2011

# SUMMARY REPORT
# CC-88 INJECTION ON BOILER NO. 2
# @ PT HIMALAYA TUNAS TEXINDO

PT MITRA CAHAYA MUKTI
Rukan Puri Bintara Regency Blok S-3,
Jl Bintara Raya, Bekasi 17134
www.mitracm.com
Asia Coal Catalyst Co: www.coalcatalyst.com

# SUMMARY REPORT

## Background

PT Himalaya Tunas Texindo has requested to increase their boiler efficiency on Energy. For over 6 months, PT Mitra CahayaMukti (M CM) as Asia Coal Catalyst Co's (ACCC) agent in country region and PT Himalaya Tunas Texindo (HTT) have been discussing to implement trial test for Coal Catalyst CC-88 at their plant. As a portion of this Trial Test it has been agreed that M CM & ACCC will demonstrate the combustion efficiency of its combustion catalyst CC-88 in a CFB boiler burning a common type of coal that HTT used daily.

This opportunity at HTT, located in Cisirung km.2, Moh Toha km 6.5, Bandung City, West Java Province, is an opportunity to demonstrate on Unit #2, a Circulating Fluidized Bed Boiler (CFB), recirculation boiler of an overall equivalent power rating of 5 Mwe and extract another 20 Ton per Hour of steam for their textile production. The coal comes from local Indonesia, probably Langkat Sumatera and having an average heat content of 5700 Kcal/kg gross caloric value, however we encountered coal having a heating range of 3572 Kcal/kg to 4325 Kcal/kg net caloric value and burns approximately 6.81 metric tons of coal per hour. Steam production is approximately 32 metric tons per hour (Ts/Tc=4.51) at the time of the demonstration.

Other information on this system is:

- No Lime stone injection for this boiler
- Recirculation of fly ash thru cyclone separator for re-burn
- Carbon content of collected fly ash approximately 7.61%
- Loss on Ignition approximately 8.89%
- There are 2 CFB boiler which is running in 2 x 100% scheme

## Demonstration Concept

The demonstration concept was to determine how much less coal will be burned while injecting M CM & ACCC's combustion catalyst CC-88 under controlled conditions. The primary method to be applied is a total no of steam being produced with certain no of coal being burned before combustion catalyst CC-88 injected compared to nos of Ts/Tc being produce

after combustion catalyst CC-88 injected with some ratio , not taking into account of any boiler heat losses.

Simultaneously, M CM will be obtaining additional data from the Boiler Log Sheets as well as recorded data from the Boiler Control Modules. The purpose of M CM data gathering is determining information on Boiler Combustion Efficiency by the change in the Ts/Tc. This data will include:

- Boiler furnace temperatures
- Coal feed rate to boiler
- Steam production
- Emissions of particulate, O2
- Fly ash analysis and bottom ash analysis for carbon content
- Exit flue gas temperature

M CM provided all necessary data to HTT as well as HTT's staff recorded all daily log data as requested and oversaw the injection system operation. In addition, M CM provided the analysis of the emissions which available in HTT monitoring system, fly ash and bottom ash. In addition, M CM provided equipment to hold the Combustion Catalyst CC-88 as well as a measuring device to inject the CC-88 onto the coal screw feeder located on the 3rd floor of the Boiler House building. This equipment was a simple mini screw feeder to hold at least 10kg of CC-88. The injection is to have a 0.37kW motor at the side and having a mesh at top of hopper to prevent any large particles entering the throat area. In addition, an inverter will be installed at the control panel which was calibrated for the specific feed rates of 0.5 and 1.0 for the HTT Certified Test.

In addition, M CM provided sufficient amount of Combustion Catalyst CC-88 to conduct these tests delivered to the site in 11#-25 kg plastic pails.

Miscellaneous Items:

- Photographs were taken of the operations, **PLEASE SEE APPENDIX**

# Goals

Each of the participating companies will have its individual goals of this demonstration.

- **HTT:** HTT would like to obtain how much reduction in coal can be achieved by the use of combustion catalyst CC-88 using the current coals. The results may allow them to reduce their operation cost. Other important information that may be important to the boiler operations are; quality of the new fly ash regarding the possibility of selling it for concrete aggregate, reductions in particulate emissions especially carbon carrying fine

particulate, and the chemical analysis of the new emissions Steam / Power Generation sizing capacity Study based on load list and equipment duty cycles and existing equipment data

- **M CM & ACCC: M CM & ACCC** are interested in obtaining information on the effectiveness of CC-88 when applied to coal combustion in Circulating Fluidized Bed Boilers (CFB) that have fly ash recirculation. This opportunity will provide us with data on improved combustion efficiency, emissions, fly ash analysis, the ability of improving the combustion characteristics of burning various quality coals, and overall boiler operating improvements

# Executed Plan & Observations

The Proposed Plan involves five (3) Phases:

M CM developed and with the assistance HTT personnel, executed the actual testing in accordance with our Standard Test Procedures for Determining Combustion Efficiency for CFB Boilers.

**09/19 and 09/21/11 Installation Phase**. With helping of HTT's staff, M CM start installing the small injection device at 3 Nos of it's screw feeder each. The purpose to have this device is injecting at screw feeder according to 0.5kg/ton of coal ratio and 1kg/ton ratio by adjusting variable speed drive frequency at control panel to bring expected output of combustion catalyst CC-88. The program was set up a day to finish all , anyhow some changes to the operating procedure was extended for installing the device.

