PRELUDE

The Salt Industry

Every day, each of the earth's 5.9 billion inhabitants uses salt. Annual salt production has increased over the past century from 10 million tons to over 200 million tons today (Salt Institute, 2008). Nearly 100 nations have salt producing facilities ranging from primitive solar evaporation to advanced multi-stage evaporation in salt refineries. Man needs salt to live. Prehistoric man obtained salt from the meat of hunted animals. When man developed agriculture, salt was added to supplement the vegetable and cereal diet and the quest for salt became a primary industry in history. In the mid-1800’s salt was valued as an important raw material for the chemical industry which was established when the Solvay process in Belgium converted the salt to synthetic soda ash. Salt today is the largest mineral feedstock consumed by the world’s chemical industry.

Salt Industry in India

India is the third largest salt producing country in the world with an average annual production of about 16 million tonnes (Salt Industry, 2007). The per-capita consumption of salt in the country is estimated to about 12 kg, which includes edible as well as industrial salt. The current annual requirement of salt in the country is estimated to be 60 lakhs tones for industrial use. Caustic soda, soda ash, chlorine and so on, are the major salt-based industries. Besides about 15 lakhs tones of salt is exported every year. Sea salt constitutes about 70% of the total salt production in the country. Salt manufacturing activities are carried out in the coastal states of Gujarat, Tamil Nadu, Andhra Pradesh, Maharashtra, Karnataka, Orissa, West Bengal, Goa and hinterland State of Rajasthan. Among these states only Gujarat, Tamil Nadu and Rajasthan produce surplus salt. These three states produce about 70%, 15% and 12% respectively of the total salt produced in the country and cater to the requirement of all the salt deficit and non-salt producing states (Salt Industry, 2007).
Private sector plays a dominant role contributing over 97% of the salt production, while the public sector contributes the rest. Co-operative sector contributes about 7% whereas the small-scale sector (less than 10 acres) accounts for nearly 30% of the total salt production in the country. The total area under salt production is about 5.0 lakhs acres. The salt manufacturing activities provide direct employment to about 10 lakh people. Salt manufacturing season commences with the closure of monsoon that is by 15th October and lasts up to June next year in East coast of India. For iodization of salt and to meet the needs of industrial sector, emphasis is being laid on manufacture of high purity salt. Up-gradation of the quality of raw salt to meet this requirement is done by encouraging establishment of salt washeries and refineries. Salt commissionerate has registered 43 salt washeries/refineries, out of which 40 units have commenced commercial production.

**Working and living conditions of salt workers in India**

During the British India salt production/trading was a Government monopoly. In recognition of the symbolic defiance of the state monopoly during the Independence struggle salt duty was abolished and a directive principle was incorporated in the constitution of India that salt should remain free of duty. Salt also ceased to be an article of monopoly. Salt, an “essential item” is a central subject under the seventh schedule of the constitution and all aspects of the salt industry are controlled by the Central Government through the Salt Commissioner Organization. The working conditions of the workers are also within the purview of the State Governments. The Government set up three special committees in the years 1948, 1950 & 1958 to review the progress of the salt industry. On the recommendation of the committee in the year 1950 the Government permitted manufacture of salt on 10 acre land without any licence. The Government also passed the Salt Cess Act, 1953 which provided the levy and collection of cess on salt for the purpose of raising funds to meet the expenses incurred on the running of the salt organization. In the year 1954-55 a five-year programme was prepared for development and welfare of the salt industry. On the recommendations of the salt committee,
in the year 1958, a salt development fund was established under the Act to be operated by the Central Salt Board. The Government also formulated a code of principles under which assistance from the cess proceeds was to be extended for labour welfare schemes and development works in salt industry. There is a common fund as above which meets the administrative expenses, measures for development and the welfare of salt workers under the Act. There is no clear separation of the funds and the result is that the administrative expenses constitute almost about 80% of the total expenditure. This is despite the fact that the Government of India gives budgetary support to the Salt Commissioner office for its running. The salt cess at Rs.3.50 per metric tonne has remain unchanged over these years. This is applicable for salt works having more than 100 acres otherwise, it is half for those having more than 10 acres but less than 100 acres. Salt works upto 10 acres are exempted from this cess.

