



Mercury releases from Coal Combustion Partnership Area 2021 Meeting

Online – 28 September 2021



AGENDA

1. Opening remarks
2. Introduction of new partners
3. Recent and upcoming Partnership Area overarching activities
4. GEF project on “Assessment of existing and future emissions reduction from the coal sector toward the implementation of the Minamata and Stockholm Conventions”
5. Introduction of the Interactive Process Optimization Guidance (iPOG)
6. Partner's updates on events and projects
7. Any other issue
8. Closing remarks



1. Opening Remarks

*Teeraporn Wiriwutikorn, Ministry of Natural Resources and Environment, Thailand
Co-chair of the Partnership Advisory Group*



UNEP
GLOBAL
MERCURY
PARTNERSHIP

UN
environment
programme

GLOBAL
MERCURY
PARTNERSHIP

2. Introduction of new partners

Tony Licata
Licata Energy & Environmental
Consultants, Inc.



2. Introduction of new partners

Sanjeev K Kanchan
Adage Automation Pvt. Limited



3. Recent and upcoming Partnership Area overarching activities

*Lesley Sloss, International Centre for Sustainable Carbon (ICSC)
Co-lead of the Partnership Area*

PARTNERSHIP AREA UPDATE

DR LESLEY SLOSS CO-LEAD

**UNEP GLOBAL MERCURY PARTNERSHIP AREA ON MERCURY RELEASES
FROM COAL COMBUSTION - AGM SEPTEMBER 2021**



**INTERNATIONAL CENTRE FOR
SUSTAINABLE CARBON**

OUTLINE

- Update on IEACCC/ICSC rebadging
- Update on the US Department of State Project
- Current and future outreach activities



INTERNATIONAL CENTRE FOR
SUSTAINABLE CARBON

Technology Collaboration Programme

by **iea**

Disclaimer: Views, findings and publications of the International Centre for Sustainable Carbon do not necessarily represent the views or policies of the IEA Secretariat or its individual member countries.



LESLEY SLOSS
INTERNATIONAL PROJECT
MANAGER

Lesley leads several outreach projects and programmes on behalf of the ICSC



INTERNATIONAL CENTRE FOR
SUSTAINABLE CARBON

Technology Collaboration Programme

by **iea**

- We are dedicated to providing independent information and analysis on how coal can become a cleaner source of energy, compatible with the UN Sustainable Development Goals
- **The International Centre for Sustainable Carbon (ICSC)** is part of a network of autonomous collaborative partnerships focused on a wide range of energy technologies known as Technology Collaboration Programmes (TCPs)
- The TCPs are organised under the auspices of the International Energy Agency (IEA), but are functionally and legally autonomous
- We are funded by national governments (contracting parties) and by corporate industrial organisations (sponsors)



THE US DEPARTMENT OF STATE PROJECT

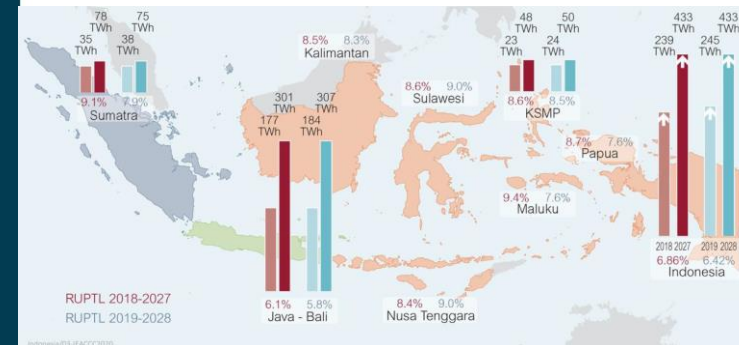
A 4-year project, running from November 2019, to evaluate options for mercury emissions from the coal sector in SE Asia, focusing on India and Indonesia.

The project focusses on capacity building and knowledge sharing and aims to deliver at least 12 regional workshops in India and Indonesia.

