Mehran Sugar Mills Limited

The pioneer of environmental protection for Surrounding Rural Community.

Wet Scrubbing of Boiler Fly Ash, An experience at Mehran Sugar Mills Limited

By

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INTRODUCTION

Air emission is one of the key environment issues of the sugar industry of Pakistan due to health hazards. The industry is also experience increasing pressure from community groups, as housing development around some of the industries are on the increase.

Generally air pollution is caused by fuel combustion. Bagasse is commonly used in sugar industry as a fuel, which leads to the generation of large amount of fly ash, which has health hazard.

The most significant pollutant emitted by bagasse fired boilers is particulate matters, caused by the turbulent movement of combustion gases with respect to burning bagasse and resultant ash emission of sulfur dioxide (SO_2) and Nitrogen oxide (NO_X).

Mechanical collectors and wet scrubbers are commonly used to control particulate emissions from bagasse fired boilers. Mostly the mechanical collectors (Cyclone type) are installed in sugar industry. Collection efficiency of mechanical arrestors is from 40 – 60 % only. Due to abrasive nature of fly ash mechanical collector performance may deteriorate over time due to erosion if the system is not well maintained.

At Mehran Sugar Mills Limited a wet scrubbing system, called Fly Ash Removal System (FARS), is installed for arresting the bagasse ash.

1st phase was started in the year 2011 & completed in the year 2012, to resolve fly ash issues.

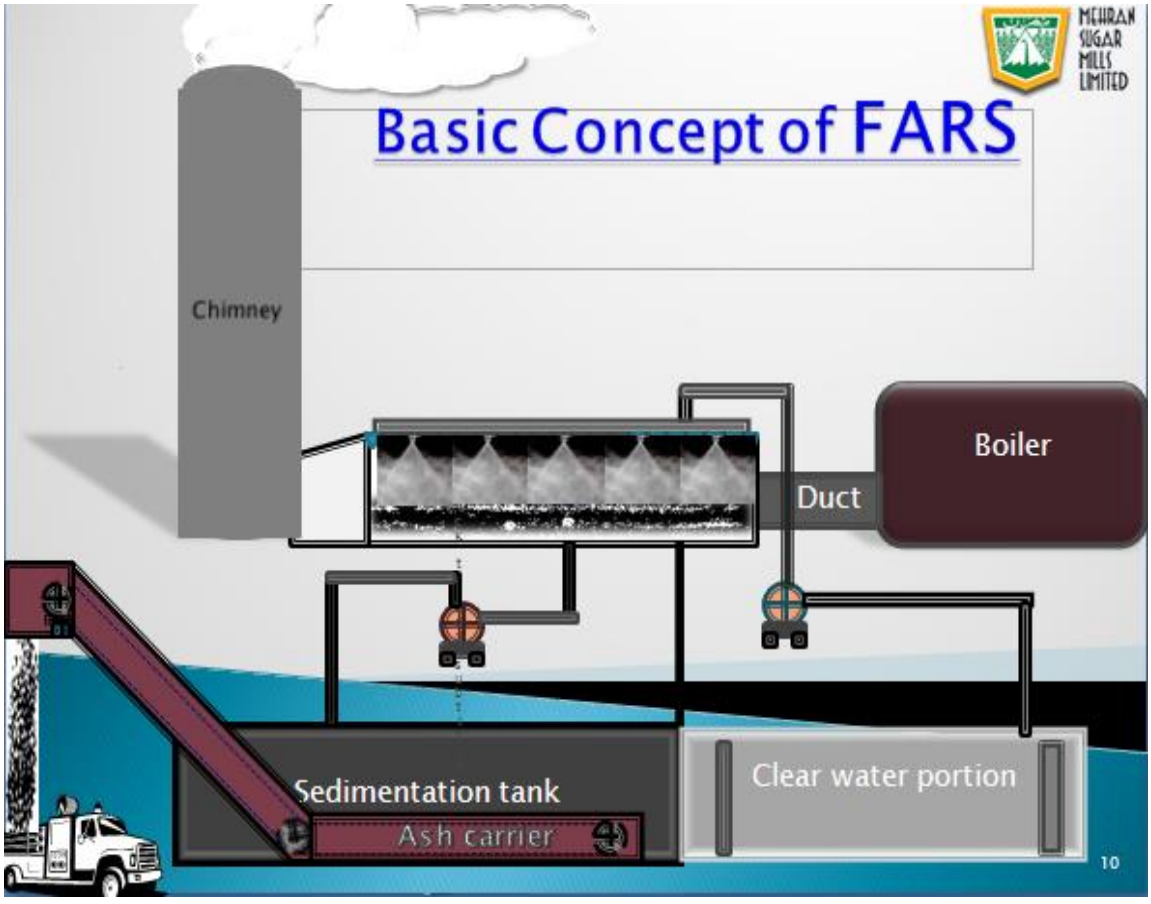
During season 2013-14 the remedial actions were taken in phase-1 & phase-2 was completed and operated satisfactorily.

