mech-well industries ltd.

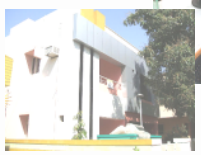
CFD APPLICATIONS IN CEMENT INDUSTRIES

CFD Solutions

Computational Fluid Dynamics (CFD) is the science of predicting the fluid flow related problem by solving mathematical equations which govern the process

Application of CFD :

- Ø Flow analysis of Boilers, Ducts, ESP, Bag-house etc.
- Ø Discrete phase and Multiphase Flow modeling.
- Ø Turbo machinery Analysis.



CFD Solutions for Cement Industries

- Ø Flow analysis of Duct, ESP, Bag-house etc.
- Ø Raw Mill and Coal Mill Analysis
- Ø Combustion analysis in Kiln
- Ø Cyclone Performance Analysis
- Ø Noise reduction in Fan using Aero-Acoustic Principle

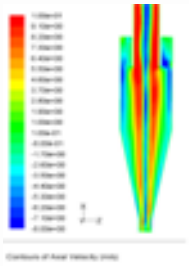
CFD Methodology

The sequence of operations required to carry out the projects are as follows:

- Ø Collection of Drawings and Data from client.
- Ø 3-D Modeling of System in ANSYS Workbench.
- Ø Grid generation in ICEM CFD and Gambit.
- Ø Performing the simulation using CFX and Fluent
- Ø Analyzing the results and locating the problematic areas in the existing design.
- Ø Iteratively modify the design so as to remove the problematic areas.

Cyclone Performance Analysis

- Ø Maximum velocity near to wall and minimum velocity at the center.
- Ø This flow pattern is useful for the designing of duct connecting cyclones.



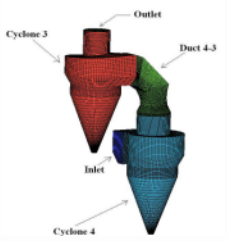
Case study - Maihar Cement

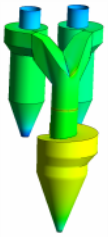
Aim:- To analyze Cyclone connecting duct design to reduce pressure drop across it.

Cyclone Connecting Duct Analysis

Poor flow distribution to the cyclone inlet affects the performance of the cyclone.

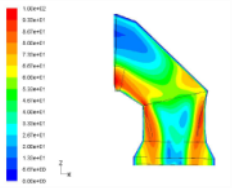
CFD was used to design the connecting duct between cyclones.





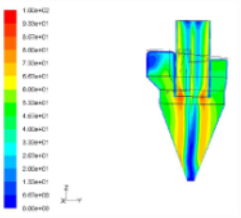
Cyclone Connecting Duct Analysis

- Ø The new duct design eliminates high velocity region.
- Ø Improved flow distribution at the cyclone inlet.

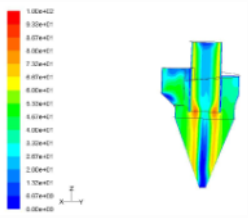


Pre-modified duct

Cyclone Connecting Duct Analysis



Pre-modified Cyclone analysis with duct



Modified Cyclone analysis with duct

Achievements- Maihar Cement Industries

- Ø Reduced pressure drop by 60 mm WC
- Ø Energy savings 50 KW/h.
- Ø Payback period less than 4 months.

The suggested modifications as per your drawings based on CFD analysis were carried out recently in the connected duct from cyclone 4 to cyclone 3 in kiln 1 of Unit 1. The benefit achieved after modification is in the pressure drop across cyclone 4 which results in power saving. The approximate values in the respect are pressure drop reduction of 60 mm WC across cyclone 4 and power saving of 50 KW

- MAIHAR CEMENT

Performance Certificate

Maihar Cement

(PROP : CENTURY TEXTILES & INDUSTRIES LTD.)

Ref : MC/AKJ/Production/2008
17th March,2008

M/S Mech-Well Industries Ltd
7-A, Old Angrewadi
Mazgaon
Mumbai - 400010

Fax No. 022-23719446
E-mail:mechwell@vsnl.com
:mechwell@hathway.com

Kind Attention : Mr Sushil kumar Jogdankar

Dear Sirs,

This has reference to our purchase order no:MC/PUR/1128/7225 dated 5th February,2007.