This is proving a challenge under COVID

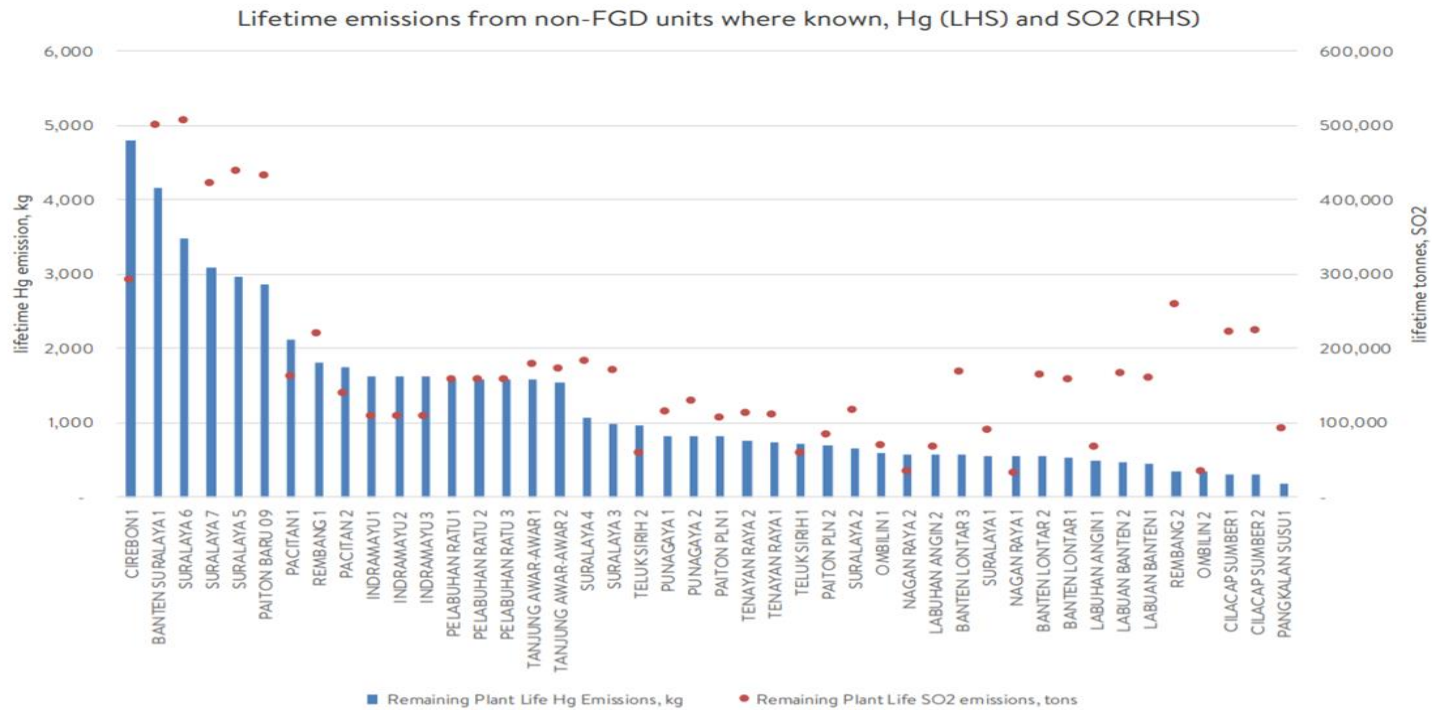
INDONESIA

- Phase 1 – evaluate mercury emissions from the entire Indonesian coal utility fleet on a unit-by-unit basis and identify plants of high concern
- Phase 2 – collect proposals and collate a catalogue of projects and strategies to reduce mercury emissions from the coal sector in Indonesia
- Phase 3 – outreach for funding to move proposals into reality. Dissemination of knowledge on the project strategy as well as on skillsets for implementation of mercury reduction programmes





SUMMARY OF RESULTS





INDONESIA RESULTS SO FAR



HOW TO REDUCE MERCURY EMISSIONS IN INDONESIA

🕒 20 January 2021



REDUCING MERCURY EMISSIONS FROM THE COAL COMBUSTION SECTOR IN INDONESIA

🕒 29 January 2021



INDONESIA VIRTUAL EVENT, HUMAN EXPERIENCE, AND SOLID CONCLUSIONS

🕒 12 April 2021

Everything is available from www.sustainable-carbon.org



WEB EVENT AVAILABLE ON YOUTUBE

DAY 1



DAY 2



DAY 3





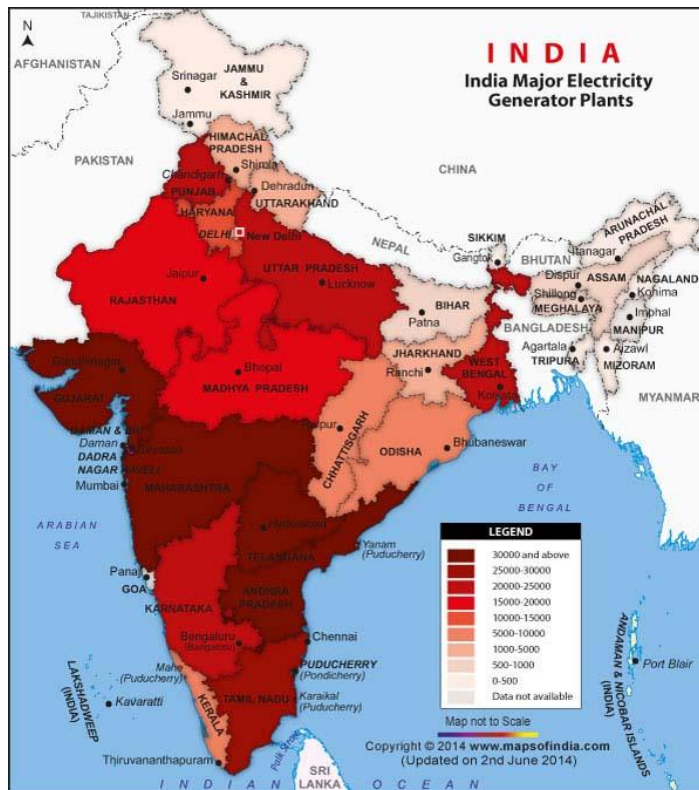
NEXT STEPS AND PARTNERSHIP INVOLVEMENT

- MEC/Coal Partnership meeting in Indonesia with site visits
- Call for proposals for mercury reduction projects and strategies
- Outreach, training and networking during final ministerial conference in Jakarta