The Saltpan workers suffer enormously from the saline environment in which they live and work in on the coastal strip around the port of Thoothukudi on the southeast cost of Tamil Nadu. Many of the villages have no fresh water due to salt contamination of the local water table. They get occupational illnesses and disabilities such as sight impairment and blindness caused by the reflected glare of the sun off the salt crystals. They develop skin ulcers which are very painful and do not heal up quickly. They also suffer from stomach problems. Their life expectancy is quite low and infant mortality is high. Their wages are insufficient as the saltpans open for only about eight months of the year. Seasonal workers work during the whole season and perform all kinds of activities in the pan. In the beginning of the season the workers get small amount as wages and the wages increase as the production of the salt increases. The maximum daily wage reaches up to Rs.125/- at the end of the season. The pan owners of 100 to 500 acres prefer to hire workers through labour contractors. The labour contractor gets a commission of one or two rupees per labourer. They supply daily wagers as well as seasonal workers for different activities. Big private companies employ few workers on salary basis for supervising, fetching water from a pump or a bore-well, circulation of water in
ponds and so on. The remaining labourers are hired in large numbers from the surrounding villages as daily wagers. There is vast disparity in salt prices and wages. The salt owners sell at Rs. 300 to 350 per metric tonne while workers get as low as Rs.5/- per metric tonne. It is also believed that small plot owners and cooperative societies get lower price of salt as compared to the big owners. The middlemen play a significant role in this price variation. The small producers are paid less in the name of ‘quality’.

The ‘Aghariya’, who depends exclusively on salt processing, live in very poor conditions. There is a lack of basic amenities like drinking water, shelter, education and facilities like gumboots, sunglasses, tools and health care. Children are brought up on salty land with no activities for growth. The seasonal workers live on the sides of pan itself. Most of them erect huts in the empty space around the pans. They face health hazards like blisters, burns, cuts, eye burning, falling of hair, headache and many other ailments. Lower legs and feet develop lesions like ulcers and wart. Skin problems occur like scaling, atrophic scars, keratoderma, callusities, and fissures. This facilitates enhanced absorption of salt into body, which could be one of the causes of high blood pressure. They also have to drink salty water most of the time. The incidence of Vitamin ‘A’ deficiency, night blindness, tuberculosis, infant mortality and gynaecological problems are common. However, it is observed that the organization of Salt Commission has generally been meeting the requirement of drinking water supply to some extent and for the other welfare measures salt workers have to depend on the respective government of the states. The thrust and the major objective of the Salt Commission are to improve the skills in the production of the salt and its quality control. The following are the schemes for the purpose: Scheme for augmentation of brine supply, construction of or improvements of roads, bridges and so on, improvements to port/jetty, research and development schemes for improved process and mechanization for harvesting of salt and undertaking/sponsoring feasibility for improving salt production. Any development work not covered in the above, list should be borne by the State Governments. Since 1998 the pattern of
sharing of the cost is two-third by the Central Government and one-third by the State Government. The State Governments get finance from the revenue earned mainly from the license fee of the land leased to the salt works.

**Employment**

Officially, salt is produced in India by recognized units (with license from the Salt Department) and non-recognized units. The latter contributed up to 28% of the total production in the year 1998. The contribution of public sector has reduced substantially over the years and now it accounts only for 2% of the total production. In terms of the salt production, Gujarat contributed almost 72% of the total production of 11.96 million tonnes in 1998. It is followed by Tamil Nadu with contribution of 13% of the total national production.

