



RESEARCH ARTICLE

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RESEARCH PAPER ON COPPER SMELTING PLANT ON ENVIRONMENT: VEDANTA COPPER SMELTING PLANT IN TUTICORIN

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ABSTRACT

Development is the need for any country's progress but not at the cost of livelihood of future generations. Industries are the bread and butter for our modern evolved country, and surplus hazardous toxic waste that comes out due to it, is continuous and unavoidable. Such hazardous toxic wastes are potentially harmful to the environment and human health if not treated well. Presently there are some cases which state that how industries emitting the hazardous toxic waste have affected the environment and the human life and Vedanta Copper Smelting Plant in Tuticorin is one of those cases. This paper gives an insight as to how the copper smelting plant has affected the lives of the people living in Tuticorin situated in Tamil Nadu.

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INTRODUCTION

Copper smelting process is the process of extracting the copper plant from its ore. Most ores are a chemical compound of metal with other elements, like or oxygen sulphur. Smelting uses heat and a reducing agent, like coal, to remove these other elements from the metal. For carrying out the said process the plants are being setup in the various parts of the world. In India, the copper smelting plants are situated in the parts of Gujarat and Tamil Nadu. The copper is very harmful and effective to the environment as well as to the human life. Elevated levels of copper are toxic in aquatic environments and may adversely affect fish, invertebrates, plants, and amphibians. Acute toxic effects may include mortality of organisms; chronic toxicity can result in reductions in survival, reproduction, and growth. Breathing high levels of copper can cause irritation of the nose and throat. Ingesting high levels of copper can cause nausea, vomiting, and diarrhoea. Very-high doses of copper can cause damage to the liver and kidneys, and can even cause death.

RESEARCH OBJECTIVES

1. To understand the history of Vedanta Copper Smelting Plant in Tuticorin.

2. To study the effects of Vedanta Copper Smelting Plant on environment and human.
3. Possible solutions in order to avoid such environmental pollution caused by Vedanta Copper Smelting Plant.

LITERATURE REVIEW

Sterlite Industries is a subsidiary of Vedanta Resources, a metals and mining conglomerate. It is based in Mumbai, India. The company operated a copper smelter plant in Thoothukudi (Tuticorin), India until it was shut down by the Government of Tamil Nadu in May 2018. The plant also included a refinery, a phosphoric acid plant and a sulphuric acid plant. The company's main operating subsidiaries are Hindustan Zinc Limited for its zinc and lead operations; Copper Mines of Tasmania Pty Limited for its copper operations in Australia; and Bharat Aluminium Company Limited for its aluminium operations. It also operates a copper mine in Australia. On 23 Feb 2001, Sterlite bought 51% stake in Bharat Aluminium Co. from the government of India by \$118.5 million. In September 2013, SESA Goa, Sterlite Industries and Vedanta Aluminium merged to form Sesa Sterlite Limited. The history of Vedanta Copper Smelting Plant, which is in controversy nowadays, is as follows:

October 1994: Tamil Nadu's then chief minister, Jayalalithaa Jayaraman, lays the foundation stone for a Rs1,300 crores

copper smelter project proposed by Sterlite Copper, in Tuticorin. It was already in controversy and reportedly rejected by Gujarat, Goa, and Maharashtra before moving to Tamil Nadu. The said project sparks opposition from residents, who join environmentalists to form the Anti-Sterlite Movement.

1996: The National Trust for Clean Environment approaches the Madras High Court to challenge the environmental clearances granted for the project by Tamil Nadu's ministry of environment and forests and the Tamil Nadu Pollution Control Board (TNPCB). In the meantime, the copper smelter is built and receives a license to operate from the government.

January 1997: The plant begins operations, producing 391 tonnes of copper anode per day. Six months later, employees at Ramesh Flowers, a dry flower manufacturing facility next door, reportedly fall sick and are rushed to hospital. A month after that, workers at a nearby Tamil Nadu Electricity Board sub-station complain of headaches and coughing.

November 1998: A report by the National Environmental Engineering Research Institute (NEERI), commissioned by the Madras high court, finds that the Sterlite Copper plant is located within 14km of the Gulf of Mannar, flouting the government's stipulation that it not be located within 25km of the ecologically sensitive area. NEERI also finds that it was gas leaks from the copper plant that made nearby workers sick, and that it had contaminated groundwater with arsenic, lead, and selenium, among other chemicals. The high court orders the plant to close but a few days later modifies its order to allow the plant to run while the NEERI conducts another study.