INDIA

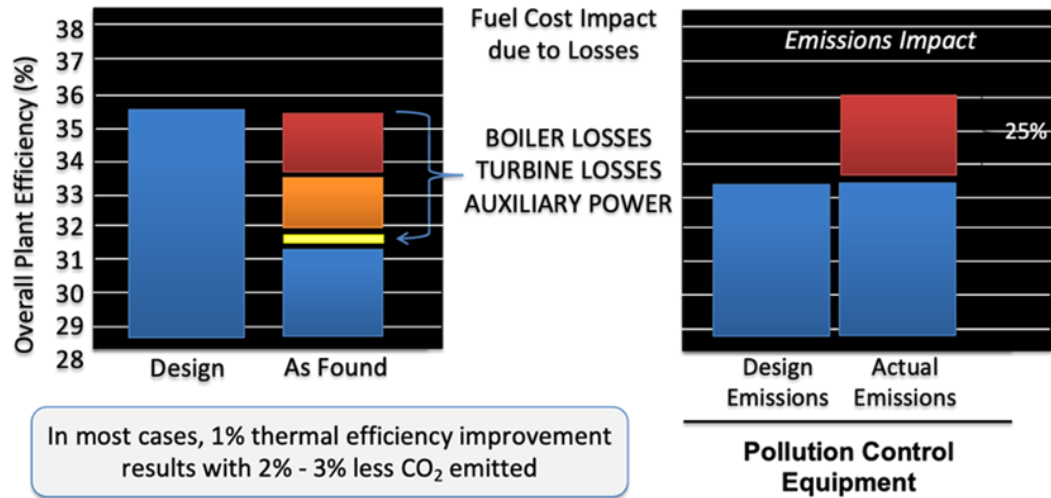


Three pillars of work in India

- Pillar 1: emissions monitoring – almost complete
- Pillar 2: emission control and ash management – about to commence
- Pillar 3: flexibility of plant operation - completed



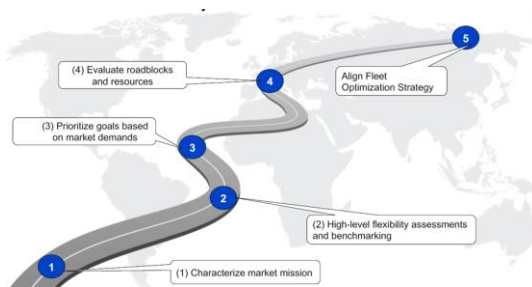
PILLAR 3 - FLEXIBILITY



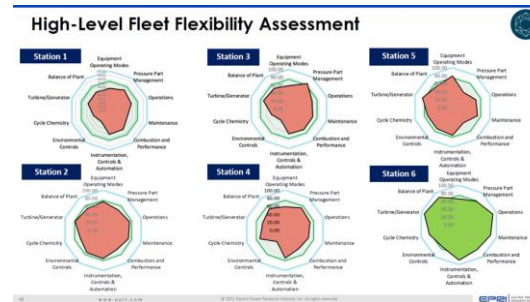
Coal plants must operate more flexibly to help balance supply and demand on the grid. This can make plants less efficient – emissions increase



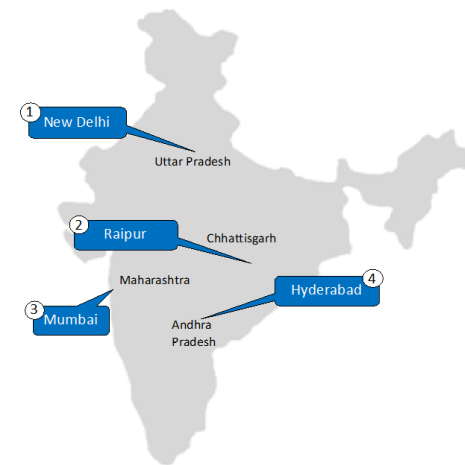
WORKING WITH EPRI TO DELIVER EXPERT TRAINING TO UTILITIES IN INDIA



Road map clarifies the goal of the training



Detailed analysis of plant operations allows identification of problem area



Training planned for 4 regions in India

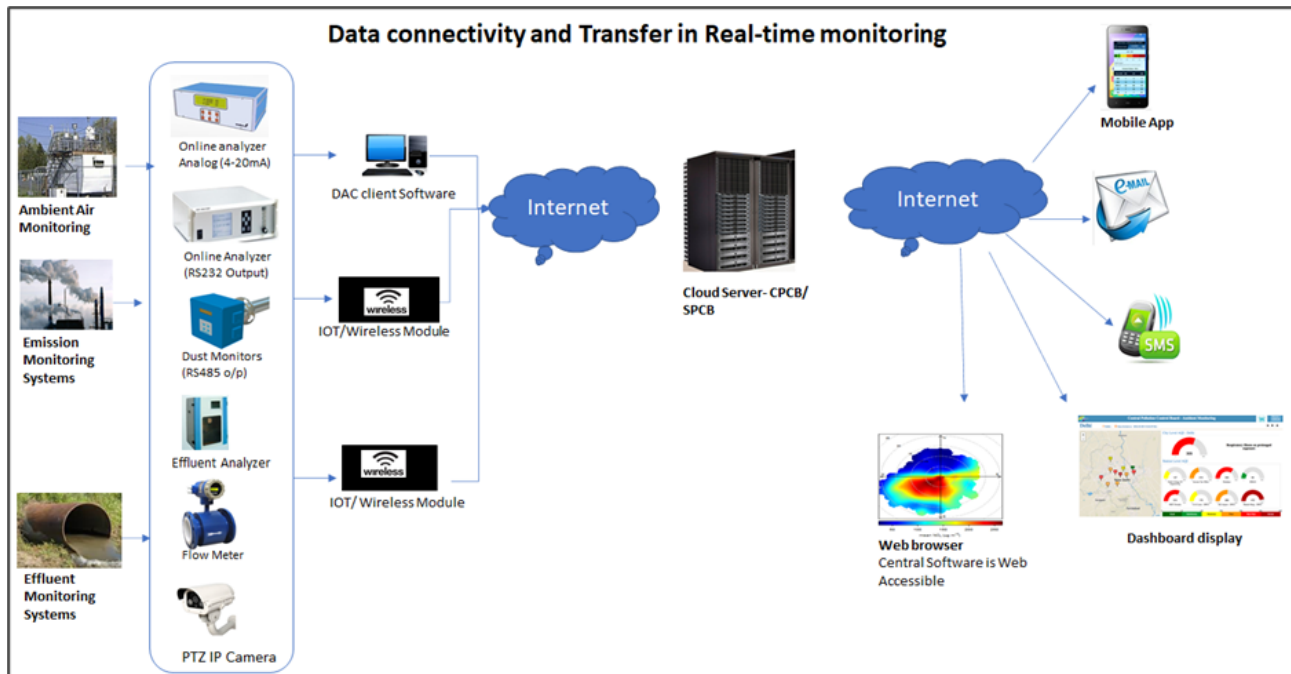


PILLAR 1 – EMISSIONS MONITORING

- Vital to evaluate current emissions in India
- Essential for compliance monitoring with new emission standards/norms
- Required for determining appropriate emission reduction strategies and for monitoring their success



CEMS ARE WIDELY INSTALLED AND OPERATED REMOTELY





TRAINING AND CAPACITY BUILDING IN INDIA

- Calibration
- QA/QC
- Certification of equipment and qualification of staff is vital to ensure valid data
- ???



