manufacturing and/or purchase, receive from outside from GPCB authorized potential generator under Rule-9 and utilization for dyes manufacturing process and/or Sell to actual end users who obtained permission under Rule-9 under Hazardous Rules-2016.

#### For Sodium Sulfate.

- During manufacturing of b-napthanol @ 500 MT/Month, around @ 385-450 MT/Month of sodium sulfite is generated during separation step. 385-450 MT/Month Sodium sulfite is being sold out to actual end users outside the premises having rule-9 permission as per Haz waste rules-2016.

#### For Solution of Solution of Sodium nitrate and Sodium nitrite.

- During manufacturing of H - acid @ 150 MT/Month, around @ 100-120 MT/Month of solution of Sodium nitrate and Sodium nitrite is generated from scrubbing system from Nitration process step. From this, @ 100-120 MT/Month of Sodium nitrate and Sodium nitrite is again reused in manufacturing of dyes, in case non-operation H - acid production, @ 100 - 120 MT/Month Sodium nitrate and Sodium nitrite is being sold out to actual end users outside the premises having rule-9 permission as per Haz waste rules-2016.
- All the relevant documents are uploaded in relevant tags.

**CCA - Renewal + Amendment, June - 2022**  
 HEAD OFFICE : +91 - 99099 50855  
 Plot No. 123-124, Phase-1, +91 - 99099 50856  
 G.I.D.C, Vatva, Ahmedabad-382 445. E-mail : info@bodal.com  
 Gujarat, India.

PLANT OFFICE :  
 UNIT - VII  
 Plot No. 804, Village : Dudhwada,  
 Ta. : Padra - 391450.

Tel : +91 - 99099 50852  
 +91 - 99099 50853  
 E-mail : info@bodal.com



**Bodal Chemicals Ltd.**  
COLOURS. INTEGRATION. INNOVATION.

## Annexure PDF\_WAT

Details on Water Consumption

Sr. No.	Sources		Water consumption (KLD)				
			As per Bodal CCA : 88988 and its amendment			As per Apollo CCA : AWH-89681	After Merger (both unit) Require
			Fresh	Reuse	Total		
1	Domestic		40	---	40	1.0	41.00
2	Industrial						
a	Process	Water	65	220	675	---	676
		Ice	390				
b	Boiler		640	---	640		640
c	R. O. Rejection		210	---	210		210
d	Cooling		500	---	500		500
e	Washing		50	320	370		370
f	Scrubber		---	50	50		50
g	Gardening		140	---	140		140
h	Firefighting		100	---	100		100
	Total		1745 + 390(Ice) = 2135	590	2725		1.0

HEAD OFFICE :  
Plot No. 123-124, Phase-1,  
G.I.D.C, Vatva, Ahmedabad-382 445. Gujarat, India.  
Tel : +91 - 99099 50855  
+91 - 99099 50856  
E-mail : info@bodal.com

PLANT OFFICE :  
UNIT - VII  
Plot No. 804, Village : Dudhwada,  
Ta. : Padra - 391450.

Tel : +91 - 99099 50852  
+91 - 99099 50853  
E-mail : info@bodal.com

A. Air Pollution Control Measures-Details (APC) Uploaded in XGN on 02/07/2022 18:01:47 from IP No: 111.93.234.214.

B. 21752-Bodal Chemicals Ltd (Unit-Vii) accepts the LEGAL responsibility

and undertakes that the furnished information is CORRECT & ACCURATE. BODAL.COM  
UNIT - VII, PLOT NO. 804, VILLAGE : DUDHWADA, TA. : PADRA - 391450, AHMEDABAD - 382445, GUJARAT, INDIA. 1986PLC009003