**Communities working as salt workers**

Landless people belonging to socially and economically backward castes and communities are compelled to work on saltpans as seasonal labourers in the absence of better income generation opportunities. SC, ST and Dalits are the communities who primarily make salt in the salt industry. Other backward castes/communities like BC, OBC communities and Muslims are engaged in allied activities like transport, loading and unloading, grinding and packaging. There are some migrant workers from the adjoining states belonging to the tribal and the OBC communities are also involved.

**Various activities performed in saltpans**

**a. Salt Production**

For producing good quality and high yield of salt, mechanization of all the operations of salt production is a must. Mechanization in scraping, lifting and transporting the salt from crystallizers to the platform involves use of heavy equipment. The crystallizer bed should be strong enough to withstand the static as well as dynamic loads exerted by the scraping and lifting equipments. The salt will be scrapped and lifted to the sides on which wheel barrows or tipper will be used. So the bed should be strong enough to carry the weight of the loaded tipper.
or wheel borrows. This requires special preparation of crystallizer beds. But in Tamil Nadu the prime importance is given to manual operations in the salt Industry. Almost all saltpan activities are performed by the well experienced workers.

b. Soil Stabilization

Clay soil area is most suitable for saltpan preparation. To start with a virgin land, all the vegetation is removed and the crystallizer area is excavated to a depth of 6”-8”, sloping from feeding channel to discharge channel. The excavated soil is mixed with sea shore sand in equal proportion. To this 3 percent lime is added. Homogenous mixture by adding 20-25 percent of water is made with tractor barrows. Then this mixture is leveled up with rollers. This is allowed to dry for three to four days. This dried bed is again rerolled. After curing with brine the bed is ready for the charge. The bed can also be compacted by using power house clinker instead of sea sand. In certain localities of Thoothukudi, especially the sea-shore area, only sandy soil is included and hence the conversion of this area into saltpan is made differently. Initially the topsoil is removed to the depth of 3-4 feet using machineries after that the area is completely covered with tarpaulin and then the removed soil is mixed with equal quantity of clay soil and spread over the tarpaulin and other routine preparatory activities are done and the land is converted into pans.

c. Pumping and Watering

Pumping of water into the pan is mostly done with centrifugal pumps. These pumps are generally low head, high capacity type. The main pump is used for pumping sea water into the main reservoir is of mixed flow type. For a salt farm producing 10,000 tonnes of salt per annum the estimated capacity of the main pump is about 15.0 kilo-litres/min. In the off shore areas the water is collected from deep bore-wells and stored in the storage pond (theppam) for several days till the required concentration is obtained and then channelised into the saltpans (Figure 1). The reservoirs are indispensable features of modern salt work serving the purposes of storing sufficient brine and concentrating the brine in the initial stage. They are laid in series
in such a way that brine is flown either by gravity or by slight pumping. Maximum advantage of tidal waves can be taken to fill the reservoirs. The brine is retained in the reservoirs till it becomes highly saline and soapy. 20% of the female workers are doing the work of watering.

**Figure 1. Saltpans fully logged with water pumped into it from deep bore wells**

![Image](image1)

**d. Raking**

20% of the female workers are doing the work of raking. After the salt crystals are formed in the crystallizer, it is necessary to take this newly formed salt from the bed, this operation is done. To give uniform size to the crystals loosening the salt bed is essential. This operation is generally carried out with wooden raker with two labourers (Figure 2).

**Figure 2. Raking activity performed by the workers**

![Image](image2)

This wooden raker has one wooden handle about 3 meters long and at the end of which one board of wooden spikes with 1.5 feet length, 10 cm width is attached. With this wooden raker, complete raking operation in one crystallizer of size 120 mtr x 38 mtr is done, in one day.
e. Puddling