March 1999: Workers at a nearby All India Radio office are hospitalised after complaining of breathlessness and nausea. Despite this, the plant is given permission to nearly double its production to 70,000 tonnes per year.

October 2008: As protests and court cases against the plant drag on, a study by researchers from Tirunelveli Medical College finds a high prevalence of respiratory tract infections among residents living within a 5km radius. They attribute this to air pollution from a mix of gases and particulate matter.

September 2010: Over a decade after the National Trust for Clean Environment filed its case against the Sterlite plant, the Madras high court orders it to be shut down, citing its violations of the law and heavy pollution. "The materials on record show that the continuing air pollution being caused by the noxious effluents discharged into the air by the respondent company is having a more devastating effect on the people living in the surroundings," its judgement said. Sterlite Copper appeals to the supreme court of India, which stays the order within days, allowing the plant to continue production.

March 2013: Residents of Thoothukudi (Tuticorin) allege that there was a gas leak from the factory, complaining of coughing, wheezing, eye irritation, and miscarriages due to the effects of the toxic gas being emitted. Locals stage a demonstration demanding the plant be shut. The TNPCB (Tamil Nadu Pollution Control Board) orders the plant to be shut until further notice.

April 2013: The Supreme Court overturns the 2010 Madras high court directive to shut down the plant, but orders a Rs100 crores fine on the company for flouting environmental norms.

June 2013: Shut for nearly three months, the factory reopens after the National Green Tribunal allows the company to commence operations on the grounds that "no scientific data, analysis, etc, has been placed...to show emission in excess of prescribed parameters.

February 2018: The latest round of protests against Vedanta begin after Sterlite Copper proposes to expand the facility and add a second unit in the factory. The company intends to double its production from the current 4,00,000 tonne capacity. If the expansion comes through, it will be the world's largest single-location copper smelter in an urban area. Beginning with around 250 people going on strike, the demonstration grows into large-scale protests with thousands from Thoothukudi (Tuticorin) and neighboring areas coming together.

March 2018: Amid the protests, the existing plant is temporarily shut for scheduled maintenance. Subsequently, the company seeks consent to reopen from the TNPCB (Tamil Nadu Pollution Control Board). The request is rejected on the grounds that the company hasn't complied with the required environmental norms. The anti-Sterlite movement, meanwhile, gains momentum with multiple political parties lending support to the protestors.

May 2018: Over 100 days of peaceful demonstrations turn violent after police open fire. At least 11 people are killed and several more injured as police try to disperse protesters. The Madras high court, on May 23, stays the expansion of the second unit at Thoothukudi, insisting that the company seek public consultation before taking on such a move.

July 2018: The Tamil Nadu government ordered permanent closure of a copper smelter of the firm after 13 people protesting to demand its shutdown on environmental concerns was killed after the verdict was given by Madras High Court.

RESULTS

Community Environmental Monitoring, an NGO program, undertook a sampling exercise in October 2010. A water sample from an open well collected from a farm in Kumareddiapuram near Copper Sterlite Plant, was found to be "completely unsuitable for use in irrigation" because of the high levels of salinity. According to the Food and Agriculture Organisation, salinity levels above 2000 mg/litre can cause severe damage to crops.

Heavy Metals in Soil Samples										
Sr. No.	Sampling Location	Fe	Mn	As	Cu	Co	Pb	Cd	Cr	Zn
(mg/kg)										
1.	Plant premises (200 m east of plant near water reservoir)	1764.6	363.0	183.0	163.5	151.0	63.5	7.2	50.0	39.7
2.	300 m west of sterlite plant (SIL) boundary	1714.6	521.0	286.5	21.1	139.0	82.5	6.8	37.6	38.7
3.	Soil sample in between old cake pond and ETP	929.6	283.0	132.5	8.6	57.0	9.2	1.9	27.7	34.8

The water in the open well had a salinity level of 7854 mg/litre – nearly four times the level at which severe crop damage can occur.