## DETAILS ON WASTEWATER GENERATION

**Bodal Chemicals Ltd.**  
COLOURS. INTEGRATION. INNOVATION.

Sr. No	Sources	KLD					
		As per Bodal CCA : 88988 and its amendment			As per Apollo CCA : AWH-89681	After Merger (both unit) Require	
		Generation	Reuse	Net to ETP			
1	Domestic	25	---	25	0.0	25	
2	Industrial						
a	Process	To ETP	122	---	122	0.0	122
		To ZED	230	---	---		---
b	Boiler	25	---	25		25	
c	R.O. Rejection	210	100	110		110	
d	Cooling Bleed off	60	60	--		--	
e	Washing	370	200	170		170	
f	Scrubber	10	10	---		---	
	<b>Total</b>	<b>1052</b>	<b>370</b>	<b>452</b>		<b>452</b>	

### Mode of Disposal:

- Here it is very clear that the waste water that is being generated (Total: 230 KL/Day) from process are subjected to Zero Discharge System.
- 452 KL/Day waste water is allowed to dispose through ECP Channel.
- While remaining 452 KL/Day along with 475 KL/Day effluent from Sulfur Product division having CCA No. AWH: 111308 will be sent to ECP after appropriate treatment if required.
- Domestic waste water is allowed to dispose through ECP Channel.

HEAD OFFICE : **CCA –Renewal + Amendment, June - 2022**  
 Plot No. 123-124, Phase-1,  
 G.I.D.C, Vatva, Ahmedabad-382 445. E-mail : info@bodal.com  
 Gujarat, India.

PLANT OFFICE :  
 UNIT - VII  
 Plot No. 804, Village : Dudhwada,  
 Ta. : Padra - 391450.

Tel : +91 - 99099 50852  
 +91 - 99099 50853  
 E-mail : info@bodal.com



**Bodal Chemicals Ltd.**  
COLOURS. INTEGRATION. INNOVATION.

PDF\_HW3

### Details of Hazardous Waste Generation and its Management

Sr. No.	Name of waste	Category No. as per HWM Rules	Quantity			Method of Disposal
			Existing as per CC&A Amendment order no. 492228 dated 29.01.19	Actual generation/proposed	Ultimate	
1	Process sludge from filtration and neutralization	26.1 of Schedule I	1350 MT/M	--	1350 MT/M	Collection, storage, transportation & Disposal to TSDF site or Sold to cement manufacturing units.
2	Iron sludge	26.1 of Schedule I	315 MT/M	--	315 MT/M	Collection, Storage, Transportation & Disposal to TSDF site or Sold to cement manufacturing units.
3	ETP sludge	35.3 of Schedule I	400-425 MT/M	--	400-425 MT/M	Collection, Storage, Transportation & Disposal to TSDF or Sold to cement manufacturing units.
4	Incineration ash /Spray drying	37.2 of Schedule I	245 MT/M	--	245 MT/M	Collection, Storage, Transportation & Disposal to TSDF site.
5	Distillation residues	36.1 of Schedule I	1.5 – 2 MT/M	--	1.5 – 2 MT/M	Collection, Storage, Transportation & Disposal to CHWI facility.
6	Used oil	5.2 of Schedule I	100 Lit/Y (Max)	--	150 Lit/Y (Max)	Collection, storage and sold to registered recyclers.
7	Discarded containers / liners	33.1 of Schedule I	@17,000 nos. / M	--	@17,000 nos. / M	Collection, Storage, and reused for disposal of waste storage to TSDF site/ Sent to registered recycler.
8	Spent Sulphuric Acid	B15 of Schedule-II	2100-2300 MT/M	--	2100-2300 MT/M	Captive consumed in manufacturing of H-acid/ sold out to authorize potential users.

HEAD OFFICE :

Plot No. 123-124, Phase-I,  
G.I.D.C, Vatva, Ahmedabad-382 445.  
Gujarat, India.

Tel : +91 - 99099 50855

E-mail : info@bodal.com

PLANT OFFICE :

UNIT - VII  
Plot No. 804, Village : Dudhwada,  
Ta. : Padra - 391450.