Crystallizing area which is the main part of salt works requires more of preliminary operations before the commencement of the manufacturing season, so as to prepare the beds 100% per collation proof. The soil of this area should be made fully impervious. The brine by the time it reaches the crystallizers is reduced to $1/10^{th}$ of its original volume. In big salt works, to overcome the porous nature of the soil condenser and crystallizer, areas are laid with polyethylene film. In smaller salt works, the crystallizers are laid with a bed of clay in a well consolidated manner by puddling and tamping. The size of the condensers determines the size of crystallizers. The length of the crystallizer may fall in line with the general direction of the wind to obtain the benefit of increased evaporation due to wind action. At vulnerable places on the bunds of the crystallizers, provisions may be made for the shoots just above the level of the brine contained in the crystallizers as to drain out the water if there are sudden rains. No fixed size can be prescribed for the crystallizers. It is done as per local conveniences. For production of industrial grade salt crystallizers are constructed in series. The salt is scraped, washed and farmed into small heaps. There after supernatant brine is drained out of the crystallizers into bittern channel. Salt is then taken to drying grounds/storage grounds. The crystallizers are ready for the next round of charging.

Figure 3. Harvesting and heaping of salts by involving labourers

f. Harvesting and Washing

Salt from the crystallizers is scraped either manually or mechanically. The scraped salt is transported to the main heap by the labourers in small saltpan and by using tractors in large
scale salt Industry. To remove the chemicals and insoluble impurities, the mechanical salt washing process is adopted. Here the salt is passed through the CaSO₄ solution. The impurity is removed from the top and the washed salt is collected from the bottom. After that the salt is transported to the stocking ground, here the salt is heaped manually by the workers. Usually the salt heaps are made in rectangular pyramids and are covered with palmyrah or knitted coconut leaves (Figure 3).

**g. Grinding and Screening**

The sizes of the salt crystals are reduced by the cylindrical roller mills. This type of mill crushes the salt into small crystals and after that the salt is packed into the required packing (Figure 4).

*Figure 4. The salt pulverizing machine used for crushing the salt crystals in the open air near the huge salt heap.*

**h. Bagging and Bulk Loading**

The bagging operation can also be mechanized and there are automatic bagging machines which can handle 20 to 25 tonnes per hour. Bagging machines can be used in line with grinding machines. Generally these workers would be encaged on contract basis on piece wage system. Small scale packing is usually done by engaging manual labourers. The small packets are then made into large bundles and loaded in the transporting vehicles. Once the salt is produced it is either stocked or loaded directly on wagons or trucks. The belt conveyor can be used for loading the trucks in huge saltpans, whereas manual loading is operational in small sectors (Figure 5).
Ergonomic status of workers

The term “Occupational illness” refers to those illnesses caused by exposures at the workplace. Occupational disorders occur in salt industry and agriculture, both as under recognized endemic diseased and sporadic epidemics. With modernization, occupational hazards have shifted from factories and mines to hospitals and office buildings. The only diseases for which reasonably good data exists are the pneumoconiosis, such as asbestosis, coal-workers pneumoconiosis and silicosis, for many other diseases, such as those due to chemicals exposure, various occupational cancers and other problems, individual fatalities are difficult to recognize and record. Many workplace-related illnesses go unreported, in part because they are unrecognized and in part because record keeping is not optimal in unorganized sector. In many unorganized sectors, the works that take place in the environment do not always meet the required standards. The occupational health standards of workers and workplaces vary substantially according to structure, level of industrialization, developmental status, climatic conditions and tradition. About 20-50% of workers may be subjected to hazardous exposures in industrialized countries and the rate may be even higher in the developing and newly industrialized countries. Mechanical, physical and chemical agents are the main problems in industries, while pesticides, heavy physical work, organic dusts, biological factors and accident are the occupational burdens of agricultural workers (Driscoll et al., 2004; Schecter et al., 1996; Clarke et al., 1997).
Over 2 million people each year are reported to suffer from ill health caused or aggravated by work (HSE, 1998). To obtain the daily bread and to lead a healthy comfortable life, every individual in the globe engages themselves in any one of the available jobs. Most of the jobs are not even providing a healthy condition to the workers. Knowingly or unknowingly the workers are suffering a lot due to the bad environmental conditions in their working place. Occupational health is an important one in the working spot. The prevention of disease and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations is essential (Park, 1997). In olden days, it was customary to think of the occupational hazards and health entirely in relation to factories and mines. Modern concepts of occupational hazards and health embrace all types of employment including agriculture, forestry, commercial enterprises, service trades and other types of labour oriented works. One of the declared aims of occupational health is to provide a safe ‘Occupational Environment’ in order to safeguard the health of the workers and to step up industrial production.