OPPORTUNITIES FOR COAL PARTNERS

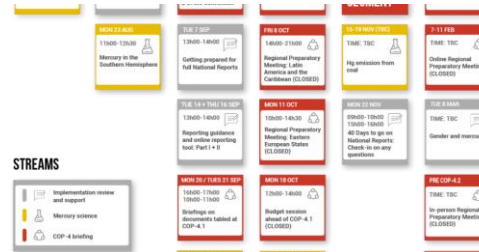
- Experts required for training and capacity building in CEM operation for all pollutants
- Opportunity for knowledge sharing for emission compliance strategies – for SO₂, NO_x and particulates as well as for mercury



OUTREACH



Session on mercury
monitoring
October 14th
Ilmexhibitions/aqeshow



Minamata On-line Season 2
23rd November
Mercuryconvention.org



ICMGP
July 2022
Ilmexhibitions/mercury202
2



INTERNATIONAL CENTRE FOR
SUSTAINABLE CARBON

THANK YOU FOR LISTENING

ANY QUESTIONS?

Technology Collaboration Programme

by **iea**

Lesley.sloss@icscarbon.org

Technology Collaboration Programme

by **iea**

Dr Lesley Sloss



4. GEF funded project on “Assessment of existing and future emissions reduction from the coal sector toward the implementation of the Minamata and Stockholm Conventions”

*Peter Nelson, Department of Earth and Environmental Sciences at Macquarie University
Co-lead of the Partnership Area*

UPDATE ON GEF PROJECT

Peter Nelson

Department of Earth & Environmental Sciences
Macquarie University
Sydney, Australia

Co-lead of the UNEP Global Mercury Partnership Area on Mercury Releases
from Coal Combustion

Partnership Area Virtual Meeting, 28th September 2021



MACQUARIE
University

Global Environment Facility

Some brief facts and role in Minamata Convention

- The Global Environment Facility (GEF)
 - established on the eve of the Rio Earth Summit to help tackle pressing environmental problems
 - has provided over \$20 billion in grants
- Today, the GEF is an international partnership of 183 countries, international institutions, civil society organizations and the private sector that addresses global environmental issues.
- The GEF is...
 - **A UNIQUE PARTNERSHIP** of 18 agencies — including United Nations agencies, multilateral development banks, national entities and international NGOs
 - **A FINANCIAL MECHANISM** for 5 major international environmental conventions: on Climate Change (UNFCCC), on Biological Diversity (UNCBD), the Stockholm Convention on Persistent Organic Pollutants (POPs), the United Nations Convention to Combat Desertification (UNCCD), and the Minamata Convention on Mercury.
 - **AN INNOVATOR AND CATALYST** that supports multi-stakeholder alliances to preserve threatened ecosystems on land and in the oceans, build greener cities, boost food security and promote clean energy for a more prosperous, climate-resilient world; leveraging additional financing.

Global Environment Facility

Some brief facts and role in Minamata Convention

Article 13 of the Minamata Convention states the following:

“The Global Environment Facility Trust Fund shall provide **new, predictable, adequate and timely financial resources to meet costs in support of implementation** of this Convention as agreed by the Conference of the Parties.

For the purposes of this Convention, the Global Environment Facility Trust Fund shall be operated **under the guidance of and be accountable to the Conference of the Parties**. The Conference of the Parties shall provide guidance on **overall strategies, policies, programme priorities and eligibility** for access to and utilization of financial resources. In addition, the Conference of the Parties shall provide guidance on an **indicative list of categories of activities** that could receive support from the Global Environment Facility Trust Fund. The Global Environment Facility Trust Fund shall provide resources to meet the agreed incremental costs of global environmental benefits and the agreed full costs of some enabling activities.”

Global Environment Facility

Development of Emissions Project

- Coal Partnership developed a proposed coal emissions project in 2015 for GEF-6; suggested countries were Vietnam and South Africa
- Partnership had already done projects in both countries
- Sufficient funding was not available in GEF-6 for this project
- GEF also suggested a broader program addressing emissions from all sources included in Annex D of the Convention:
 - *Coal-fired power plants*
 - *Coal-fired industrial boilers*
 - *Smelting and roasting processes used in the production of non-ferrous metals (lead, zinc, copper and industrial gold)*
 - *Waste incineration facilities*
 - *Cement clinker production facilities*

Assessment of Existing and Future Emissions Reduction from the coal sector toward the implementation of the Minamata and Stockholm Conventions

- The GEF indicated the need for a preparatory project to particularly address the potential emissions of mercury (and POPs) from the coal sector worldwide
- 2-3 year project, commencing Q4 2021
- Involvement of the Coal Partnership high priority as source of data, contacts and local knowledge
- Project agreement between Macquarie University and UNEP close to being finalised

Assessment of Existing and Future Emissions Reduction from the coal sector toward the implementation of the Minamata and Stockholm Conventions