Tel : +91 - 99099 50852

+91 - 99099 50853

E-mail : info@bodal.com



9	Hydrochloric acid	B15 of Schedule-II	810-975 MT/M	--	810-975 MT/M	Reuse for captive consumption for dyes manufacturing and/or Receive, from outside from authorized generator under Rule-9 for manufacturing of dyes process and/or Sell to actual potential end users who obtained permission under Rule-9 under Hazardous waste management Rules-2016
10	SBS Solution	B15 of Schedule-II	0.00	800.00 MT/Month	800.00 MT/Month	Collection, Storage, reused as captive consumption @ 430 MT/Month for VS Manufacturing and balance @ 370 MT/Month will be sold out to authorized potential users under rule-9 under Haz waste rules-2016
11	Sodium sulfite	B15 of Schedule-II	0.00	385- 450 MT/Month	385- 450 MT/Month	Collection, Storage, @ 385- 450 MT/Month will be sold out to actual potential users under rule-9 under Haz waste rules-2016
12	Solution of Sodium nitrate and Sodium nitrite	B15 of Schedule-II	0.00	100-120 MT/Month	100-120 MT/Month	Collection, Storage, reuse as captive consumption @ 100-120 MT/Month for manufacturing dyes and in case dyes plant is not in operation @ 100-120 MT/Month will be sold out to authorized potential users under rule-9 under Haz waste

HEAD OFFICE :

Plot No. 123-124, Phase-I,

G.I.D.C, Vatva, Ahmedabad-382 445.

Gujarat, India.

Tel : +91 - 99099 50855

+91 - 99099 50856

E-mail : info@bodal.com

PLANT OFFICE :

UNIT - VII

Plot No. 804, Village : Dudhwada,

Ta. : Padra - 391450.

Tel : +91 - 99099 50852

+91 - 99099 50853

E-mail : info@bodal.com



**Bodal Chemicals Ltd.**  
rules-2016  
COLOURS. INTEGRATION. INNOVATION.

Non-Hazardous Waste						
1	Fly Ash	--	240 MT/M	--	240 MT/M	Collection, Storage, Transportation and reused in cement manufacturing industry, brick manufacturing industry.
2	Bottom Ash	--	100 MT/M	--	100 MT/M	Collection, Storage, Transportation and reused for filling of low-lying area, in brick manufacturing industry.

HEAD OFFICE  
Plot No. 123-124, Phase-I,  
G.I.D.C, Vatva, Ahmedabad-382 445.  
Gujarat, India.

**CCA - Renewal + Amendment, June - 2022**

Tel : +91 - 99099 50855  
+91 - 99099 50856  
E-mail : info@bodal.com

PLANT OFFICE :  
UNIT - VII  
Plot No. 804, Village : Dudhwada,  
Ta. : Padra - 391450.

Tel : +91 - 99099 50852  
+91 - 99099 50853  
E-mail : info@bodal.com



**Bodal Chemicals Ltd.**  
COLOURS. INTEGRATION. INNOVATION.

**Flue Gas Stacks:**

Sr. No.	Stack Attached To	Fuel details		Stack Height	Pollution Control Measures
		Fuel type	Consumption		
<b>As per Bodal CCA : 88988 and its amendment</b>					
1	IBR steam boiler – 1 [8 MTH]	Lignite/coal	1.25 MT/hr.	37 M	Multicyclone  (Presently under replacement stage because of maintenance issues. APCM will be upgraded once it is reinstalled.)
2	IBR steam boiler – 2 [8 T/hr.]	Lignite/coal	1.25 MT/hr.		
3	Thermic fluid heater [15 Lac kcal/hr]	Lignite/coal	0.5 MT/hr.	30 M	Multicyclone+ Bag Filter+ Alkali Wet scrubber
4	IBR steam boiler – 3 No. [15 T/hr]	Coal	100 MT/D		
5	HAG for Dyes (35 Lac kcal/hr.)	Coal	20 MT/D	30 M	Multicyclone+ Bag filter
6	TFH [15 Lac kcal/hr.]	Lignite/coal	8 MT/D		
7	TFH [6 Lac kcal/hr.]	Lignite/coal	3.5 MT/D	30 M	Multicyclone + Alkali wet scrubber
8	IBR steam boiler- for MEE of dyes – [6TPH]	Coal	1 MT/Day		
9	Hot air generator – 2 nos. [35 Lac kcal/hr.]	Coal	20 MT/D (Each)	30 M (common)	Multicyclone+ Bag Filter
10	Incinerator-1 (2000 L/hr)	F.O.	0.25 KL/hr.		Stand-by Quenching

HEAD OFFICE :  
Plot No. 123-124, Phase-I,  
G.I.D.C., Vatva, Ahmedabad-382 445.  
Gujarat, India.