**Observations**:

- On Sept 21st M CM began to record the Base Line Data for 12 hours. The data was for Base Line, Phase #1.
- During this period, the #3 screw feeder feed rate & screw feeder totalizer are recorded .
- Our observation of the data looks very good. The Ts/Tc's are 4.51
- CC-88 started injection at 03:00AM on 09/22 entering phase 2
- Flys Ash & Bottom ash sample had been taken at end of phase 1

**SEE APPENDIX FOR PHASE 1 RESULT**

**09/22/11 Phase 2.** Immediately following Phase 1, CC-88 was injected at a rate of 0.5 kg/mt of coal at 03:00AM on 09/22 into the boiler along with the coal. After approximately 12 hours to

make boiler into equilibrium state the same procedure in Phase 1 was instituted. The results will be compared with Phase 1 result and a percentage improvement was determined.

**SEE APPENDIX FOR PHASE 2 RESULT**

**Observations :**

- On Sept 22nd 2011, 03:00PM data had been taken for phase1, the data was for phase 2 to be compare with phase 1, base line data
- Fly & Bottom Ash had been taken at the end of phase 2, significantly fly ash color had been changed much more whiter - see appendix
- Fly ash lab result consist of 4.23% carbon content – see appendix

**09/23/11 Phase 3.** This phase 3 covers 1.0kg ratio of combustion catalyst CC-88 per ton of coal The data taken during this period seem to be correct as Ts/Tc actually went above the Base Line number and phase 2. At the time of this report, no issues had been found.

**Observation :**

- Data gathered from 03:00PM Sept 23th, 2011 and recorded after 12 hours of injection Combustion Catalyst CC-88
- Fly and Bottom ash had been taken at the end of phase 3

**SEE APPENDIX FOR PHASE 3 RESULT**

**SEE APPENDIX FOR DATA SUMMARY**

# Review of Carbon Content of Fly & Bottom Ash and Observation

The analysis of the carbon content of the fly ash and bottom ash showed trending results. With the fly ash we would expect to have a reduction in the carbon content but not as significant as in the bottom ash. This is because the fly ash is re-circulated back to the furnace to obtain a second chance of burning the carbon and the bottom ash does not.

In all cases the fly ash content went as expected which we feel is in good result. the carbon content of the fly ash on 09/21 was higher than on 09/22. The Base Line Data for, no CC-88 injection. The carbon content of the fly ash was up 7.61% on 09/21 and having 44% reduction after injecting 0.5kg CC-88/ton and going down drastically to 67% during 1.0kg CC-88/ton.

In all cases that carbon content in fly ash show reduction after injecting CC-88 is supported by Loss on Ignition data.

**SEE APPENDIX FOR FLY ASH RESULT**

The Bottom Ash carbon content change was consistently down in all cases as would be expected. Down 43% the numbers given to us by the Institut Teknologi Bandung laboratory.

**SEE APPENDIX FOR BOTTOM ASH RESULT**

In reviewing the coal analysis, M CM feels that the stability in the coal chemistry most likely had the greatest impact on the performance as reported. In summary, S**ee Appendix** , as the days of the demonstration went on, the moisture content stable (showing correct improved efficiency), ash content quite stable, volatile matter stable providing proven heat available, to prove increasing combustion efficiency shown fairly.

# Overview

- Consistent Data
- No equipment failure appear during test shown a good data
- Efficiency appeared to increase more when injection CC-88 at 1.0 vs. 0.5 kg/t coal. In the case of the CFBC boiler, it appears that an injection rate of 0.5 is having quite fast response for the operating condition and the dynamics of the furnace.

# Conclusion

1. Based upon the original ITB (Institute Technology Bandung), laboratory tests on the HTT fly ash produced during trials done in September 2011, it was probable that the full scale operations would produce an improved combustion efficiency (or reduced coal quantity). Our findings, showed an improvement of 4.91% at 0.5kg CC-88/ ton of Coal and resulting combustion improvement of 5.55% at 1.0kg CC-88/ton of coal.

2. Observations of the slagging within the boiler indicate that the CC-88 was beginning to remove the slag at the end of the demonstration cycle. If this is proven, the combustion efficiency and reduced coal consumption will improve further. Slag is an insulator and when it forms on the boiler tubes it reduces the rate of heat transfer from the hot furnace through the tube metal making steam inside the tubes.

3. O2 level increased with CC-88 injection which is opposite with expected value after using combustion catalyst, perhaps excess air is too high

4. The furnace temperature initially increased slightly with 0.5 injection but decreased from that with 1.0 injection. Reduction could be from lowering coal feed rate with 1.0 ratio. The exit flue gas temperature increased slightly indicating the coal feed could be reduced further.

5. There is a definite indication of the coal feed rate with 4.48% decreased at 0.5 and 9.29 at 1.0 injection, however the steam production dropped 0.72% at 0.5 and 2.69% at 1.0

**SEE APPENDIX FOR A SUMMARY OF ALL DATA**

# Recommendation

1. M CM & ACCC recommends that HTT undertake a minimum six month long commercial operation of injection of an agreed level 0.5 kg/t of coal. During this period regular simple data gathering by the plant people can show certain trends. In addition, other trends can be determined on a cleaner boiler which will improve heat transfer to the steam, lower coal usage, lower emission levels (SO2, NOx, particulate), less carbon in fly ash and bottom ash, lower O2 levels, etc. over a long period. There is a possibility development of combustion efficiency while using this CC-88 over a long period to achieve boiler equilibrium state

2. Compare this six month test against an identical operating boiler, #1 , Differences can then be measured that would provide side-by- side comparisons.

3. Following this six month operation, if successful

4. The Return on Investment (ROI) for HTT resulted in a 4.91% net coal cost savings, adding value to the plant's bottom line. The reduction of carbon and heat within the fly ash and bottom ash indicates an excellent reaction of the CC-88 catalyst with the coal in the furnace and provides backup to the percent improvements in combustion efficiency and reduction in coal demand. HTT may consider to produce more steam adding their production capacity in textile or having less coal to maintain same production as the time being.