The suggested modifications as per your drawings based on CFD analysis were carried out recently in the connected duct from cyclone no:4 to cyclone no:3 in our kiln no:1 of unit-1.

The benefit achieved after modification is in the pressure drop across cyclone no:4 which results in power saving .The approximate values in this respect are pressure drop reduction of 60 mm wg across the cyclone no:4 and power saving of 50 kw

Thanking you,

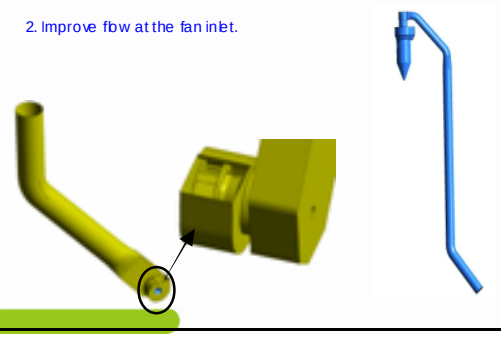
Yours faithfully,
For MAIHAR CEMENT

(Ajai Kumar Jain)

Downcomer Duct Analysis

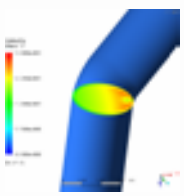
Aim :- 1. To reduce pressure drop across down comer duct.

2. Improve flow at the fan inlet.

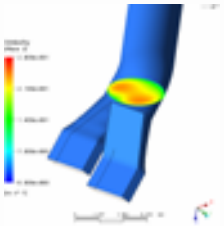


Case study - Dalmia Cement Industries

Down Comer Duct Analysis



Velocity profile on plane
(Premodified Duct)



Velocity profile on plane
(Premodified Duct)

Case study - Dalmia Cement Industries

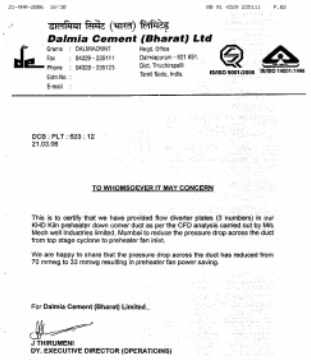
Achievements-

- Ø Reduced pressure drop by 37mm WC.
- Ø Energy savings 64 KW/h.
- Ø Payback period less than 4months

This is to certify that we have provided flow diverter plates (3 no.) in our KHD kiln pre heater down comer duct as per the CFD analysis carried out by M /s MECHWELL INDUSTRIES LTD MUMBAI to reduce the pressure drop across the duct from top stage cyclone to pre h eater fan inlet.
We are h appy to sh are that the pressure drop across the duct has reduce d by 37mm wc resuting in preheater fan power saving .

- DALMIA CEMENT

Performance Certificate



डालमिया सिमेंट (भारत) लिमिटेड
Dalmia Cement (Bharat) Ltd

DCB / PLT : 023 : 12
21.03.06

TO WHOMSOEVER IT MAY CONCERN

This is to certify that we have provided flow diverter plates (3 numbers) in our KHD Kiln preheater down comer duct as per the CFD analysis carried out by M/s Mech well Industries limited, Mumbai to reduce the pressure drop across the duct from top stage cyclone to preheater fan inlet.

We are happy to share that the pressure drop across the dust has reduced from 70 mmwg to 33 mmwg resulting in preheater fan power saving.

For Dalmia Cement (Bharat) Limited,

J THIRUMENI
DY. EXECUTIVE DIRECTOR (OPERATIONS)

Case study 3 - Ambuja Cement

Benefits:-

Power savings more than 40 kWh

Pay back period:-

Less than 5 months

Down Comer Duct
Analysis

Performance Certificate

Nagaraju Reddy to me Oct 31 (20 hours ago)

From: Nagaraju Reddy <wireddy@ambujamail.com>
To: vtjadhav <vtjadhav@gmail.com>
Date: Oct 31, 2005 6:03 PM
Subject: Re: ESP Arstorm

Dear Mr. Jadhav,

Please find the details of CFD for PH fan at down comer duct.

Description	Before CFD	After CFD
Kiln feed, tph	5' 1	507
PH fan ML draft	564	542
PH fan ML temp	285	278
PH Fan kW	2584	2512

As we have not installed the system in Cooler ESP, results can be informed after installing the system.