In this paper we have mainly discussed the installation procedures, bottlenecks and their remedy, effectiveness and maintenance of the system.

METHODOLOGY

In wet scrubbing method, the boiler flue gases are passed through concrete tunnel and heavy water spray (mist formation), with a special formation and design of nozzles, is applied on the gases to trap the ash.

The ash contaminated water is collected in a sedimentation tank and the ash is allowed to settle down then it is removed by a slow moving carrier operating in the bottom of the sedimentation tank. The clear water of the tank is recycled for spraying. The performance of the system is 100%.



SPIRAL NOZZELS

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FARS-I

Code	Size	Flow Ipm	# of Nozzle	Flow m^3/hr
ECW 2230	3/8"	23.50	21	29.61
ECW 2317	3/8"	31.70	48	91.28
ECW 2156	3/8"	15.60	30	28.07
EDW 3128	1/2"	120.00	16	115.20
EDW 2940	1/2"	94.40	09	50.96
Total			**104**	**315.12**

FARS-II

Code	Size	Flow lpm	# of Nozzle	Flow m^3/hr
ECW 2230 B31	3/8"	23.5	23	32.43
ECW 2317 B31	3/8"	31.7	53	100.8
EDW 2156 B31	3/8"	15.6	32	29.95
EDW 3128 B31	1/2"	120	18	129.6
EDW 2940 B31	1/2"	94.4	09	50.97
Total			**135**	**343.75**

FLY ASH REMOVAL SYSTEM

Project was divided into two phases

Reasons

- To gain experience from phase-I
- Fool proof installation of phase-II

Target

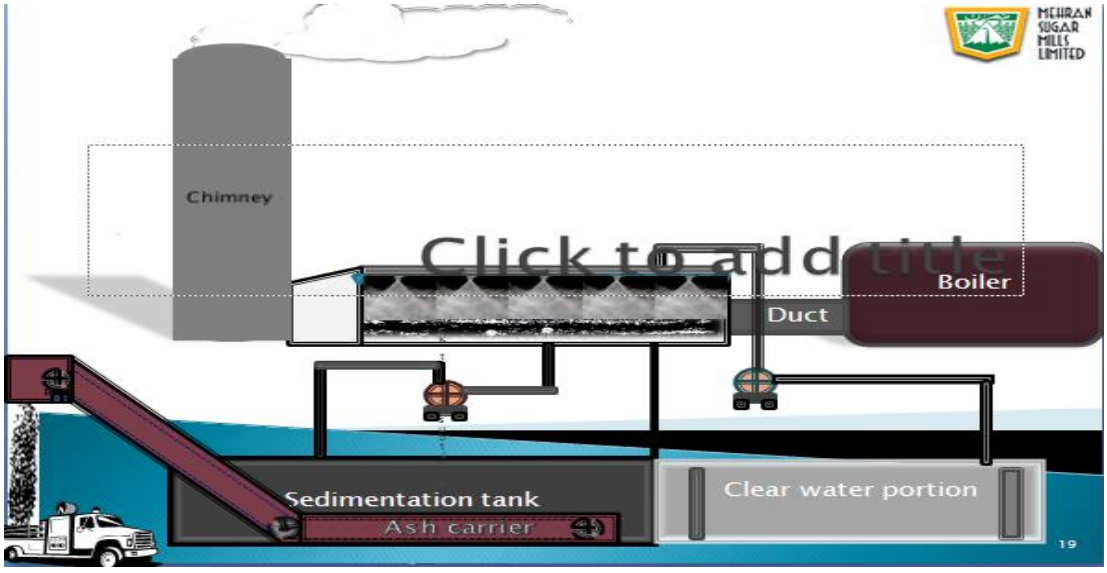
0% fly ash emission to the atmosphere.

Project execution

- Two boilers (45 + 80 tons) were considered for phase-I.
- In phase-2 three boilers (25 + 25 + 80 tons) were added.

Problems faced in phase-1

- Low I.D Fan capacity to meet the resistance of the installed system.
- Improper metallic duct size and route.
- Downward concrete slope offering resistance to the flue gases.



