

17th December 2017

Forenoon	Flow properties for silo design
	Principles of mass flow hoppers
	Troubleshooting pneumatic conveying systems

Afternoon	Principles of funnel flow hoppers
	Flow problems and discharge aids
	Discussion

In addition to the lectures, laboratory visits to the pneumatic conveying and dense slurry conveying facilities shall be arranged during the course.

### Course Dates, Venue and Course Fee

The course shall be held at **IIT Delhi** from **15<sup>th</sup> to 17<sup>th</sup> December 2017**.

The course fee is Rs.15, 000/- plus GST @ 18% per participant. The course fee includes course material, exhaustive lecture notes, lunch and tea/coffee. IIT Delhi is exempt from TDS. Hence no tax to be deducted and full fee should be remitted.

#### Bank Details for e-transfer/RTGS/NEFT

(i)	Bank Account No.	36819334799
(ii)	Bank Address	State Bank of India, IIT Delhi, Hauz Khas New Delhi-16
(iii)	MICR Code	110002156
(iv)	Beneficiary	IITD CEP ACCOUNT
(v)	IFSC Code	SBIN0001077
(vi)	MICR Code	110002156
(vii)	Account Type	Saving

### Registration

Please send your request through email with full contact details and the fee payment advise/ transaction details from the bank. The request may be sent to: [coalash.iitd@gmail.com](mailto:coalash.iitd@gmail.com)

### Course Management

**Dr. V. K. Agarwal** (Programme Coordinator)  
ITMMEC (V140), Indian Institute of Technology Delhi  
Hauz Khas, New Delhi 110 016  
Tel: 011-26591278; Mob: (0) 9810204943  
Email: [vagarwal@itmmecc.iitd.ac.in](mailto:vagarwal@itmmecc.iitd.ac.in),  
[agarwal\\_vijay@hotmail.com](mailto:agarwal_vijay@hotmail.com)

**Mr. Ashwani Sharma** (Project Officer)  
Continuing Education Programme (CEP), Indian Institute  
of Technology Delhi  
Hauz Khas, New Delhi 110 016  
Tel: 011-26591343/ 7678266203  
Email: [coalash.iitd@gmail.com](mailto:coalash.iitd@gmail.com)

## TRANSPORTATION AND STORAGE OF COAL ASH

*(Pneumatic Conveying, Dry Bottom Ash Conveying, High Concentration Slurry Disposal and Silo Design)*

13<sup>th</sup> to 15<sup>th</sup> December 2017

At

IIT Delhi



Presented by

**Industrial Tribology, Machine Dynamics and  
Maintenance Engineering Centre (ITMMEC)**

**INDIAN INSTITUTE OF TECHNOLOGY DELHI,  
HAUZ KHAS, NEW DELHI-16**

## About the Course

Handling, transportation and storage of bulk materials is an integral part of a range of different industries. Bulk materials come in a very wide range of particle sizes, shape, density and flow characteristics. Depending upon the application and the material to be handled, conveying rates could vary from a few kg/h to several hundred tones/h and the conveying distance could range from a few meters to several kilometers. Storage of such materials is another very important aspect of dealing with bulk materials. In many cases the materials may have to be stored for very short time as in the case of process industry while in several other situations, storage over longer periods is not very uncommon. Storage of food grains is a common example of long term storage requirement.

Transportation, storage and disposal of flyash are a major challenge to the engineers in the thermal power plants. It is estimated that the power plants in India presently generate close to 150 million of tones of flyash every year. About 40 – 50%% of it is used in various applications and needs to be handled in dry form. The same amount of flyash needs to be stored at various locations till it is actually used. The remaining quantity of ash has to be disposed off safely in ash ponds. High concentration slurry disposal (HCSD) systems have proved to be very successful and economic for pumping of ash to the ponds.

Pneumatic conveying offers an ideal choice for transportation of powdered and granular materials in dry form. Since the material is transported in a closed pipeline test loop it offers protection to the environment from products such flyash and cement and by the same means protects food and pharmaceutical products against contamination from the environment. It is important, however, to understand the influence that different materials or different grades of the same material can have on the conveying performance and hence on the system design. For a designer it is important to understand the performance characteristics of a particular product in the pipeline, while a system user should be able to compare the specifications so that an energy efficient and economic system can be selected. Pilot plants are often used to generate design for a material, and hence this process is dealt with in some detail in the course, including a demonstration of the high-pressure dense phase conveying facilities available at IIT Delhi. Extensive research has been undertaken at IIT Delhi in pneumatic conveying and slurry disposal systems. High concentration slurry disposal systems are finding much acceptability at the power plants. This short course will cover design and operational aspects of such systems in some detail.

A very important section will cover the principles and design features of the storage hoppers and silos. Mass flow hoppers and funnel flow hoppers are the two main types of flow conditions. Which type of flow is relevant for flyash and what are the main considerations in the design of such silos will be considered. If the flyash flow from the existing silos is not satisfactory, suitable means have to be employed to aid the flow. Troubleshooting flow problems is another aspect which will be covered in the course. Basic considerations in silo design will be presented.

This Three-day course on the subject would be of specific interest to both designers and users of pipeline transportation and storage of bulk materials. The sessions cover various aspects of system design, component selection and the conveying capability of different grades of flyash. It is a practical course, with emphasis on design, operation, control and maintenance of systems, and features a number of case studies. The case studies will cover design of systems to convey materials such as flyash in dense phase pneumatic conveying and disposal through high concentration slurry systems. Participants may also send specific problems, which could be taken up for discussion during the course. Several internationally renowned experts will participate and deliver lectures in this short course.

## List of Speakers

The following speakers will deliver the lectures during the course:

1. Dr. Mark Jones, Director, Centre for Bulk Materials Handling, The University of Newcastle, Australia
2. Dr. S. N. Singh, Indian Institute of Technology Delhi
3. Dr. V.K. Agarwal, Indian Institute of Technology Delhi
4. Dr. V. Seshadri, Former Professor, Indian Institute of Technology Delhi

All the above speakers have wide experience and have undertaken extensive research in conveying and storage of flyash. They have designed systems for thermal power plants, published technical articles and books and have advised both the user plants as well as the vendors supplying ash handling systems.

## Indicative List of Topics

A tentative schedule of lectures is given below:

### 15<sup>th</sup> December 2017

<b>Forenoon</b>	<b>Ash generation at power plants and Types of Pneumatic conveying systems</b>
	<b>Feeding devices for pneumatic conveying systems</b>
	<b>Selection of air movers</b>
<b>Afternoon</b>	<b>Air requirements</b>
	<b>Conveying capability of materials</b>
	<b>Rheology of ash slurries</b>
	<b>Discussion</b>

### 16<sup>th</sup> December 2017

<b>Forenoon</b>	<b>Scaling parameters for pneumatic conveying system design</b>
	<b>Comparison of vacuum and pressure conveying systems</b>
	<b>Dense phase pneumatic conveying design case study</b>
	<b>Flow regimes in slurry transportation and classification of suspensions</b>
<b>Afternoon</b>	<b>Selection of pumps</b>
	<b>Design of slurry pipelines including HCSD</b>
	<b>Dry bottom ash conveying</b>
	<b>Laboratory visit</b>