**CCA - Renewal + Amendment - June - 2022**

Tel : +91 - 99099 50855  
+91 - 99099 50856  
E-mail : info@bodal.com

PLANT OFFICE :  
UNIT - VII  
Plot No. 804, Village : Dudhwada,  
Ta. : Padra - 391450.

Tel : +91 - 99099 50852  
+91 - 99099 50853  
E-mail : info@bodal.com

www.bodal.com  
CIN No. : L24110GJ1986PLC009003



**Bodal Chemicals Ltd.**  
COLOURS INNOVATION. INNOVATION.

11	Incinerator-2 (1000 L/hr)	F.O.	0.10 KL/hr.		ventury scrubber followed by spray Tower
12	IBR steam boiler [50 T/hr] For 5 mw cogeneration captive power plant	Coal/Lignite	6.126 T/hr	70 m	4 stage ESP + Auto Lime dosing system
		LDO/FO (For start up)	2 KL/hr		
13	Waste steam generated by one unit of the company	Steam generated	~ 12 MT/hr	--	--
<b>As per Apollo CCA : AWH-89681</b>					
1	Hot air generator no.-1 (20 lacs Kcal/hr) for spray dryer no.-1	Coal	550 kg/hrs.	Common 30 m	Multicyclone+ Bag Filter+ Alkali Wet scrubber
2	Hot air generator no.-2 (20 lacs Kcal/hr) for spray dryer no.-2	Coal	550 kg/hrs.		

**CCA-Renewal + Amendment, June 2022**  
HEAD OFFICE :  
Plot No. 123-124, Phase-1,  
G.I.D.C, Vatva, Ahmedabad-382 445. Gujarat, India.  
+91 - 99099 50856  
E-mail : info@bodal.com

PLANT OFFICE :  
UNIT - VII  
Plot No. 804, Village : Dudhwada,  
Ta. : Padra - 391450.

Tel : +91 - 99099 50852  
+91 - 99099 50853  
E-mail : info@bodal.com



## Process Gas Emission

**Bodal Chemicals Ltd.**  
 COLOURS. INTEGRATION. INNOVATION.

Sr. no.	Stack attached to	Stack height	Pollution Control Measures	Type of Pollutant	Conc. of Pollutant	Remark
1	Chloro sulphonator & Decomposition	15 m	Packed column followed by two venturi scrubbers followed by alkali scrubber	HCl SO <sub>2</sub>	<20 mg/Nm <sup>3</sup> <40 mg/Nm <sup>3</sup>	As per Bodal CCA : 88988 and its amendment
2	Neutralizer vessel of H-acid Plant	15 m	Venturi scrubber followed by two-stage caustic soda scrubber	NO <sub>x</sub>	<25 mg/Nm <sup>3</sup>	
3	Isolation vessel of H-acid plant	15 m	Four venturi scrubber followed by three stage alkali scrubbers	SO <sub>2</sub>	< 40 mg/Nm <sup>3</sup>	
4	Spray dryer # 1 Spray dryer # 2 Spray dryer # 3 Spray dryer # 4	25 m [each]	Two stage cyclone separator followed by wet scrubber	PM	< 50 mg/Nm <sup>3</sup>	
5	Process vent from fusion vessel	15 m	Alkali scrubber	SO <sub>2</sub>	< 40 mg/Nm <sup>3</sup>	
6	Chloro sulphonator & Decomposition	15 m	Packed column followed by two venturi scrubbers followed by alkali scrubber	HCl SO <sub>2</sub>	<20 mg/Nm <sup>3</sup> <40 mg/Nm <sup>3</sup>	
7	Spray Dryer # 1A Spray Dryer # 2A Spray Dryer # 3A Spray Dryer # 4A Spray Dryer # 5A	30 m [each]	Two stage cyclone separator followed by wet scrubber	PM	<50 mg/Nm <sup>3</sup>	
8	Spray Dryer-1	30 m	Cyclone followed by alkali scrubber	PM	<100 mg/Nm <sup>3</sup>	As per Apollo CCA : AWH-89681
9	Spray Drier-2					

  
**True Copy**

HEAD OFFICE: **CCA - Renewal + Amendment, June 2022**  
 Plot No. 123-124, Phase-1,  
 G.I.D.C, Vatva, Ahmedabad-382 445. E-mail : info@bodal.com  
 Gujarat, India.