Learning curve of phase-1

- Before complete achievement in new projects, the alternate option should be kept alive.
- Thorough study of the project with all aspects is essential to minimize the failure risk.
- Analyze the root cause of the problems.
- Installation of proper instruments to observe the performance at each stage.
- Knowledge of the redundant capacity of the equipment.

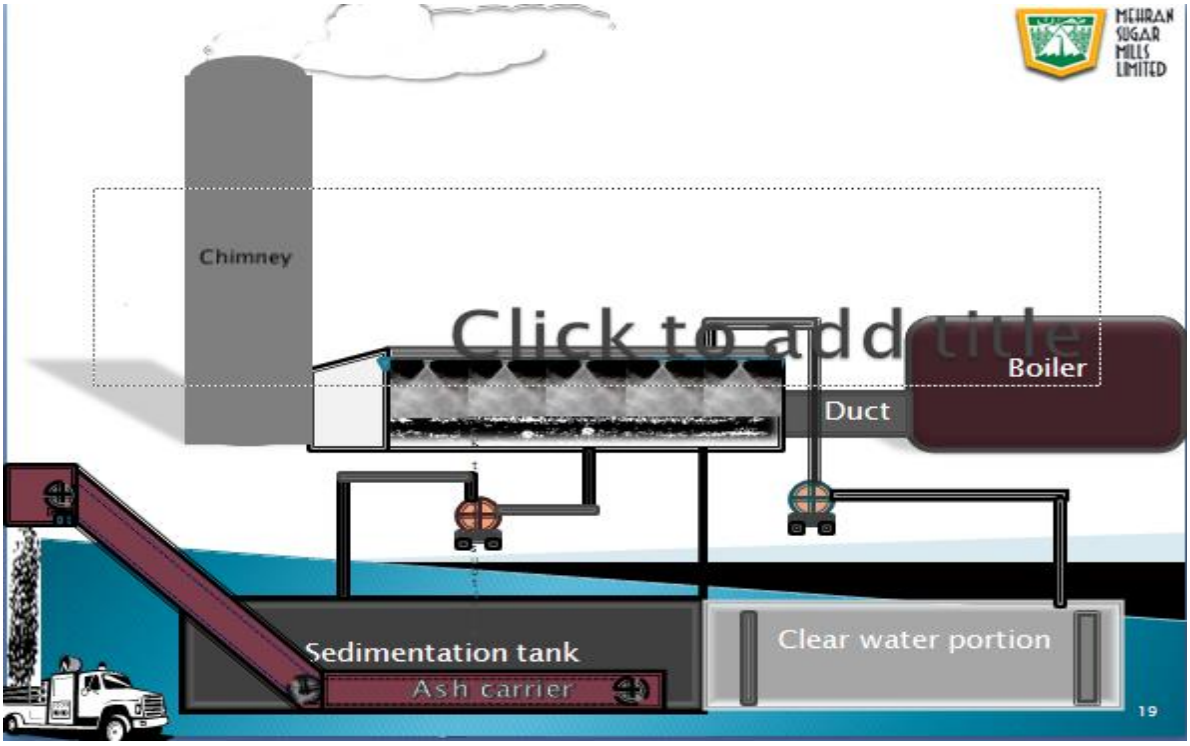
Budget of the project FARS 1 & 2

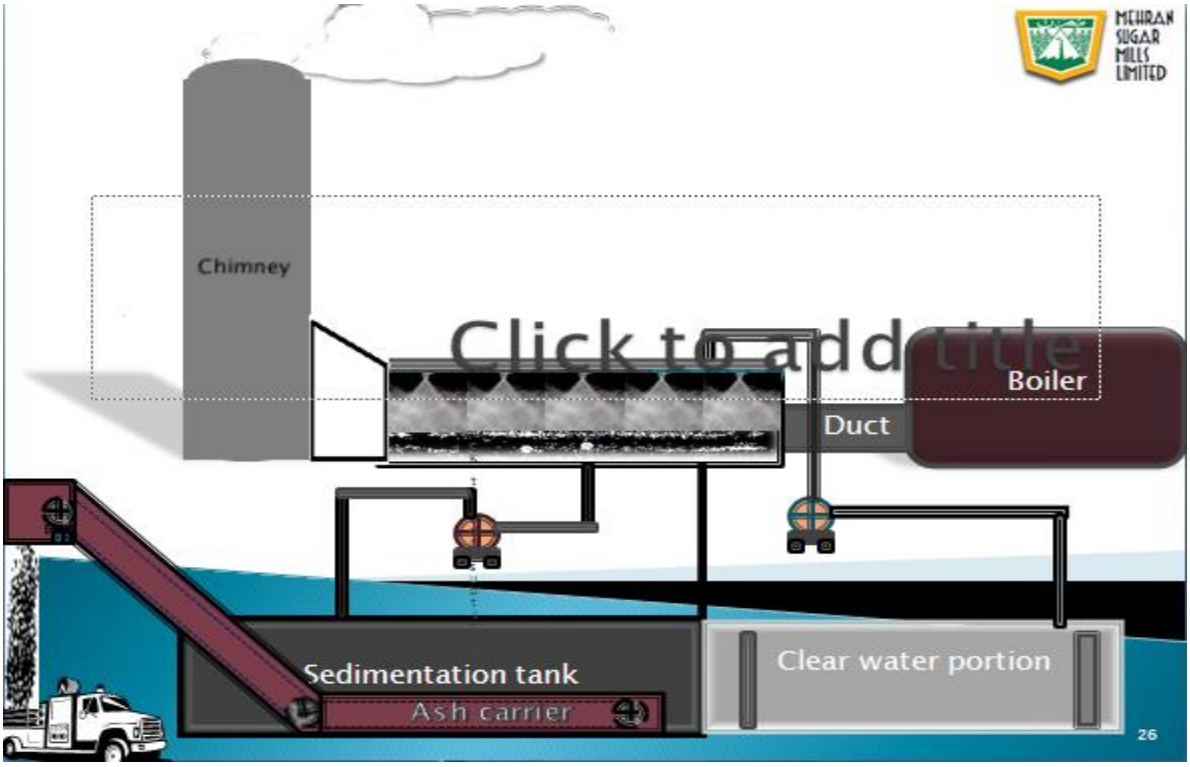
- Fars-1,Expenses in millions **45**
- Fars-2,Expenses in millions **55**

Total **100** millions

Remedial actions taken at FARS-1

- Capacity of ID Fan (80 ton Boiler) enhanced from 5200 to 5800 cubic meters/min.
- Short radius bends of steel ducts replaced by long radius bends and unnecessary bends removed to reduce the resistance.
- Downward concrete slab at the entrance of concrete chimney modified in upward direction.


MEHRAN SUGAR MILLS LIMITED
Chimney
Click to add title
Boiler
Duct
Sedimentation tank
Ash carrier
Clear water portion
19


MEHRAN SUGAR MILLS LIMITED
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Completion of the project

- The experience of FARS-1 enables us to execute the FARS phase-2 in fool proof manner and operating with 100 % capacity without any trouble.
- We were confident with the operation of FARS-2 so, the metallic chimneys were removed.
- Modification was done in sedimentation tank to meet the capacity of FARS-1 & FARS-2 operational through single ash removing carrier.