The below mentioned study gives the list of hazardous incidents involving death or injury of workers and non-workers due to copper smelting plant situated in Tuticorin:

Date	Incident	Dead/Injured
18.9.2010	During night shift, Muthukrishnan, a young acid tanker driver of Uthumalai village, and belonging to Abirami Transport, fell unconscious after being exposed to sulphuric acid fumes. On 13 October, he succumbed to intense burn injuries incurred during the accident. According to one version, he was climbing atop the tanker to see the level of acid in the tanker, when he slipped and fell on a pool of acid. In another, he is said to have slipped on a pool of acid and burnt himself and lost consciousness. In a third version, he is said to have opened the release valve and released more acid than he meant to, and fell unconscious after inhaling the fumes. He was not discovered for 1.5 hours, while a Sterlite employee in-charge slept inside in an a/c cabin. An FIR was registered, and a case is said to have been filed against Sulphuric Acid Plant in-charge Sankaranarayanan.	1 dead
19.9.2010	One North Indian boy lost sight in both eyes after exposure to acid. No further details were available. According to villagers, incidents involving North Indians are hushed up by authorities with ease in the absence of any family to create a scene on their behalf.	1 injured
September 2010	One North Indian worker, residing at Therku Veerapandiapuram, was severely injured, requiring 9 stitches running from his stomach upwards.	1 injured
Sometime between May to June 2010	During annual shutdown, a pumphouse was being hurriedly constructed in the Sulphuric Acid plant to ensure completion before commencement of operations post-shutdown. Because of the shoddy nature of construction, the pumphouse collapsed on a North Indian employee (Staff), crushing him to death.	1 dead
14.1.2010	An accident in the smelter cast wheel area left one mechanic (contract labour) with a serious injury crushing his left ankle downwards. A forklift, operated by Muthuvel, ran over Govindan's left ankle. Muthuvel was fired immediately. However, workers say that it is very difficult to drive safely considering the congested space, with less than permissible clearances on the pathway to be used by forklifts, and the high density of worker movement in the area, and the punishing time pressures to load and unload material. Forklifts require about 6 feet of clearance on either side, and less than 3 ft is available. Further, the high speeds required, and the heavy loads carried make braking ineffective and even dangerous when the paths are made slippery with water and slush.	1 injured
Around October-November 2009	One worker was crushed under the wheels of a tipper truck near Material Gate No. 2. It was after this incident that the transport section gate and worker entry gates were separated.	1 dead
04.06.08	Balakrishnan, 27, married with child, lived in Pandarampatti. He was involved in cleaning a chimney's uptake in the smelter converter area. As per safety rules, cleaning must be begun at the topmost manhole, with the cleaners accessing progressively lower manholes keeping the bottom manhole for the last. It was a one-day shutdown, the management was keen to get the cleaning done soon. So, the unit-in-charge managers Rajaraman and Manohar asked Balakrishnan to begin work at the bottom manhole. When Balakrishnan put his head and right hand in to peer into the manhole, a several ton heavy load of copper and smelter dust slid down from the top of the chimney decapitating him, cutting off his right hand and causing his death on the spot. His head was never recovered. His widow gets Rs. 4500 as ESI pension now, and the child is studying.	1 dead
Around 2007	Cleaner of a tipper was found dead at the bottom of a load of copper concentrate. He was discovered during unloading in Sterlite. Without knowing that he was sleeping in the wagon of the tipper, the loading had commenced in Port Trust.	1 dead
Around April 2007	A cleaner sleeping beneath a lorry was crushed when the lorry went over him near the PAP Gypsum pond.	1 dead
June 2008	One lorry cleaner was crushed to death when he got down at the weighbridge to get his chit. The lorry moved over him, killing him on the spot. There is a constant rush, giving trucks on weighbridges no time to wait. Trucks keep coming, one worker said.	1 dead
May 2008	Murugesan, Teresepuram, lost a hand in a conveyor in the smelter area. This kind of accident too is routine. The worker was unclogging a "choke" in the conveyor belt. The belt was started even without waiting for his go-ahead or alerting him.	1 injured
2009	One staff working in PAP was crushed between two conveyor belts when he was standing on the conveyor doing maintenance work. The belt was started without his knowledge.	1 dead
March 2009	During the monthly shutdown, a staff, from Tanjore was working near the cooling tower, when a pump house and the cooling tower collapsed and fell on his head	1 dead
May 2009	In 2009, the yearly shutdown was only for 15 days. Brick-laying work was in progress in the ISA Boiler. One north Indian boy was inside when the bricks collapsed and he was crushed to death.	1 dead
1997	Natarajan, 45, a worker, and Pandi, a staff from Tirunelveli, were charred to the bone when dust from the ESP filter fell down the chimney throwing hot glowing embers out of the bottom. Two other contract workers, Balaguru and Madasamy, from Therku Veerapandiapuram who were standing nearby still bear the burn marks on the forearms.	2 dead, 2 injured
May 1998	A month after a major accident involving an explosion where a 40-ton lid was blown out and flung by the impact killing 2 workers and injuring four, a contract worker with Thomson contractor was killed while doing some welding work. He was standing atop a platform overlooking an oil tank. Welding ought not to have begun before the oil tank was shut. Sparks that fell on the oil ignited it causing a fire ball that burnt the worker.	2 dead; 4 injured
8.3.2013	Amalan, 30, sustained serious injuries after an electrical fire broke out at Motor Control Room of Phosphoric Acid Plant.	1 injured
18.3.2013	Swaminathan, 50, killed after falling into Phosphoric Acid tank. Due to the poor light conditions, the worker tripped on the scaffolding and fell 15 metres into an open and empty tank.	1 dead
23.3.2013	Massive gas leak, suspected to be Sulphur dioxide or trioxide, causes suffocation and panic around the Sterlite Copper plant. One Sterlite contract worker, Shailesh Mahadev, 35, reportedly succumbed to exposure to the gas.	1 dead; several injured
23.8.2011	One North Indian worker, sourced by labour contractor Lohit, and employed by Mahesh Engineering was injured while working in the Phosphoric Acid Plant. Workers, who said very little information was available about his condition and what actually happened. He is reported to have had 5 stitches.	1 injured
17.8.2011	A white gas (suspected to be Sulphur Dioxide) escaped for about 45 minutes at ground level throwing a scare among Sterlite workers, after a power outage caused a shutdown of the Copper smelter and sulphuric acid plant at around 10 a.m. today (17 August, 2011). The wind was blowing from East to West and carried the smoke away from the highway and the Milavittan village.	
13.8.2011	Thangapandi, a 32-year old contract worker, engaged by OEG Ltd to work in Sterlite's copper smelter factory sustained first degree burns due to an electrical accident. Thangapandi is a resident of Pandarampatti.	1 injured
31.5.2011	Amalanathan, a 28-year old crane maintenance mechanic, was electrocuted and killed in Vedanta-subsiary Sterlite Copper's premises today. According to workers, Amalanathan died on the spot at around 11.30 a.m. As of 3.30 p.m., the police had not yet registered a First Information Report. According to a Marumalarchi Dravida Munnetra Kazhagam (MDMK) party worker, it was only after the communist unions and MDMK intervened by staging a road blockade did the Police even enter the scene. Amalanathan, who was married barely 3 months ago, is a resident of a locality called 3rd Mile, near Sterlite.	1 dead
3.3.2011	Ratheesh, a young contract employee from Sterlite, sustained 30 to 35 percent burn injuries on chest and hand. He was admitted to Apollo Hospital, Madurai, and underwent treatment until 24.3.2011. Inpatient Number: 205688. Referred by Dr. Vanitha Stephen, Tuticorin.	1 injured