Occupational dermatitis is one of the most widespread causes of ill health and affects people working in many industrial sectors, including salt workers. Approximately 4 million working days are estimated to be lost each year owing to absenteeism resulting from work-related skin disorders (English, 1999). Occupational health problems also prevail in service and office occupations where psychological stressors and ergonomic problems often increase the workload, job dissatisfaction and affect health and productivity. A number of studies have provided convincing evidence of a positive association between health, well-being, well-organized work and a healthy work environment (Bull et al., 2002; Keshia Pollack et al., 2007; Henlengchee et al., 2004; Gheldofa et al., 2005; Bernard et al., 2005; Meerdenga et al., 2005; Julia et al., 2006; Choobineth et al., 2007). It is universally accepted according to the principles of the United Nations, the World Health Organization (WHO) Global strategy for health for all by the year 2000, the International Labour Organization (ILO) and other that every citizen of the world has a right to healthy and safe work and to a work environment that
enables to live a socially and economically productive life. All countries should show a progressive development of occupational health services with the ultimate objective of covering all workers with such services irrespective of the sector of economy, size of company, occupation, mode of employment, or nature of self employment. About 120 million occupational accidents with 2,00,000 fatalities are estimated to occur annually and some 68 to 157 million new cases of occupational disease may be caused by various exposures at work (Jeebhay et al., 2001; Koleva and Kostova, 2003).

More than 50% workers in industrialized countries complain today about stress in the workplace. Job stress and overwork have been associated with sleep disturbance and depression. Job stress is associated with several types of chronic health problems, including cardiovascular diseases, hypertension, and musculoskeletal and psychological disorders, reproductive disorders, mental, and neurological problems (Bernard, 1997). Moreover, not only injuries and diseases caused by work, but occupational exacerbation of symptoms and disability in pre-existing disorders, for example, asthmatic attacks precipitated by irritants in the workplace occur.

In the industrialized countries around 15% of work place is at risk of viral or bacterial infection, allergies, and respiratory diseases, tuberculosis infections and chronic parasitic disease. Workers may be exposed to several physical factors such as noise, vibration, ionizing radiation and microclimatic conditions which are known to affect their health. The new occupational health problems of industrialized countries are associated with implementation of new technologies, new substances, psychosocial factors and special needs of ageing populations and vulnerable groups. The hazards such as occupational accidents, occupational diseases are caused by mineral, organic dusts, chemicals, toxic metals, solvents, heavy physical work, pesticides, heat stress, and biological factors such as viruses and bacterial infections.
Bull *et al.*, (2002) reported that contact with sharp objects, excessive noise, welding, spray paint and soldering fumes were not regarded as harmful, while exposures to wood dust and oil were, regarded as harmful because it could make someone dirty and ill. More than 60 percent of reported occupational illnesses are work-related musculoskeletal disorders of various types.