PLANT OFFICE :  
 UNIT - VII  
 Plot No. 804, Village : Dudhwada,  
 Ta. : Padra - 391450.

Tel : +91 - 99099 50852  
 +91 - 99099 50853  
 E-mail : info@bodal.com



**Bodal Chemicals Ltd.**  
COLOURS. INTEGRATION. INNOVATION.

O/C

N.N.P  
04/05/2022

**Gujarat Pollution Control Board**  
Head Office  
Sector No.-10-A,  
Gandhinagar-382010

PCB ID: 21752  
Dated: 06/05/2022

To,  
Regional Officer,  
GPCB-Vadodara,  
Gujarat

Dear Sir,

Kind Attn: Mrs. D.P.Shah Mam and Mr. R.B.Trivedi Sir  
Sub: Reply to email received from [ro-gpcb-vado@gujarat.gov.in](mailto:ro-gpcb-vado@gujarat.gov.in) dated 06/05/2022

In continuance with your letter as mentioned above we would like to reply as following for your kind consideration please:

1. We have already submitted product wise water balance and now we have attached H-Acid and V.S. Mass balance as **Annexure-A** as desired.
2. We have already submitted CCA Correction letter. However, to apply for CCA-Renewal and Amendment, we have started working on it, we will take maximum 1 week. That please take a note.
3. We are attaching herewith latest remediation report for your ready reference as **Annexure-B**.

We would like to humbly request your good-self to kindly take a note of above clarifications and be humble to us. Please consider this reply in a positive & hopeful way and consequently consider our explanations on your higher side and oblige us by providing us revocation order at earliest and be humble to us.

Yours truly,  
For: Bodal Chemicals Limited

*For*  
*D.P. Mahajan*  
Director/Authorized Signatory

Enclosure: As mentioned above  
CC: Unit Head Vadodara, Gujarat Pollution Control Board, "Paryavaran Bhawan", Sector-10A, Gandhinagar (Gujarat)

HEAD OFFICE :  
Plot No. 123-124, Phase-1,  
G.I.D.C, Vatva, Ahmedabad-382 445.  
Gujarat, India.