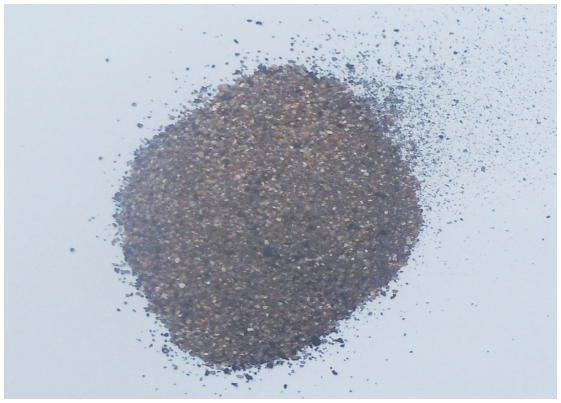
# Commercial

M CM has added commercial offer for HTT consideration including the illustration of cost saving per daily, monthly and annum basis.

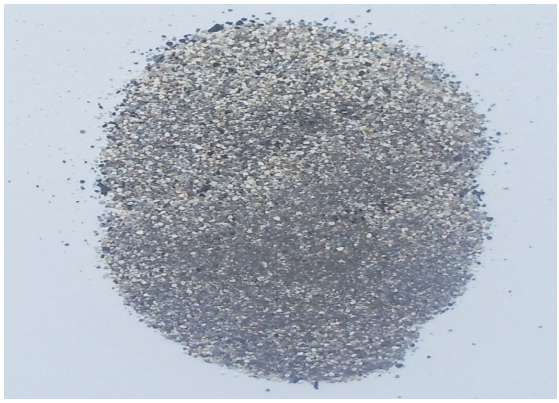
**PLEASE SEE APPENDIX**


Stack Emission before using CC-88


Stack Emission after using CC-88



Fly Ash before using CC-88



Fly Ash after using CC-88

Trial test CC-88


CC-88 Injection

Fly Ash Sample during trial

Bottom Ash sample during trial


Fly Ash Storage

Control Room


Fly Ash Sample at 1.0 CC-88 injection ratio

11 Nos of CC-88 pails for free trials

# APPENDIX

ASIA COAL CATALYST COMPANY

# PT. HIMALAYA TUNAS TEXINDO

PT MITRA CAHAYAMUKTI

## #1 Form A

## BASE LINE DATA

**9/21/2011**

| HOURS | | COAL FEED | | | STEAM | COAL SCREW (RPM) | | | FURNACE TEMP. | EXHAUST GAS | $O_2$ | | NOTE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | SCREW 1 | SCREW 2 | SCREW 3 | T/H | SCREW 1 | SCREW 2 | SCREW 3 | $^0C$ | TEMP. ($^0C$) | 1 | 2 | |
| **0** | 02.00 PM | 686171 | 117819 | 445984 | | | | | | | | | to get 12 hours |
| 1 | 03.00 PM | 686617 | 118260 | 446423 | 32.3 | 335 | 335 | 339 | 974 | 123 | 9.89 | 9.57 | |
| 2 | 04.00 PM | 687034 | 118677 | 446841 | 31.7 | 370 | 375 | 378 | 952 | 120 | 8.62 | 8.7 | |
| 3 | 05.00 PM | 687492 | 119120 | 447304 | 30.6 | 344 | 324 | 353 | 961 | 121 | 9.6 | 9.4 | |
| 4 | 06.00 PM | 687954 | 119583 | 447771 | 34.7 | 345 | 347 | 351 | 977 | 120 | 9.51 | 9.19 | |
| 5 | 07.00 PM | 688401 | 120032 | 448885 | 33.1 | 334 | 361 | 338 | 982 | 120 | 9.41 | 9.33 | |
| 6 | 08.00 PM | 688859 | 120525 | 448691 | 33 | 357 | 361 | 369 | 966 | 119 | 9.09 | 8.83 | |
| 7 | 09.00 PM | 689309 | 120976 | 449148 | 33.3 | 322 | 322 | 325 | 959 | 119 | 10 | 9.81 | |
| 8 | 10.00 PM | 689707 | 121373 | 449548 | 30.9 | 345 | 347 | 349 | 953 | 119 | 9.86 | 9.18 | |
| 9 | 11.00 PM | 690156 | 121823 | 450003 | 32.8 | 334 | 336 | 340 | 979 | 119 | 9.58 | 9.63 | |
| 10 | 12.00 PM | 690625 | 122313 | 450480 | 34 | 333 | 398 | 340 | 968 | 120 | 9.42 | 8.36 | |
| 11 | 01.00 AM | 691036 | 122749 | 450898 | 33.7 | 334 | 336 | 341 | 967 | 119 | 9.25 | 8.71 | |
| 12 | 02.00 AM | 691480 | 123239 | 451348 | 36.6 | 334 | 336 | 337 | 956 | 121 | 10 | 9.56 | |
| | | 5309 | 5420 | 5364 | 396.7 | 4087 | 4178 | 4160 | 11594 | 1440 | 114.23 | 110.27 | Total |
| | | 29013.69 | 29620.3 | 29314.26 | 33.06 | 340.58 | 348.17 | 346.67 | 966.17 | 120.00 | 9.52 | 9.19 | Avg. Base Line |
| | | 29.014 | 29.620 | 29.314 | | | 345.139 | | | | | 9.35 | Avg. of two pts. |
| Total | | 87.948 | | | | | | | 973.17 | 120.83 | | 9.46 | Avg. 0.5 2 pts. |
| | | **7.33** | | | | | | | 969.00 | 122.08 | | 9.68 | Avg. 1.0 2 pts. |
| **Average** | | 8960150 | | | | | | | | | | | |