- Components include:
 1. **Comprehensive Coal Sectoral Analysis**
 - *Scientific data on mercury/POPs/GHGs from CFPPs reviewed, summarised and disseminated to relevant stakeholders*
 - *Impact of UNFCCC Paris Agreement¹ commitments and targets on coal sector emissions analysed and disseminated to relevant stakeholders*
 - *Potential mercury/POPs/GHG reduction figures and scenarios from CFPPs produced and disseminated to relevant stakeholders*
 - **Project Outcomes**
 - *Estimated mercury/POPs/GHGs reductions and future scenarios for CFPPs and industrial boilers management are endorsed by high potential countries*

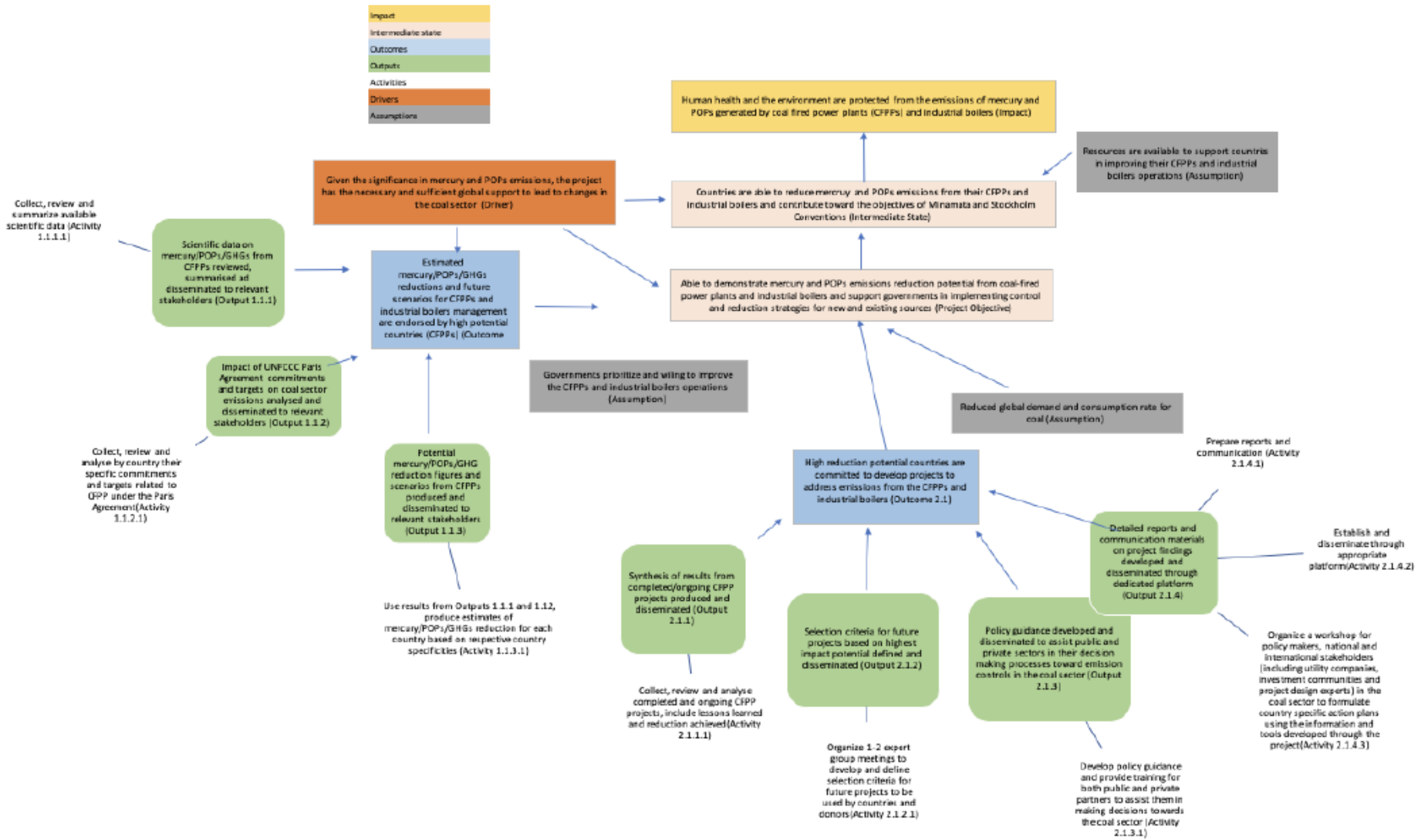
¹ With updated commitments at Glasgow COP included

Coal Mercury Partnership – key stakeholders for project outputs and outcomes

Assessment of Existing and Future Emissions Reduction from the coal sector toward the implementation of the Minamata and Stockholm Conventions

2. Strategy for the coal sector's emissions reduction contribution to Stockholm and Minamata Conventions

- *Synthesis of results from completed/ ongoing CFPP projects produced and disseminated*
- *Selection criteria for future projects based on highest impact potential defined and disseminated*
- *Policy guidance developed and disseminated to assist public and private sectors in their decision making processes toward emission controls in the coal sector*
- *Detailed reports and communication materials on project findings developed and disseminated through dedicated platform*



Assessment of Existing and Future Emissions Reduction from the coal sector toward the implementation of the Minamata and Stockholm Conventions

Stakeholders

- *UNEP – manage project implementation and oversee execution agency (Macquarie University)*
- *Global Mercury Partnerships and Partnership on Mercury Control in Coal Combustion – expertise and existing tools; members regularly consulted*
- *International Centre for Sustainable Carbon – assist in execution*
- *Macquarie University – executing agency*
- *Parties to the Convention – direct beneficiaries of the project’s outputs*
- *Convention Secretariats – critical sources of information*
- *Relevant Civil Society Groups*