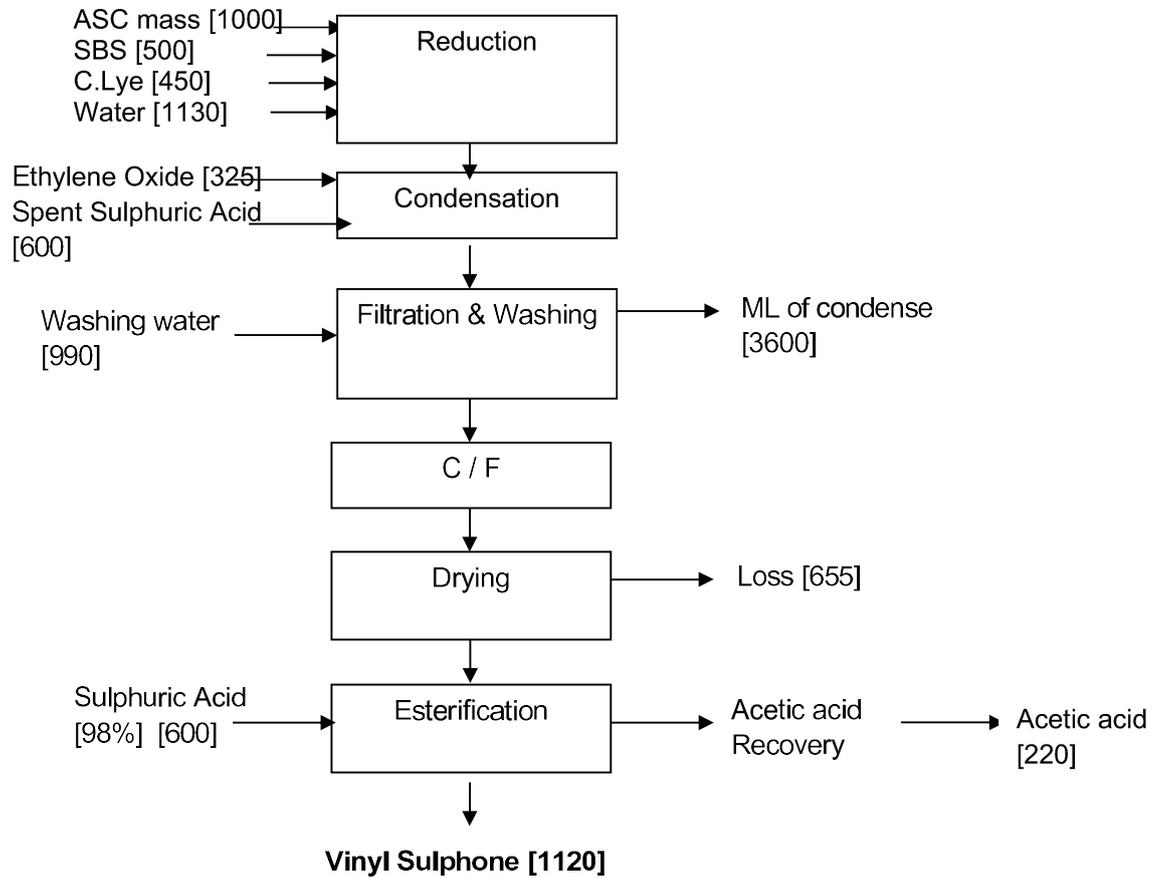
Tel : +91 - 99099 50855  
+91 - 99099 50856  
E-mail : [info@bodal.com](mailto:info@bodal.com)

PLANT OFFICE :  
UNIT - VII  
Plot No. 804, Village : Dudhwada,  
Ta. : Padra - 391450.

Tel : +91 - 99099 50852  
+91 - 99099 50853  
E-mail : [info@bodal.com](mailto:info@bodal.com)