**TS/TC =** **4.511**

**4.511**

ASIA COAL CATALYST COMPANY

# PT. HIMALAYA TUNAS TEXINDO

PT MITRA CAHAYAMUKTI

## #2 Form B

## 0.5 KG/T CC-88 INJECTION

**9/22/2011**

| HOURS | | COAL FEED | | | STEAM | COAL SCREW (RPM) | | | FURNACE TEMP. | EXHAUST GAS | $O_2$ | | NOTE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | SCREW 1 | SCREW 2 | SCREW 3 | T/H | SCREW 1 | SCREW 2 | SCREW 3 | $^0C$ | TEMP. ($^0C$) | 1 | 2 | |
| **0** | 02.00 PM | 696733 | 128451 | 456636 | | | | | | | | | to get 12 hours |
| 1 | 03.00 PM | 697158 | 128875 | 457060 | 31.6 | 312 | 313 | 309 | 975 | 124 | 9.82 | 9.62 | |
| 2 | 04.00 PM | 697574 | 129290 | 457475 | 34.4 | 323 | 325 | 325 | 963 | 121 | 9.74 | 9.51 | |
| 3 | 05.00 PM | 697961 | 129682 | 457862 | 32.4 | 329 | 324 | 323 | 979 | 121 | 9.52 | 9 | |
| 4 | 06.00 PM | 698416 | 130136 | 458317 | 32.8 | 357 | 361 | 367 | 998 | 121 | 8.81 | 8.274 | |
| 5 | 07.00 PM | 698836 | 130557 | 458739 | 33.3 | 323 | 324 | 324 | 966 | 121 | 9.8 | 9.53 | |
| 6 | 08.00 PM | 699258 | 130986 | 459161 | 34.8 | 322 | 323 | 323 | 973 | 121 | 10 | 9.43 | |
| 7 | 09.00 PM | 699678 | 131406 | 459581 | 33.9 | 333 | 335 | 338 | 971 | 121 | 9.56 | 9.1 | |
| 8 | 10.00 PM | 700089 | 131818 | 459992 | 32.4 | 321 | 321 | 320 | 974 | 121 | 8.89 | 9.78 | |
| 9 | 11.00 PM | 700558 | 132287 | 460457 | 31.2 | 321 | 322 | 324 | 974 | 120 | 9.91 | 9.62 | |
| 10 | 12.00 PM | 701024 | 132753 | 460922 | 32.4 | 321 | 335 | 338 | 971 | 120 | 10 | 9.44 | |
| 11 | 01.00 AM | 701413 | 133150 | 461317 | 32.3 | 320 | 373 | 336 | 968 | 120 | 9.34 | 9.26 | |
| 12 | 02.00 AM | 701782 | 133560 | 461690 | 31.9 | 333 | 339 | 337 | 966 | 119 | 9.64 | 9.37 | |
| | | 5049 | 5109 | 5054 | 393.4 | 3915 | 3995 | 3964 | 11678 | 1450 | 115.03 | 111.934 | Total |
| | | 27592.79 | 27920.685 | 27620.11 | 32.78 | 326.25 | 332.92 | 330.33 | 973.17 | 120.83 | 9.59 | 9.33 | Average |
| | | 27.59279 | 27.920685 | 27.62011 | | | 329.83 | | | | | 9.46 | Avg. of two pts. |
| Total | | 83.13358 | | | 393.4 | | | | | | | | |
| | | **6.93** | | | | | | | | | | | |
| **Average** | | 9095529 | | | | | | | | | | | |