Assessment of Existing and Future Emissions Reduction from the coal sector toward the implementation of the Minamata and Stockholm Conventions

Project Steering Committee (proposed members)

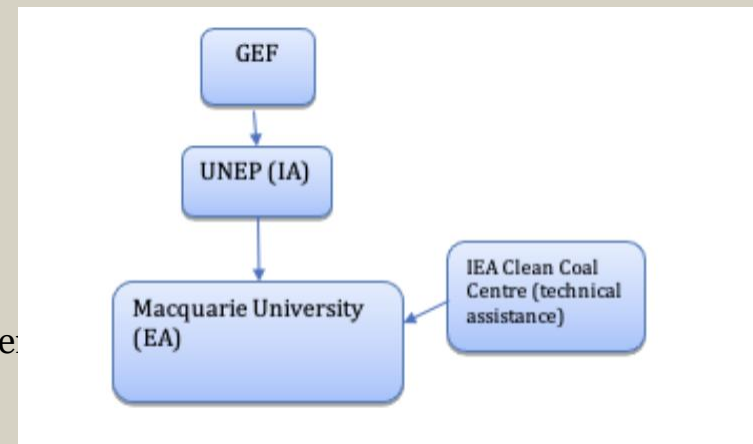
UNEP

International Centre for Sustainable Carbon

Global Mercury Partnership

Macquarie University (secretary as executing agency)

Institutional Arrangements





QUESTIONS?



5. Introduction of the Interactive Process Optimization Guidance (iPOG)

Wojciech Jozewicz, Atlantic Energy Associates, LLC



ATLANTIC ENERGY
ASSOCIATES LLC

Emission Estimates using the iPOG Focus on Indonesia

Mercury Releases from Coal Combustion Area Meeting
28 September 2021

Wojciech Jozewicz, Atlantic Energy Associates, LLC
Lesley Sloss, International Centre for Sustainable Carbon



Outline

- Overview of iPOG structure
- iPOG analyses of coal-fired units in Indonesia
- Examples of iPOG analyses around the world

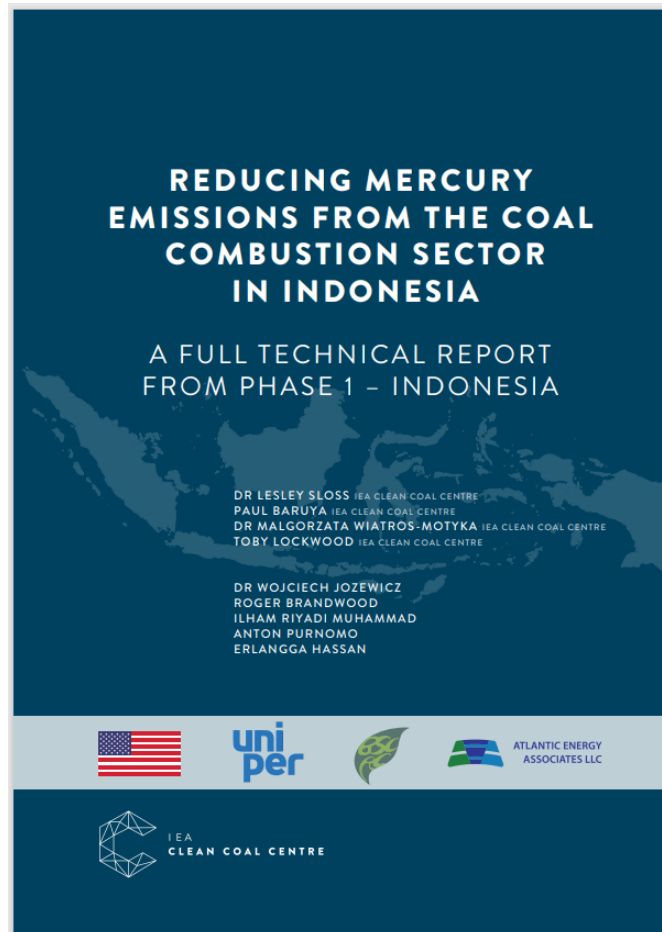


USDOS Project - 2021

- Utilize iPOG and other UNEP tools to update 2017 estimates of mercury (Hg) emissions from selected coal-fired electricity generating units in Indonesia
- Select three coal-fired units for detailed studies
- Obtain approval from the Ministry for sites and technologies selected
- Work with BCRC to prepare cases for improvement for presentation to stakeholders
- Define data needs, initiate informational exchanges, and use iPOG to model units of interest for future Hg emission reduction strategies
- Comply with BAT/BEP approach and country-wide NIP for Minamata Convention



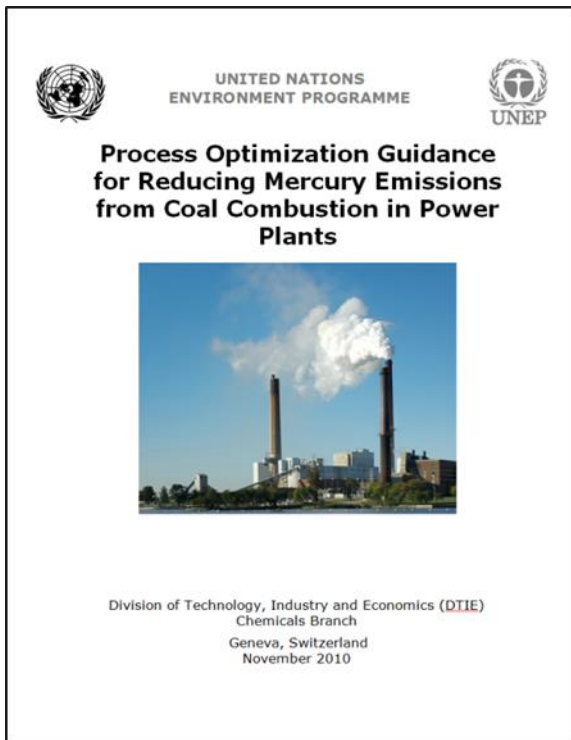
Indonesia Report Phase 1 Results - 2021



- A plant nearing the end of life, likely to upgrade soon
SURALAYA 6
- A plant with SWFGD, to investigate means to reduce potential increased Hg deposition
PAITON I Unit 2
- An inefficient plant due for imminent refurbishment
OMBILIN 1



