



## 2018-IP05: International Amine Workshop organized by the Japan's Ministry of Environment

The Japan's Ministry of Environment organized the "International Amine Workshop", under the framework of the "Sustainable CCS Project" [10]. The project runs from 2016 to 2020 and the outputs



will be used to develop policies and measures to facilitate carbon capture and storage (CCS) deployment in Japan. From a technical perspective, this project is evaluating the environmental impacts of amine-based CO<sub>2</sub> capture process, the shipping of CO<sub>2</sub> captured and the integration of CCS in the energy system. Additionally, social and economic studies are being considered as part of the partners compromise.

This workshop was divided in two days. The first day was split in two sections: the first

focused on presentations from the group of international specialists; and the second one aiming to explain the CCS strategy of the Japanese Ministry of Environment and how the leading partners (TOSHIBA and Mizuho Information & Research Institute), are evaluating the amine emissions, including a mitigation plan and an environmental risk assessment in amine-based post-combustion plants.

During the first section, Dr Karl Anders (SINTEF) updated the attendees on the activities of the Technology Center in Mongstad (TCM) and their advances on measuring and mitigating amine emissions. Following this presentation, Dr. Purvil Khakharia (TNO) focused their speech on aerosol emissions and its mitigation. Prof Jon Gibbins (University of Sheffield), explained the challenges of CCS in the current energy market. Finally, I delivered a presentation on emerging technologies and emissions on amine-based post-combustion systems, supported on our past IEAGHG reports [1-4], updated with recent studies (such as 5-6) and introducing our ongoing technical studies [7-8].

Takuya Kishimoto, from the Ministry of Environment, explained in detail the role of CCS in industry and the power sectors and how the Japanese strategy will fulfil their short and long-term plans, in line with international environment agreements. Japan is implementing their measures to achieve their ambition. As highlight, the Japanese government is funding the 100% of carbon capture projects and it is remarkable the compromise of all the parties involved, where the private sector is committed to voluntarily implement adjustments in the near future. Following that presentation, TOSHIBA showed a technical description of amine emissions analysis and its mitigation. Finally, as update of information presented in GHGT-13 [9] and PCCC4 (see the summary of the conference in [http://ieaghg.org/docs/General\\_Docs/PCCC4/PCCC4\\_Summary.pdf](http://ieaghg.org/docs/General_Docs/PCCC4/PCCC4_Summary.pdf)), Mizuho Information & Research Institute updated the audience on the guidelines to assess the risks associated to amine-based carbon capture plants. Lastly, it was opened up to a discussion between the attendees moderated by Dr. Makato Akai (AIST), as leader of this whole project.



During the second day, we were fortunate to visit the TOSHIBA's facilities in Fukuoka, placed in the Mikawa Power Plant, which is now being retrofitted to include both coal- and biomass-fired power generation and will become the world's first power plant equipped with a large-scale carbon capture demonstration facility that is able of capturing CO<sub>2</sub> from a biomass power plant by 2020. In addition to the pilot plant and testing facilities, we saw the first construction works for the future implementation of a larger scale carbon capture plant, which will capture more than 500 tons of CO<sub>2</sub> per day. Of particular note is the outstanding strategy of TOSHIBA on the optimization of the carbon capture and utilization processes in both the power and industrial sectors. In addition, their commitment on measuring and minimizing the emissions in PCCC plants was clear, supported on advanced experimental evaluation techniques.

As conclusion, this workshop was a great opportunity to discuss cooperatively the implementation of CCS in Japan. Positive outputs were obtained: the overview of how Japan is dealing with new technologies in a complex energy market, and the contribution from international specialists to this ongoing project. I believe that Japan, as from the public and private sectors, is an example of good practices in CCS, and their commitment is supported by their actions. It was a pleasure to be part of such initiative and we look forward to seeing the next advances and participate in future discussions. In the meantime, we will monitor the last advances on amine emissions and risks associated to post-combustion plants during the GHGT-14 (October, Melbourne) and PCCC5 (to be confirmed location and dates) and we suggest to keep an eye on those events.

- [1] Emissions of Substances Other than CO<sub>2</sub> from Power Plants with CCS [http://ieaghg.org/docs/General\\_Docs/Reports/2012-03.pdf](http://ieaghg.org/docs/General_Docs/Reports/2012-03.pdf)
- [2] Gaseous Emissions from Amine Based Post Combustion CO<sub>2</sub> Capture Processes and their deep removal [http://ieaghg.org/docs/General\\_Docs/Reports/2012-07.pdf](http://ieaghg.org/docs/General_Docs/Reports/2012-07.pdf)
- [3] Workshop on Environmental Impact of Amine Emissions during Post-Combustion Capture [http://ieaghg.org/docs/General\\_Docs/Reports/2010-11.pdf](http://ieaghg.org/docs/General_Docs/Reports/2010-11.pdf)
- [4] Environmental Evaluation of CCS Using Life Cycle Assessment (LCA) [http://ieaghg.org/docs/General\\_Docs/Reports/2010-TR2.pdf](http://ieaghg.org/docs/General_Docs/Reports/2010-TR2.pdf)
- [5] Cousins A., Nielsen P.T., Huang S., Rowland R., Edwards B., Cottrell A., Chen E., Rochelle G.T., Feron P.H.M., Pilot-scale evaluation of concentrated piperazine for CO<sub>2</sub> capture at an Australian coal-fired power station: Nitrosamine measurements, IJGC 37(2015) 256-263
- [6] Review of amine emissions from carbon capture systems, 2015, Natural Scotland, SEPA
- [7] Further Assessment on Emerging Technologies (ongoing IEAGHG technical study)
- [8] Review of Fuel Cell Technologies with CO<sub>2</sub> Capture (ongoing IEAGHG technical study)
- [9] H.Kimura, T. Kubo, M. Shimada, H. Kitamura, K. Fujita, K. Suzuki, K. Yamamoto, M. Akai, Environmental Risk Assessment of MEA and its Degradation Products from Post-combustion CO<sub>2</sub> Capture Pilot Plant: Drafting Technical Guidelines, Energy Procedia 2017, 114 (6490-6500)
- [10] Toshiba Press Release, Toshiba and Mizuho Information & Research Institute to Lead Japan's Largest CCS Project : [https://www.toshiba.co.jp/about/press/2016\\_07/pr2601.htm](https://www.toshiba.co.jp/about/press/2016_07/pr2601.htm)

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