**TS/TC =** 4.732

**4.732**

**Combustion Efficiency Result :** **4.911%**

**4.911%**

ASIA COAL CATALYST COMPANY

# PT. HIMALAYA TUNAS TEXINDO

PT MITRA CAHAYAMUKTI

## #3 Form C

## 1.0 KG/T CC-88 INJECTION

**9/23/2011**

| HOURS | | COAL FEED | | | STEAM | COAL SCREW (RPM) | | | FURNACE TEMP. | EXHAUST GAS | $O_2$ | | NOTE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | SCREW 1 | SCREW 2 | SCREW 3 | T/H | SCREW 1 | SCREW 2 | SCREW 3 | $^0C$ | TEMP. ( $^0C$) | 1 | 2 | |
| **0** | 02.00 PM | 706937 | 138795 | 466880 | | | | | | | | | to get 12 hours |
| 1 | 03.00 PM | 707373 | 139229 | 467324 | 36.2 | 323 | 324 | 327 | 981 | 124 | 9.41 | 9.15 | |
| 2 | 04.00 PM | 707799 | 139654 | 467752 | 31.5 | 313 | 311 | 311 | 957 | 124 | 9.89 | 9.4 | |
| 3 | 05.00 PM | 708202 | 140055 | 468154 | 34.9 | 312 | 311 | 313 | 982 | 125 | 9.85 | 9.38 | |
| 4 | 06.00 PM | 708642 | 140493 | 468598 | 30.3 | 324 | 324 | 326 | 985 | 123 | 9.11 | 8.78 | |
| 5 | 07.00 PM | 709033 | 140930 | 468987 | 32.7 | 310 | 308 | 312 | 976 | 122 | 9.61 | 9.48 | |
| 6 | 08.00 PM | 709501 | 141393 | 469452 | 30.3 | 311 | 309 | 310 | 970 | 121 | 9.84 | 9.36 | |
| 7 | 09.00 PM | 709865 | 141754 | 469814 | 33.5 | 309 | 308 | 307 | 965 | 121 | 10.1 | 9.52 | |
| 8 | 10.00 PM | 710246 | 142133 | 470194 | 32.3 | 319 | 320 | 323 | 975 | 122 | 10 | 9.49 | |
| 9 | 11.00 PM | 710682 | 142565 | 470629 | 32.4 | 310 | 305 | 310 | 970 | 121 | 10.5 | 9.84 | |
| 10 | 12.00 PM | 711081 | 142959 | 471026 | 32.2 | 310 | 305 | 310 | 969 | 122 | 10.4 | 9.69 | |
| 11 | 01.00 AM | 711479 | 143351 | 471417 | 32.4 | 310 | 306 | 309 | 955 | 120 | 9.9 | 9.51 | |
| 12 | 02.00 AM | 711923 | 143834 | 471874 | 32.1 | 296 | 331 | 304 | 943 | 120 | 10.2 | 9.91 | |
| | | 4986 | 5039 | 4994 | 390.8 | 3747 | 3762 | 3762 | 11628 | 1465 | 118.81 | 113.51 | Total |
| | | 27248.49 | 27538.135 | 27292.21 | 32.57 | 312.25 | 313.5 | 313.5 | 969.00 | 122.08 | 9.90 | 9.46 | Average |
| | | 27.24849 | 27.538135 | 27.29221 | | | 313.08 | | | | | 9.68 | Avg. of two pts. |
| Total | | 82.07884 | | | 390.8 | | | | | | | | |
| | | **6.840** | | | | | | | | | | | |
| **Average** | | 9227749 | | | | | | | | | | | |

**TS/TC =** 4.761

**4.761**

**Combustion Efficiency Result :** **5.557%**

**5.557%**

INSTITUT TEKNOLOGI BANDUNG
FAKULTAS TEKNIK SIPIL DAN LINGKUNGAN
Jl. Ganesha No. 10 Bandung 40132 Tel : +62 22 2504952, Intern Pesawat : 8739 Ext 103-113 Fax : +62 22 2516566

Laboratorium
Buangan Padat dan B3
Labtek IX C Lantai 4
Telp/Fax : +62 22 2534187

# HASIL ANALISA LABORATORIUM
## *Lab. Result of Analysis*

**Limbah/***Waste* : -
**Tanggal /***Date* : 22 September 2011
**Sumber/***Source* : PT. Himalaya Tunas Texindo
**Analisa/***Tested* : C- Organik
**Pemesan/***Principal* : PT Mitra Cahaya Mukti

| No. | Kode Sampel | Satuan | Hasil Analisa |
|---|---|---|---|
| **FORM A** | | | |
| 1. | Fly ash | % BK | 7,61 |
| 2. | Bottom Ash | % BK | 5,43 |
| **FORM B** | | | |
| 3. | Fly ash | % BK | 4,23 |
| 4. | Bottom As | % BK | 3,06 |
| **FORM C** | | | |
| 5. | Fly ash | % BK | 2,49 |
| 6. | Bottom Ash | % BK | 5,40*) |

*Cat : BK = Berat Kering*

*) possible sample fix up or not correct

Bandung, 5 Oktober 2011
Kepala Lab./*Head of Laboratory*,

LAB. SOLID AND HAZARDOUS WASTE
DEPT. ENVIRONMENTAL ENGINEERING

Dr. Env. Eng. Sukandar
NIP 132 316 903

INSTITUT TEKNOLOGI BANDUNG
FAKULTAS TEKNIK SIPIL DAN LINGKUNGAN
Jl. Ganesha No. 10 Bandung 40132 Tel : +62 22 2504952, Intern Pesawat : 6739 Ext. 103-113 Fax : +62 22 2516586

Laboratorium
Buangan Padat dan B3
Labtek IX C Lantai 4
Telp/Fax : 162 22 2534187

Up Bp. Greg.

## HASIL ANALISA LABORATORIUM
***Lab. Result of Analysis***

**Limbah/***Waste* : Fly ash (FORM A)
**Tanggal** */Date* : 22 September 2011
**Sumber/***Source* : PT. Himalaya Tunas Texindo
**Analisa/***Tested* : Oksida - Logam
**Pemesan/***Principal* : PT Mitra Cahaya Muktl

| No. | Parameter | Satuan | Hasil Analisa |
|---|---|---|---|
| 1. | $SiO_2$ | % BK | 64,89 |
| 2. | $Fe_2O_3$ | % BK | 10,56 |
| 3. | $Al_2O_3$ | % BK | 6,66 |
| 4. | $K_2O$ | % BK | 0,17 |
| 5. | $Na_2O$ | % BK | 0,19 |
| 6. | CaO | % BK | 4,78 |
| 7. | mgO | % BK | 3,76 |
| 8. | $TiO_2$ | % BK | 0,09 |
| 9. | $P_2O_5$ | % BK | 0,11 |
| 10. | LOI | % BK | 8,89 |
| 11. | $SO_3$ | % BK | 0,001 |

*Cat : BK = Berat Kering*

Bandung, 5 Oktober 2011
Kepala Lab./*Head of Laboratory,*

LAB. SOLID AND HAZARDOUS WASTE
DEPT. ENVIRONMENTAL ENGINEERING

**Dr. Env. Eng. Sukandar**
NIP. 132 316 903

INSTITUT TEKNOLOGI BANDUNG
FAKULTAS TEKNIK SIPIL DAN LINGKUNGAN
Jl. Ganesha No. 10 Bandung 40132 Tel : +62 22 2504952, Intern Pesawat : 8739 Ext. 103-113 Fax : +62 22 2516586