UNEP Tools



Mercury IPOG

Post-Combustion Controls	Mercury Controls	Coal Properties		Furnace Conditions	Mercury Control Parameters	Calculate
		Single	Blend			

Standard Hg Controls

Inherent Only ▼

Configure Hg Control Options

Coal	Halogen	Sorbents
<input checked="" type="checkbox"/> None	<input checked="" type="checkbox"/> None	<input checked="" type="checkbox"/> None
<input type="checkbox"/> Washing	<input type="checkbox"/> Cl Addition	<input type="checkbox"/> Untreated ACI
<input type="checkbox"/> Float/Sink	<input type="checkbox"/> Br Addition	<input type="checkbox"/> Brominated ACI
<input type="checkbox"/> Blending	Inj. Location	Inj. Location



POG Overview

- Addressed Hg control options from coal-fired boilers
- Produced for UNEP with technological status quo in 2010
- Utilized global Hg control experience
- Significant utilization of results from USDOE Hg research program
- Has emphasized co-benefit approaches
- Was used as a platform for UNEP BAT/BEP development



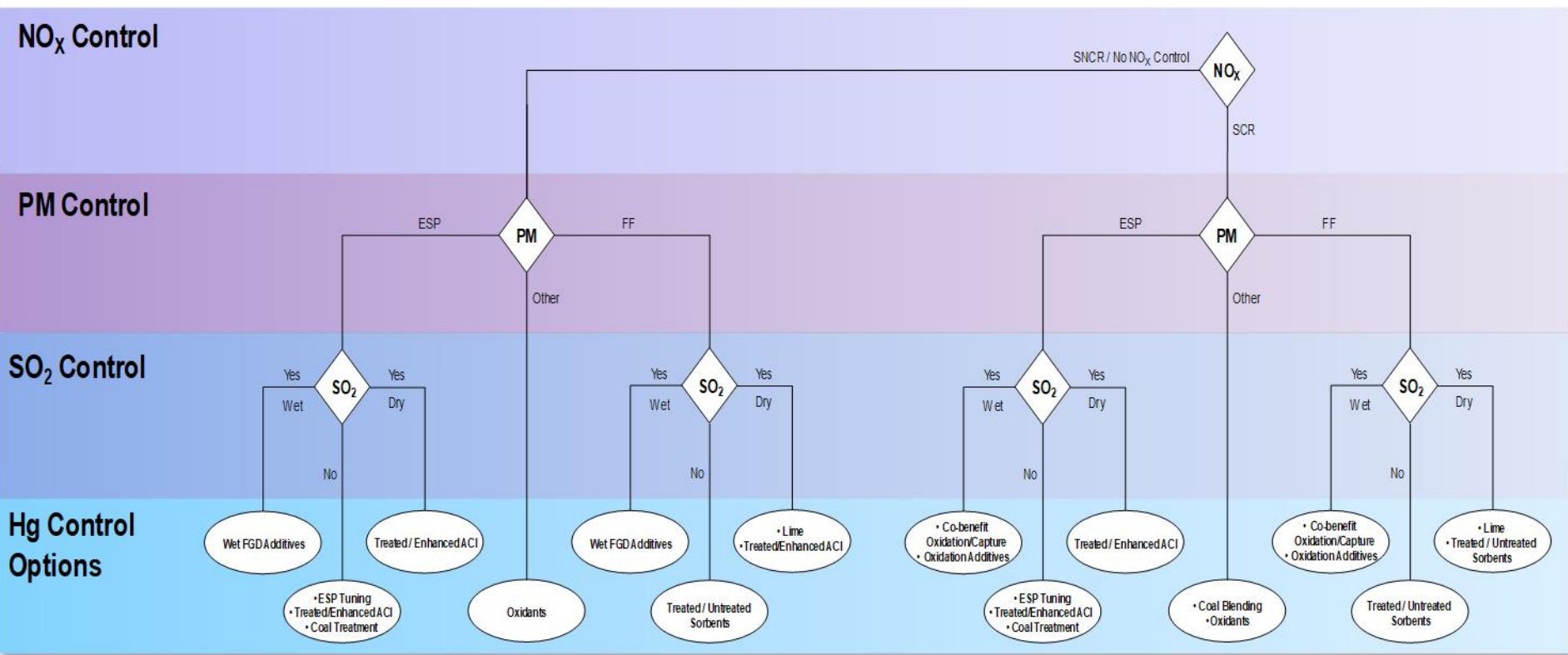
iPOG Overview

- Developed by Niksa Associates in cooperation with the Coal Partnership
- Has been coded according to POG
- Utilizes proprietary calculations
- Intuitive interface over complex set of equilibrium calculations
- Free download from UNEP's website at:

https://www.unep.org/resources/report/interactive-process-optimization-guidance-ipogtm?_cf_chl_managed_tk__=pmd_7AOq4pJhAAkd7aNOf2LatYiP1OivbzpqGaVHKNd7feU-1631718181-0-gqNtZGzNAzujcnBszQiR