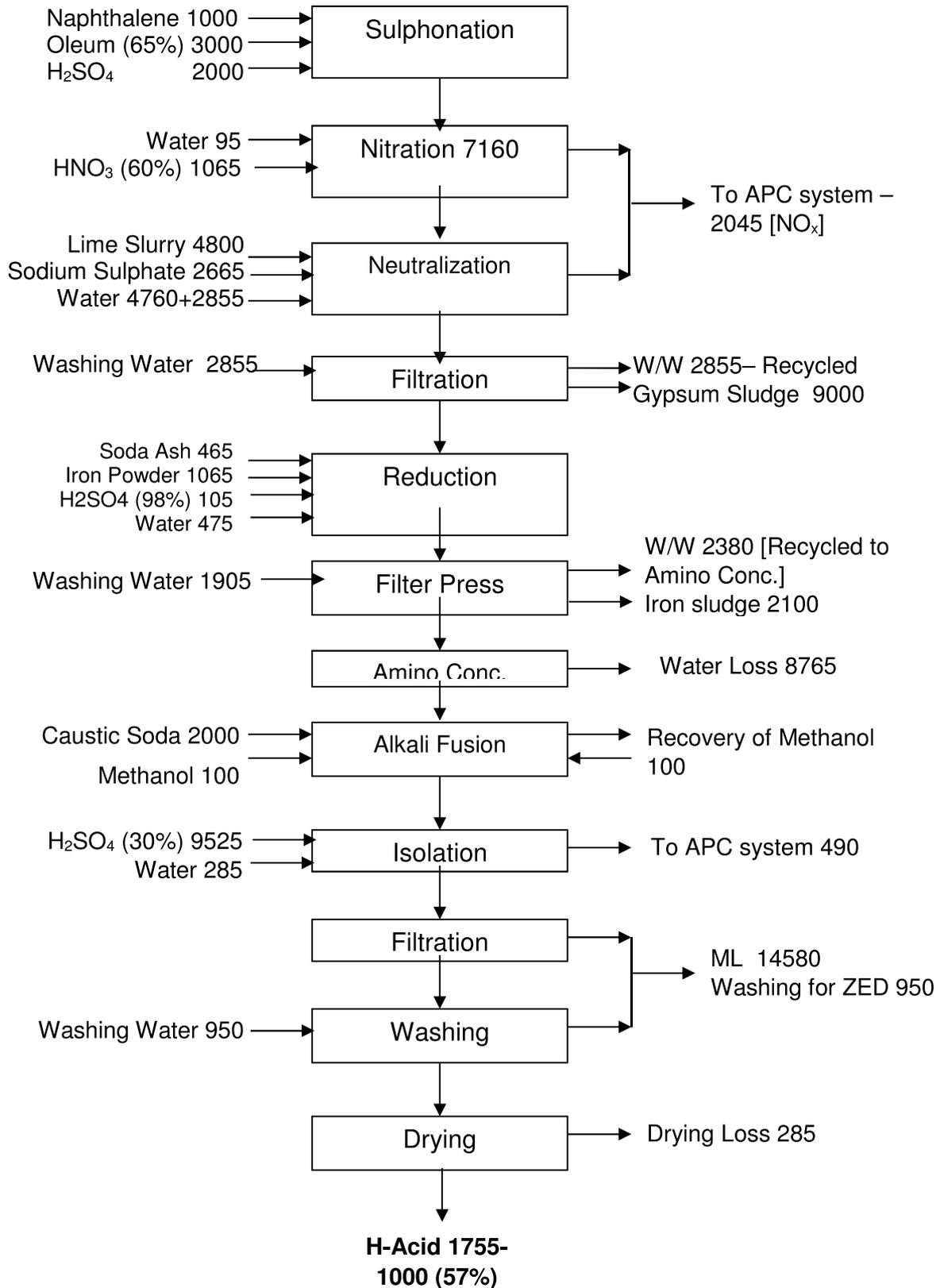
## Vinyl Sulphone

1. In reduction vessels the slurry of sodium bisulphate, caustic lye and water is prepared and gradual addition of wet cake of ASC is carried out. The pH is maintained around 7 using little quantity of sulphuric acid and temperature is maintained around 55°C using circulation chilled water.
2. The reacted mass from reduction vessel is taken to another reactor for carrying out condensation with ethylene oxide with sulphuric acid. The temperature is maintained around 50°C using cooling water recirculation.
3. The condensed mass is vacuum filtered. The filtrate containing about 15 to 20% of Glauber salt is taken for recovery of Glauber salt and the rest of the filtrate is sent to the incinerator for zero discharge.
4. The wet cake of condensed mass is dried.
5. Dried condensed mass is subjected to esterification using concentrated sulphuric acid of 98%.
6. The vapours evolved during esterification are taken to condenser through vacuum to obtain acetic acid.
7. The esterified mass is Vinyl Sulphone. It is pulverized and packed.

VINYL SULPHONE

## H-Acid

1. Sulphonation of Napthalene is carried out in closed jacketed vessel using Sulphuric acid and Oleum (65%).
2. The sulphonated liquid mass is then transferred to another closed-jacketed vessel for nitration through gradual addition of 60% Nitric acid.
3. Nitrated mass is then dumped into a closed dumping / neutralization vessel (MSRL) containing solution of lime slurry and sodium sulphate.
4. The vapour of oxide of nitrogen evolved during dumping is taken to air pollution control system consisting of venturi ejector followed by alkali scrubber for effective absorption.
5. The neutralized mass is filtered through notch filter for removal of gypsum sludge.
6. Gypsum sludge is further washed with freshwater to recover traces of nitro mass and wash water is recycled for the preparation of lime slurry for next batch.
7. The neutralized liquid of nitro mass is subjected to reduction using soda ash, iron powder and hydrochloric acid.
8. The amino mass obtained after reduction is subjected to filtration to separate iron sludge.
9. The iron sludge is washed and the wash water is reused.
10. The amino mass is subjected to concentration.
11. The fusion of concentrated amino mass is carried out in an autoclave using caustic soda in presence of methanol. The methanol is recovered through condensation and reuse back after addition of make-up quantity.
12. The isolation of fusion mass is carried out using spent sulphuric acid in a closed vessel. The sulfur dioxide gas evolved during the process is sent to air pollution control system for effective absorption process emission.
13. The isolated mass is subjected to filtration and centrifuge to obtain wet cake of H-acid. It is further washed with water.
14. The wet cake of H-acid is dried and packed.