Laboratorium
Buangan Padat dan B3
Labtek IX C Lantai 4
Telp/Fax : 162 22 2534187

# HASIL ANALISA LABORATORIUM

***Lab. Result of Analysis***

**Limbah/***Waste* : Fly ash (FORM B)
**Tanggal** */Date* : 25 September 2011
**Sumber/***Source* : PT. Himalaya Tunas Texindo
**Analisa/***Tested* : Oksida - Logam
**Pemesan/***Principal* : PT Mitra Cahaya Mukti

| No. | Parameter | Satuan | Hasil Analisa |
|---|---|---|---|
| 1. | $SiO_2$ | % BK | 72,01 |
| 2. | $Al_2O_3$ | % BK | 11,45 |
| 3. | $Fe_2O_3$ | % BK | 6,85 |
| 4. | $K_2O$ | % BK | 0,11 |
| 5. | $Na_2O$ | % BK | 0,15 |
| 6. | CaO | % BK | 5,17 |
| 7. | MgO | % BK | 3,02 |
| 8. | $TiO_2$ | % BK | 0,15 |
| 9. | $P_2O_5$ | % BK | 0,08 |
| 10. | LOI | % BK | 1,22 |
| 11. | $SO_3$ | % BK | 0,001 |

*Cat : BK = Berat Kering*

Bandung, 5 Oktober 2011
Kepala Lab./*Head of Laboratory*,

LAB. SOLID AND HAZARDOUS WASTE
DEPT. ENVIRONMENTAL ENGINEERING - ITB

**Dr. Env. Eng. Sukandar**
NIP. 132 316 903

INSTITUT TEKNOLOGI BANDUNG
FAKULTAS TEKNIK SIPIL DAN LINGKUNGAN
Jl. Ganesha No. 10 Bandung 40132 Tel : +62 22 2504952, Intern Pesawat : 8739 Lxt 103-113 Fax : +62 22 2516560

Laboratorium
Buangan Padat dan B3
Labtek IX C Lantai 4
Telp/Fax : +62 22 2534187

## HASIL ANALISA LABORATORIUM
***Lab. Result of Analysis***

**Limbah/***Waste* : Fly ash (FORM C)
**Tanggal** */Date* : 25 September 2011
**Sumber/***Source* : PT. Himalaya Tunas Texindo
**Analisa/***Tested* : Oksida - Logam
**Pemesan/***Principal* : PT Mitra Cahaya Mukti

| No. | Parameter | Satuan | Hasil Analisa |
|---|---|---|---|
| 1. | $SiO_2$ | % BK | 65,23 |
| 2. | $Al_2O_3$ | % BK | 11,11 |
| 3. | $Fe_2O_3$ | % BK | 7,24 |
| 4. | $K_2O$ | % BK | 0,18 |
| 5. | $Na_2O$ | % BK | 0,19 |
| 6. | CaO | % BK | 5,11 |
| 7. | MgO | % BK | 3,33 |
| 8. | $TiO_2$ | % BK | 0,11 |
| 9. | $P_2O_5$ | % BK | 0,07 |
| 10. | LOI | % BK | 6,66 |
| 11. | $SO_3$ | % BK | 0,001 |

*Cat : BK = Berat Kering*

Bandung, 5 Oktober 2011
Kepala Lab./*Head of Laboratory,*

LAB. SOLID AND HAZARDOUS WASTE
DEPT. ENVIRONMENTAL ENGINEERING ITB

**Dr. Env. Eng. Sukandar**
NIP. 132 316 903

ASIA COAL CATALYST COMPANY

# FORM A

PT MITI

14.00 686 171 117 819 445 984 33.0 347 360 333 958 112 9.30 START

| H | COAL FEED | | | FLOW | COAL SCREW (RPM) | | | FURNACE TEMP. | EXHAUST GAS | $O_2$ | | NO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SCREW 1 | SCREW 2 | SCREW 3 | T/H | SCREW 1 | SCREW 2 | SCREW 3 | ℃ | TEMP. (℃) | VALUE | | |
| 15 100 | 686617 | 118260 | 446 423 | 32.3 | 335 | 335 | 339 | 974 | 123 | 9.89 | 9.57 | |
| 16 200 | 687034 | 118677 | 446 841 | 31,7 | 370 | 375 | 378 | 952 | 130 | 8.62 | 8.70 | 1 |
| 17 300 | 687492 | 119120 | 447309 | 30.6 | 344 | 324 | 357 | 961 | 131 | 9.60 | 9.40 | 120 |
| 18 400 | 687954 | 119583 | 447771 | 34.7 | 345 | 347 | 351 | 977 | 120 | 9.51 | 9.19 | |
| 19 500 | 688401 | 120032 | 448225 | 33.1 | 334 | 361 | 328 | 982 | 120 | 9.41 | 9.33 | |
| 20 600 | 688859 | 120525 | 448691 | 33.0 | 357 | 361 | 369 | 966 | 119 | 9.09 | 8.83 | |
| 7 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | |
| Total | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Average | | | | | | | | | | | | |