Raw mill circuit details are not clear

However, the system is satisfactory for the PH fan. We shall inform the details after the study run of the all systems. Presently plant is under shutdown

Regards,

Nagaraju REddy

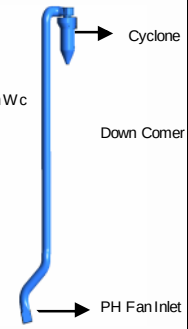
Case study 4 - Maihar Cements

Benefits:-

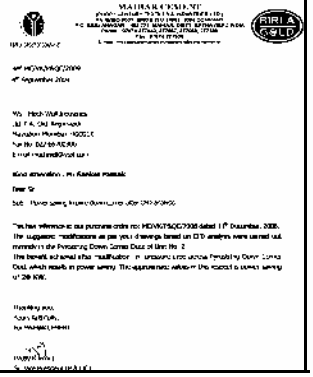
Minimum pressure drop reduction of 12 mmWc

Pay back period:-

Less than 5 months



Performance Certificate



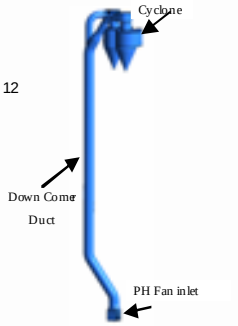
Case study - India Cements

Benefits:-

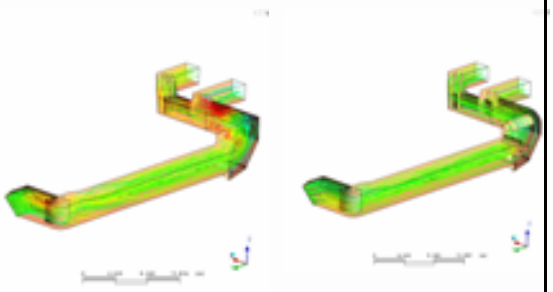
Minimum pressure drop reduction of 12 mmWc

Pay back period:-

Less than 5 months



Case Study – IB Thermal



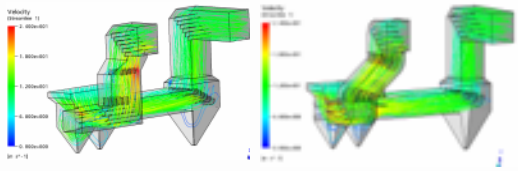
Streamline Plot for Pre-modified duct

Streamline Plot for Modified duct

Case Study – Nasik TPS Unit # 3

In pre-modified duct design, distribution of flow was poor resulting in high erosion and pressure drop.

Mech-Well provided new duct design for Nasik power plant unit III which reduced the pressure drop and erosion and made equal the distribution in all the passes.



Pre-Modified

Modified

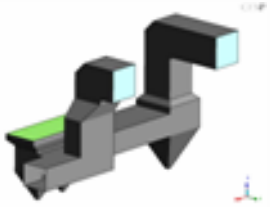
Case Study – Nasik TPS Unit # 3

Duct Design

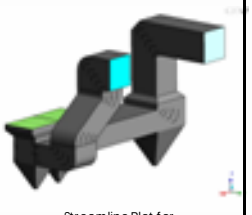
Design and erection by Mech-well

	Load	ID fan current (Amp.)	
		A Pass	B Pass
Before Modification	180 MW	140	140
After modification	215 MW	112	122

Case Study – Nasik TPS Unit # 3



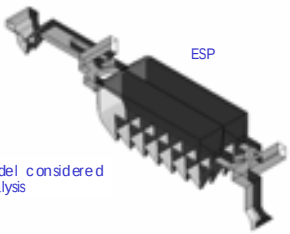
Streamline Plot for Pre-modified model



Streamline Plot for Modified model

Case Study – Gandhinagar TPS Unit # 3

AH Outlet



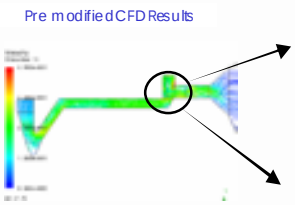
ESP

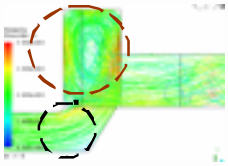
3D-Computational Model considered for CFD Analysis