H-ACID

**env**

---

**From:** Rutuja Zaveri <rutuja@kadamenviro.com>  
**Sent:** 02 May 2022 12:58  
**To:** Bhavin Jambucha  
**Cc:** sangram@kadamenviro.com; 'Ameya Vaze'; env; Shailesh Meghani; Rakesh Patel  
**Subject:** RE: Response for GPCB w.r.t. GW abstraction of 800 KLD (Designed capacity)  
**Attachments:** Reply to GPCB\_Bodal\_2.5.2022.docx

Dear Bhavin,

Please find enclosed response to GPCB regarding the abstraction volumes.

Kind Regards,

**Rutuja Zaveri**

Solid Waste & Contaminated Sites Expert, Engineering Department



**Kadam Environmental Consultants**  
Vadodara • Delhi  
**Environment for Development**

871/B/3, GIDC Makarpura, T +91 265 6131 000 (B) / + 91 265 6131 036 (D) E [rutuja@kadamenviro.com](mailto:rutuja@kadamenviro.com)  
Vadodara, Gujarat, C [kadamenviro@kadamenviro.com](mailto:kadamenviro@kadamenviro.com)  
INDIA - 390010 M +91 98980 17738 W <http://www.kadamenviro.com/>

*Internet communications cannot be guaranteed to be secure or error-free as their content could be intercepted, corrupted, lost, arrive late or contain viruses. The sender therefore does not warrant the accuracy or reliability of any information transmitted by e-mail. Any opinions expressed in this message are those of the author and may not be endorsed by Kadam Environmental Consultants or Group Companies unless intended solely for the use of the individual or entity they are addressed to. If you have received this email in error please notify [kadamenviro@kadamenviro.com](mailto:kadamenviro@kadamenviro.com).*

---

**From:** Bhavin Jambucha [mailto:[bhavin.jambucha@bodjal.com](mailto:bhavin.jambucha@bodjal.com)]  
**Sent:** 30 April 2022 13:46  
**To:** [rutuja@kadamenviro.com](mailto:rutuja@kadamenviro.com)  
**Cc:** Ameya Vaze <[ameya@kadamenviro.com](mailto:ameya@kadamenviro.com)>; sangram@kadamenviro.com; env <[env@bodjal.com](mailto:env@bodjal.com)>; Shailesh Meghani <[shailesh@bodjal.com](mailto:shailesh@bodjal.com)>; Rakesh Patel <[rakeshpatel@bodjal.com](mailto:rakeshpatel@bodjal.com)>  
**Subject:** Response for GPCB w.r.t. GW abstraction of 800 KLD (Designed capacity)

Dear Madam,

As per our today's discussion at your good office, we need to provide a response to GPCB that at present why we are not able to abstract designed capacity for GW remediation. Reasoning and justification w.r.t current abstraction and strategy for abstraction of 800 KLD is required from your end.

Kindly treat this on URGENT basis... we have to submit the response by Monday morning.

With Regards,



+91 706 904 6773



## Bhavin Jambucha

Head - Environment  
Bodal Chemicals Limited



[bhavin.jambucha@bodal.com](mailto:bhavin.jambucha@bodal.com)

[www.bodal.com](http://www.bodal.com)

Bodal Chemicals Ltd. (UNIT-VII), Plot No. 804,  
Village: Dudhwada, Ta. Padra, Gujarat – 391450