ASIA COAL CATALYST COMPANY

# FORM A

PT MITI

| H | COAL FEED | | | FLOW | COAL SCREW (RPM) | | | FURNACE TEMP. | EXHAUST GAS | $O_2$ | | NO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SCREW 1 | SCREW 2 | SCREW 3 | T/H | SCREW 1 | SCREW 2 | SCREW 3 | ℃ | TEMP. (℃) | VALUE | | |
| | | | | | | | | | | ~~10.0~~ | ~~9.81~~ | |
| 1 | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| 6 | FORM A | FORM A | | | | | | | | | | |
| 21. 7 | £89309 | 120976 | 449148 | 33.3 | 322 | 322 | 325 | 959 | 119 | 10.0 | 9.81 | |
| 22 8 | £89707 | 121373 | 449548 | 30.9 | 345 | 347 | 319 | 953 | 119 | 9.86 | 9.18 | |
| 23 9 | 690156 | 121823 | 450003 | 32.8 | 334 | 336 | 340 | 979 | 119 | 9.58 | 9.63 | |
| 29 10 | 690625 | 122313 | 450480 | 34.0 | 333 | 348 | 340 | 968 | 120 | 9.42 | 8.36 | |
| 01 11 | 691036 | 122749 | 450898 | 33.7 | 334 | 336 | 341 | 967 | 119 | 9.25 | 8.71 | |
| 02 12 | 691480 | 123239 | 451348 | 36.6 | 334 | 336 | 337 | 956 | 121 | 10.0 | 9.56 | BOTTOM ASH |
| 13 | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | |
| Total | FORM B | | | | | | | | | | | |
| Average | | | | | | | | | | | | |

ASIA COAL CATALYST COMPANY

# FORM B

PT MIT

| H | COAL FEED | | | FLOW | COAL SCREW (RPM) | | | FURNACE TEMP. | EXHAUST GAS | $O_2$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | SCREW 1 | SCREW 2 | SCREW 3 | T/H | SCREW 1 | SCREW 2 | SCREW 3 | ℃ | TEMP. (℃) | VALUE | |
| 3 1 | 691960 | 123761 | 451835 | 34.8 | 321 | 321 | 321 | 983 | 121 | 9.80 9.38 | |
| 4 2 | 692363 | 124183 | 452291 | 29.8 | 332 | 329 | 333 | 934 | 118 | 10.2 9.48 | |
| 5 3 | 692792 | 124603 | 452677 | 34.7 | 332 | 331 | 337 | 976 | 119 | 10.0 9.64 | |
| 6 4 | 693237 | 125039 | 453128 | 34.2 | 395 | 407 | 349 | 950 | 120 | 10.1 9.48 | |
| 7 5 | 693674 | 125485 | 453571 | 32.0 | 345 | 345 | 351 | 969 | 119 | 9.62 9.28 | |
| 8 6 | 694104 | 125904 | 454002 | 31.5 | 344 | 348 | 351 | 948 | 120 | 9.72 9.53 | |
| 9 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |
| 11 | | | | | | | | | | | |
| 12 | | | | | | | | | | | |
| 13 | | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| 15 | | | | | | | | | | | |
| 16 | | | | | | | | | | | |
| 17 | | | | | | | | | | | |
| 8.00 18 | 699258 | 130986 | 459161 | 24.8 | 322 | 323 | 323 | 973 | 121 | 10.0 9.43 | |
| 9 19 | 699678 | 131406 | 459581 | 33.9 | 333 | 335 | 338 | 971 | 121 | 9.56 9.10 | |
| 20 | 700089 | 131818 | 459992 | 32.4 | 321 | 321 | 320 | 974 | 121 | 9.89 9.78 | |
| 21 | 700558 | 132287 | 460457 | 31.2 | 321 | 322 | 324 | 974 | 120 | 9.91 9.62 | |
| 22 | 701024 | 132753 | 460922 | 32.4 | 321 | 335 | 338 | 971 | 120 | 10.0 9.44 | |
| 23 | 701413 | 133150 | 461317 | 32.3 | 320 | 323 | 326 | 968 | 120 | 9.34 9.26 | |
| 24 | 701782 | 133560 | 461690 | 31.9 | 333 | 339 | 337 | 966 | 119. | 9.60 9.87 | |
| Total | | | | | | | | | | | |
| | | | | | | | | | | | |
| Average | | | | | | | | | | | |

ASIA COAL CATALYST COMPANY

# FORM B

PT MIT

22

| H | COAL FEED | | | FLOW | COAL SCREW (RPM) | | | FURNACE TEMP. | EXHAUST GAS | $O_2$ | | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SCREW 1 | SCREW 2 | SCREW 3 | T/H | SCREW 1 | SCREW 2 | SCREW 3 | ℃ | TEMP. (℃) | VALUE | | |
| 1 | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 7 | 694175 | 125975 | 459073 | 33,7 | 346 | 386 | 338 | 962 | 120°C | 10.6 | 11.4 | M2=26,0 |
| 8 | 694605 | 126308 | 454506 | 33,7 | 347 | 349 | 357 | 959 | 112 | 9.47 | 9.20 | M2= |
| 9 | 695008 | 126791 | 459919 | 33,6 | 346 | 350 | 354 | 983 | 112 | 9.49 | 9.25 | M1, M2, |
| 10 | 695499 | 127233 | 455359 | 32,9 | 335 | 336 | 339 | 981 | 122 | 8.86 | 8.66 | M1 OFF |
| 11 | 695878 | 127626 | 455783 | 32,1 | 323 | 356 | 314 | 938 | 124 | 11.1 | 11.1 | M1, M2, |
| 12 | 696294 | 128034 | 456196 | 31,4 | 324 | 328 | 340 | 980 | 124 | 9.14 | 8.82 | 11 |
| 13 | 696733 | 128451 | 456636 | 33,3 | 325 | 327 | 325 | 955 | 124 | 9.80 | 9.42 | 11 |
| 14 | 697150 | 128875 | 457060 | 31,6 | 312 | 313 | 309 | 975 | 124 | 9.82 | 9.62 | 1 |
| 15 | 697574 | 129290 | 457475 | 34,4 | 323 | 325 | 325 | 963 | 124 | 9.74 | 9.51 | 1 |
| 16 | 697961 | 129682 | 457862 | 32,9 | 329 | 329 | 323 | 979 | 121 | 9.53 | 9.00 | alarm |
| 17 | 698416 | 130136 | 458317 | 32,8 | 357 | 361 | 367 | 998 | 121 | 8.81 | 8.27 | BB l |
| 18 | 698836 | 130557 | 458739 | 33,3 | 323 | 329 | 324 | 966 | 121 | 9.80 | 9.53 | M1, M2, |
| 19 | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | |
| Total | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Average | | | | | | | | | | | | |