ID Fan Inlet

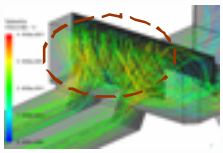
Case Study – Gandhinagar TPS Unit # 3

Pre modified CFD Results





Streamline Plot



CFD Plot :Marked Portion showing the very high turbulence with recirculation & highest velocity at the back surface of the duct, which will cause highest pressure drop in the duct

Case Study – Gandhinagar TPS Unit # 3

Performance Evaluation

Sr. No.	Parameters	2009-10	
		Pre Installation	Post Installation
	Date	11.09.2009	06.11.2009
1	Load MW	210	210
2	ID Fan A current (amp)	123	Stand By
3	ID Fan B current	126	134
4	ID Fan C current	120	130
5	FD Fan current A	50	45
6	FD Fan current B	50	43
14	SPM	138.73	113.225

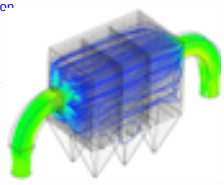
ESP Flow Analysis

Electrostatic Precipitator (ESP)

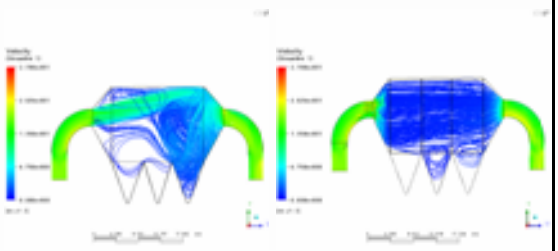
Proper flow through an ESP is critical for optimal performance. Improper flow can result in high opacity, unwanted dust build up and erosion. Because of poor flow distribution through an ESP, high velocity regions cause particle momentum to overcome electrostatic forces, resulting in suboptimal capture efficiency.

High efficiency performance of the ESP requires uniform flow and mass distribution across the precipitator plates. This is achieved by optimal design of flow control devices and PDPL (screens) at appropriate location

Simulation demonstrates the improved flow distribution through an ESP.

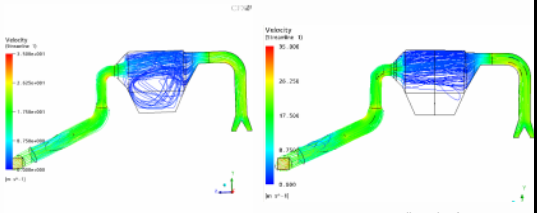


Case study – Clair Engineers Pvt. Ltd.



Case study - Shree Cements Ltd., Beawar

Raw Mill ESP Analysis - CFD Results



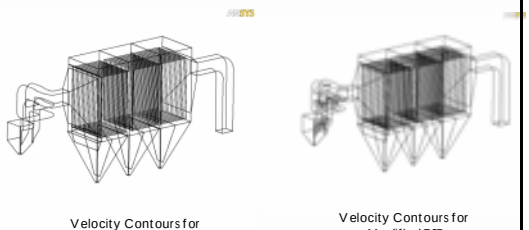
Streamline Plot for Pre-modified model

Streamline Plot for Modified model

Streamlines illustrate fluid flow pattern in Duct and ESP & after Modification Flow through ESP has been improved

Case Study - Hamon Shriram Cottrell

ESP Analysis - CFD Results

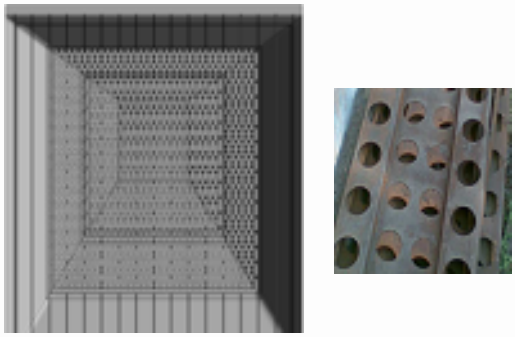


Velocity Contours for Pre-modified ESP

Velocity Contours for Modified ESP

Optimization Of ESP – Hamon Shriram Cottrell

PDPL Configuration



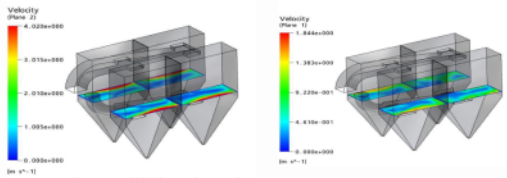
Other ESP Projects Carried Out..