Mental illness is one of the chronic outcomes of work stress that inflicts a major social and economic burden on communities (Jenkins and Coney, 1992; Miller and Kelman, 1992). Two disciplines, psychiatric epidemiology and mental health sociology (Aneshensel Rutter and Lachenbruch, 1991), have studied the effects of psychosocial and organizational factors of work on mental illness. There are numerous studies in which the focus has been a single occupation. Depression has been the focus of interest in recent studies of secretaries (Garrison and Eaton, 1992), professionals and managers (Phelan, 1991), computer workers (Mino, 1993), fire-fighters (Guidotti, 1992), teachers (Schonfeld, 1992), and “maquiladoras” (Guendelman and Silberg, 1993). Symptoms of anxiety and depression which are indicative of psychiatric disorder have been found among garment workers, nurses, teachers, social workers, offshore oil industry workers and young physicians (Fith-Cozens, 1987; Fletcher, 1988; McGrath Reid and Boore, 1989; Parker, 1992). Workers in unskilled manual jobs and lower-grade civil servants have shown high prevalence rates of minor psychiatric disorders in England (Stanfeld and McMarmot, 1992).

**Statement of the problem**

The environmental conditions in saltpan create a lot of problems and troubles to the physical, mental and physiological status of the workers to a greater extent. Till today not much work has been recorded on the health status of saltpan workers and also the influence of saltpan environment on the health status of the worker. Hence the researcher has planned this study to explore the every aspects of occupational problems the saltpan workers face every day.
Reason for selection of the problem

Thoothukudi is one of the major salt producing centres in Tamil Nadu. Several thousands of labourers are involved in salt production. Both males and females are employed in this work. Salt production is a hard bone breaking and muscle stretching work. The workers are exposed to scorching sun and highly concentrated brine water for several hours in a day. The dust and salt fumes that evolve during various salt producing operations may enter into the body of the workers through respiratory air and also cracks of the skin may result in various physical and physiological complications such as high serum sodium, high blood pressure and so on. The radiation and glare created from the salt crystals and heaps also affect the skin and eye of the workers. In order to study the impact of the environmental conditions of saltpan on the workers, the researcher has chosen this topic for the research activity. Even though there are lot of works on the occupational hazards, especially in relation to the mechanized industries, the occupational hazards of the saltpan workers are in paucity.

Study area profile

Thoothukudi, which is also called as Pearl City, is one the major towns in Tamil Nadu. It is the capital of Thoothukdui district (Figure 6). Apart from many major mechanized industries, Thoothukudi also provides jobs for thousands of workers through its famous Salt Industries and Fishing Industries. Thoothukudi district has an area of 4621 sq.km. It is bound by Virudhunagar district in the north, Kanyakumari district in the south, Tirunelveli district in the west and Gulf of Mannar in the East. The Census report 2001 stated that total population of 15,72,273 includes 7,66,823 males and 8,05,450 females (Statistical Hand Book, 2007). The density of population is 291 per sq.km, as against the state average of 372. The total geographical area of the district is 4,59,744 hectares accounting for 3.52 percent of the total geographical area of the state. The district constitutes 70 percent of the total salt production of Tamil Nadu and meets 15 percent of salt requirement of our country. Salt industry in
Thoothukudi district provides large scale employment to laborers. Every year during January and February the saltpans are prepared for the salt production that is mending of bunds, desilting of channels, preparation of crystallizer bed and so on. All the salt manufacture related works are attended to only manually. Apart from the preparation period of saltpans every year in January and February, the manufacturing season from February to October provides employment to both men and women. The works during this period are pumping of water, chanalizing the water to crystallizers, raking of salt from the crystallizers and then carrying the salt in baskets to the platforms, where the salt is stocked in big heaps.

Figure 6. Location map of Thoothukudi District, Tamilnadu
OBJECTIVES

The present study is an attempt to peep into the health problems and status of the saltpan workers of Thoothukudi. The study further focuses its attention on the impact of saltpan environment on the health condition of the workers. The study was carried out using the following objectives.

- Indepth study on the haematology, blood and urine chemistry of workers.
- Clinical studies on the blood pressure of workers.
- Study on the ophthalmological status and assessment of the native microbes of the eye of the workers.
- Evaluation of the respiratory illness among saltpan workers.
- Investigation on the native skin microbes and skin disorders of saltpan workers.
- Assessment of the socio-economic status of saltpan workers.