ASIA COAL CATALYST COMPANY

# FORM C

PT M

| H | COAL FEED | | | FLOW | COAL SCREW (RPM) | | | FURNACE TEMP. | EXHAUST GAS | $O_2$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | SCREW 1 | SCREW 2 | SCREW 3 | T/H | SCREW 1 | SCREW 2 | SCREW 3 | °C | TEMP. (°C) | VALUE | |
| 03. 1 | 702285 | 134079 | 462198 | 32.4 | 320 | 323 | 322 | 956 | 119 | 10.2 | 9.43 |
| 04. 2 | 702615 | 134909 | 462528 | 32.7 | 319 | 323 | 323 | 955 | 120 | 10.5 | 9.80 |
| 05 3 | 703058 | 134843 | 462983 | 31.5 | 321 | 321 | 322 | 967 | 110 | 10.2 | 9.45 |
| 06 4 | 703494 | 135229 | 463370 | 32.3 | 321 | 320 | 322 | 946 | 120 | 10.8 | 10.1 |
| 7 5 | 703896 | 135683 | 463824 | 33.5 | 366 | 370 | 375 | 968 | 122 | 8.85 | 8.61 |
| 8 6 | 704323 | 136118 | 464255 | 33.3 | 331 | 334 | 336 | 946 | 122 | 10.2 | 9.78 |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |
| 11 | | | | | | | | | | | |
| 12 | | | | | | | | | | | |
| 13 | | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| 15 | | | | | | | | | | | |
| 16 | | | | | | | | | | | |
| 17 | | | | | | | | | | | |
| 18. 18 | 709501 | 141393 | 469952 | 30.3 | 311 | 309 | 310 | 970 | 121 | 9.89 | 9.36 |
| 19 | 709865 | 141754 | 469814 | 33.5 | 309 | 308 | 307 | 965 | 121 | 10.1 | 9.52 |
| 20 | 710246 | 142133 | 470194 | 32.33 | 310 | 320 | 323 | 975 | 122. | 10.0 | 9.29 |
| 21 | 710682 | 142565 | 470629 | 38.9 | 310 | 305 | 310 | 970 | 121 | 10.5 | 9.84 |
| 22 | 711081 | 142959 | 471026 | 32.2 | 310 | 305 | 310 | 969 | 122. | 10.9 | 9.69 |
| 23 | 711470 | 143351 | 471417 | 32.1 | 310 | 306 | 309 | 955 | 120 | 9.90 | 9.51 |
| 24 | 711924 | 143804 | 471876 | 32.6 | 276 | 341 | 306 | 943 | 120 | 10.2 | 9.91 |
| Total | | | | | | | | | | | |
| | | | | | | | | | | | |
| Average | | | | | | | | | | | |

ASIA COAL CATALYST COMPANY

# FORM C

| H | COAL FEED | | | FLOW | COAL SCREW (RPM) | | | FURNACE TEMP. | EXHAUST GAS | $O_2$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SCREW 1 | SCREW 2 | SCREW 3 | T/H | SCREW 1 | SCREW 2 | SCREW 3 | $^0C$ | TEMP. ($^0C$) | VALUE | | |
| 1 | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 7 | 704906 | 136197 | 464391 | 34.3 | 321 | 156 | 321 | 934 | 122 | 12.0 | 11.4 | (in) |
| 8 | 704710 | 136562 | 469717 | 32,2 | 334 | 335 | 340 | 961 | 123 | 10.9 | 9.43 | |
| 9 | 705220 | 137056 | 465169 | 33.0 | 321 | 323 | 337 | 976 | 129 | 10.4 | 9.78 | |
| 10 | 705698 | 137476 | 465599 | 35.0 | 346 | 351 | 354 | 985 | 124 | 9.45 | 9.20 | |
| 11 | 706087 | 137932 | 466038 | 31,4 | 323 | 326 | 323 | 977 | 124 | 9.99 | 8.52 | |
| 12 | 706539 | 138379 | 466490 | 33,0 | 325 | 325 | 325 | 1006 | 124 | 10.4 | 10.4 | |
| 13 | 706937 | 130795 | 466888 | 32,0 | 313 | 312 | 315 | 986 | 124 | 9.87 | 9.53 | |
| 14 | 707373 | 139229 | 467329 | 36,2 | 323 | 324 | 327 | 981 | 124 | 9.41 | 9.5 | |
| 15 | 707799 | 139659 | 467752 | 31,5 | 313 | 311 | 311 | 957 | 124 | 9.89 | 9.46 | |
| 16 | 708202 | 140055 | 468154 | 34,9 | 312 | 311 | 313 | 983 | 125 | 9.85 | 9.38 | |
| 17 | 708642 | 140493 | 468598 | 30.3 | 329 | 329 | 326 | 985 | 123 | 9.11 | 8.78 | |
| 18 | 709033 | 140930 | 468987 | 32,7 | 310 | 308 | 312 | 976 | 122 | 9.4 | 9.48 | |
| 19 | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | |
| Total | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Average | | | | | | | | | | | | |