1. Hindalco
2. NTPC, Vindhyachal
3. Chandrapur TPS, Unit III
4. Rajghat, Unit II
5. Parli TPS, Unit III, IV & V
6. Bhusawal, Unit II & IV.
7. Khaperkheda TPS, Unit I, II & III.
8. Nasik TPS, Unit I & II.
9. Alstom, Renusagar, Unit IV & Many more.....

Case study – Clair Engineers Pvt. Ltd. (1)

Bag House Analysis

- Ø Equal distribution of flow Efficient.
- Ø High velocities at the bottom of the bags which explains excessive erosion.
- Ø Cost-effective solution in the shortest time.

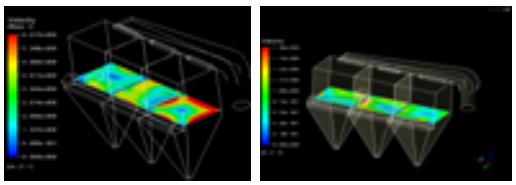


(Premodified Baghouse)

(Modified Baghouse)

Case study – Clair Engineers Pvt. Ltd. (2)

Bag House Analysis



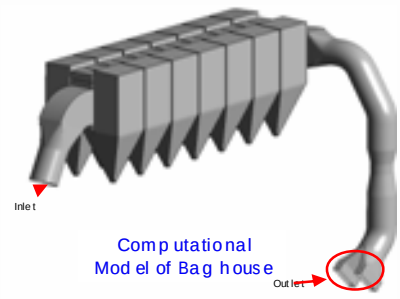
(Premodified Baghouse)

(Modified Baghouse)

mech-well industries ltd.

Case study – ACC Ltd.

Bag House Analysis



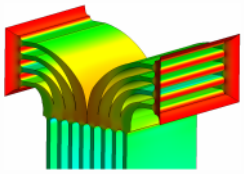
mech-well industries ltd.

Aero Acoustic Solution

- Prediction & Testing of noise generated due to fan.
- Study of existing problem
- Suggestion for noise control
- Design, Analysis & Manufacture of Silencer.

mech-well industries ltd.

Case study – Jaypee Rewa, CPP



mech-well industries ltd.

Case study – Jaypee Rewa, CPP

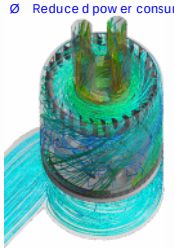
Original Silencer

CFD Designed Silencer

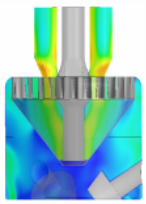
mech-well industries ltd.

Turnkey Solutions For Coal Mill

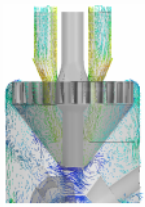
- Reduced localized erosion
- Reduced band width of coal particles
- Reduced power consumption



Streamline illustrates flow distribution in Coal Mill



Velocity contour illustrates flow distribution in Coal Mill



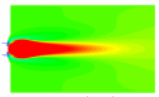
Vector plot illustrates flow distribution in Coal Mill

mech-well industries ltd.

Combustion Analysis

- Improved burner design.
- Scope for analysis using alternative fuels in Kiln.

Coal combustion



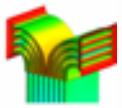
Gas combustion

Benefits to our Clients

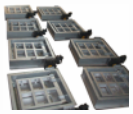
- Ø Improved performance of ESP, Bag-House, Cyclone, Raw mills, Coal mills and auxiliary.
- Ø Meet the emission legislation by increasing equipment collection efficiency.
- Ø Lower noise brings plants into statutory environmental compliance.
- Ø Drive down the operational cost with improved quality.
- Ø And the most important - cost effectiveness.

Manufacturing Capabilities

Expansion Joints - Metallic & Non-metallic



Silencers



All types of Dampers & Gates

List of some of our valued clients

Cement Plants

Thermal Power Stations

MAHAGENCO → Nasik, Bhusawal, Parli, Chandrapur, Khaperkheda, Koradi, Uran

NTPC → Shaktinagar, Rihand, Vindhyachal, Korba, Unchahar, Ramagundam, Dadri, Auraiyya

TATA → Trombay

Other Thermal Power Stations

Others