They have also collected a soil sample from the backyard of a residence in Therku Veerapandiapuram village, near Tuticorin, containing 3,35,602 mg/kg of iron. At such levels, accidental ingestion of just 3.5 grams can cause serious poisoning in a child. Consuming larger quantities can be lethal. Symptoms of iron poisoning range from abdominal pain, vomiting, diarrhoea and damage to the intestine. Other effects include heart, liver and central nervous system damage. National Environment Engineering Research Institute (NEERI) took samples from 12 wells situated inside the Copper Smelting Plant. All 12 samples were contaminated, and had higher than permissible levels of dissolved solids. 9 samples violated the limits for sulphates and iron content, and five exceeded the permissible fluoride level.

RECOMMENDATIONS

From the present mentioned research paper, it has been understood that there has been environmental negligence. Thus the following is being recommended before setting up of any copper smelting plant in the country:

- a. Various steps and precautions needs to be taken before setting a copper smelting plant.
- b. Such plants should be started after taking all the approvals (including the legal) keeping into the mind about the environment aspect.

- c. The copper smelting plants should use such methods and equipments that use less energy and produce less air pollution and solid waste so that the environment and the health of the people is not affected.

CONCLUSION

The Copper Smelting Plant was operating in Tuticorin for a long period though the effects caused to the environment were due to emission of various hazardous metals and gasses by the Plant. This has happened due to the internal politics and by the Environment Board without considering the environmental effects before giving approval for starting such a Plant in Tuticorin. Copper Smelting Plant stood as a classic case of failed environmental governance.

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