- Polyelectrolyte (IC-2125) of M/S International Chemical Engineering was added at sedimentation tank for increasing capacity to meet requirement of both FARS. Results were very encouraging;
- Recirculation of fly ash reduced by more than 95%.
- Abrasion effect of fly ash on pumps, valves, lines and nozzles reduced, thus increasing life of these equipments.

Time frame of completion

- Target for completion of the FARS-2 project was completed before season 2013-14 with the Grace of Almighty ALLAH.

Boiler gas analysis by SUPARCO

Parameters	Boiler # 5	Boiler # 4	After FARS	Pak NEQS limit
Flue Temp 0C	201.5	202.2	50	50
Smoke%	40	40	20	40
Particulate matter Mg/Nm3	21	141	90	500
Oxide of Nitrogen	80.8	80.7	53.9	400
Carbon Monoxide	177	661	108	600
H2S (mg /Nm3)	2.5	N/D	2.6	10

Checking the performance

- With the help of above rectification FARS-1 project became 100 % functional and steel chimneys of 45 and 80 ton boilers removed.
- FARS project was tested by laying white cloth sheets 36 Nos: in different places of the vicinity.
- The result was found satisfactory, no ash particle observed on the sheets.

Local Government Trust

- D.C.O Tando Allahyar visited Mills with the delegation of local government and showed not only his trust in the system but also appreciated the efforts of the management.

Achievement

- Al Hamd-u-lillah, the FARS project is in operation with the satisfactory performance of 0 % fly ash emission.

Acknowledgment

- We are thankful to the MSM staff for their valuable contribution in the project and for this presentation. We are also thankful of our Resident Director and Managing Director for their support and encouragement.