iPOG Flow





Example of iPOG Input - Configuration

The screenshot displays the iPOG software configuration interface. At the top, there is a menu bar with 'File', 'View', 'Window', and 'Help'. Below the menu bar, the 'Standard Configurations:' section has a dropdown menu set to 'ESPC Only'. To the right, the 'Configure Cleaning System:' section contains several dropdown menus: 'NOx Control' is set to '<None>/Any In-Furnace', 'Number of PM Controls' is set to '1', 'PM Control 1' is set to 'ESPC', 'SO2 Control' is set to 'None', and 'PM Control 2' is set to 'None'. Below these settings, there are input fields for 'Control Efficiencies (%)': NOx (0), PM1 (98), SO2 (0), and PM2 (0). At the bottom of the interface is a process flow diagram showing a furnace on the left, followed by a yellow ESP (Electrostatic Precipitator) unit, a blue ESPC (Electrostatic Precipitator with Catalyst) unit, and finally a tall smokestack on the right. Arrows indicate the flow of gas from the furnace through the ESP, then the ESPC, and finally to the smokestack.

- Example configuration: ESP only, no SO₂ control, no post-combustion NO_x control systems



Example of iPOG Input - Coal

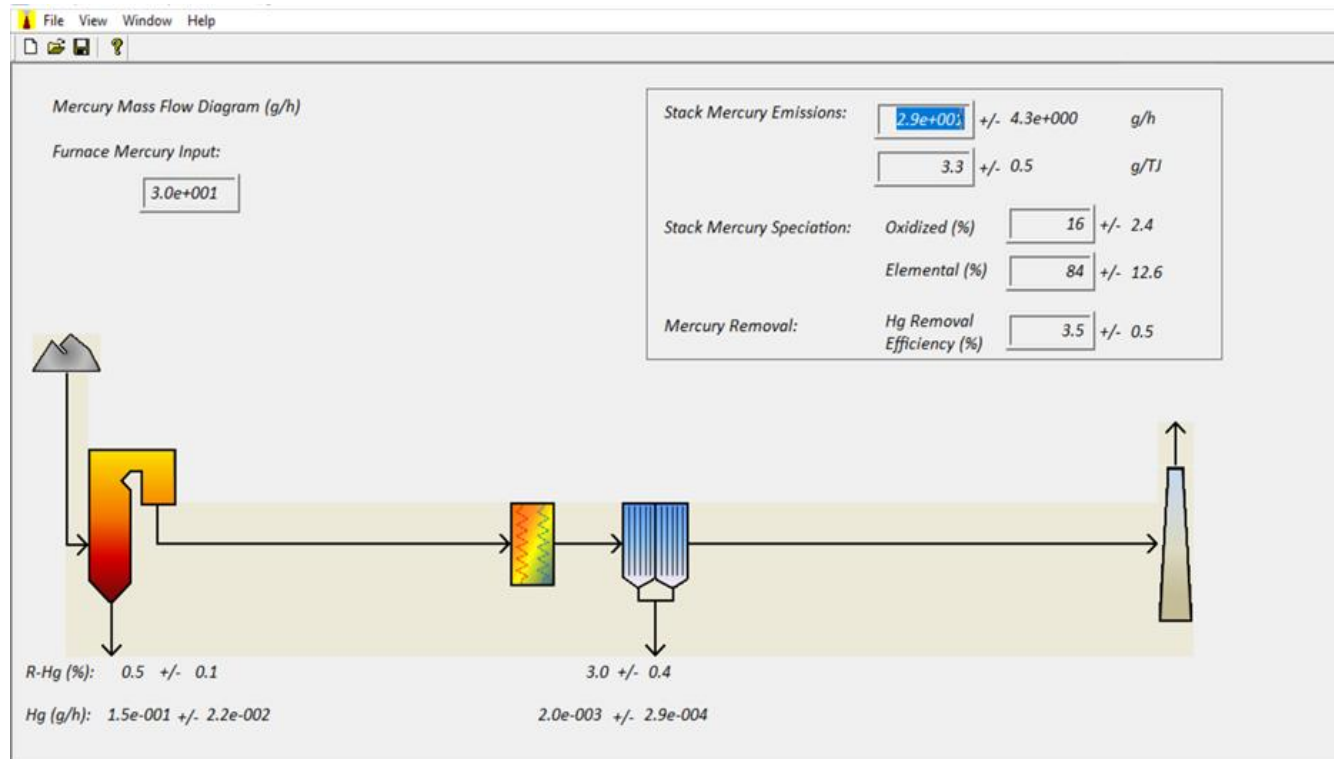
The screenshot shows the 'Single Coal Properties' tab in the iPOG software. The interface includes a menu bar (File, View, Window, Help) and a toolbar. The main content area is titled 'Single Coal Properties: (as-received %)' and features a coal pile icon. Below this, there are three sections for coal data entry:

- Select Coal:** A dropdown menu set to '<User Defined>'. Below it is a table with columns: Moisture, Ash, Sulfur, Chlorine, Mercury (ppmw), and HHV (I/g). All values are currently 0.
- Coal Rank:** A dropdown menu set to 'Subbituminous'. To its right is a text field for 'Coal Name' containing 'Suralaya Coal'. Below these are input fields for Moisture (27.5), Ash (3.8), Sulfur (0.95), Chlorine (0.015), Mercury (ppmw) (0.1017), and HHV (I/g) (23107). There are 'Load Coal' and 'Use This Coal' buttons.
- Current Coal:** A summary section showing 'Coal Rank: Subbituminous' and 'Coal Name: Suralaya Coal'. Below it are the same column headers as in the previous section.

- Higher heating value (HHV) of coal is used
- Coal blends may be used and may be user-defined
- Data should be entered for coal S and Cl content; these elements can significantly affect Hg behavior
- Data should be entered for Hg content in coal; affects Hg release from plant



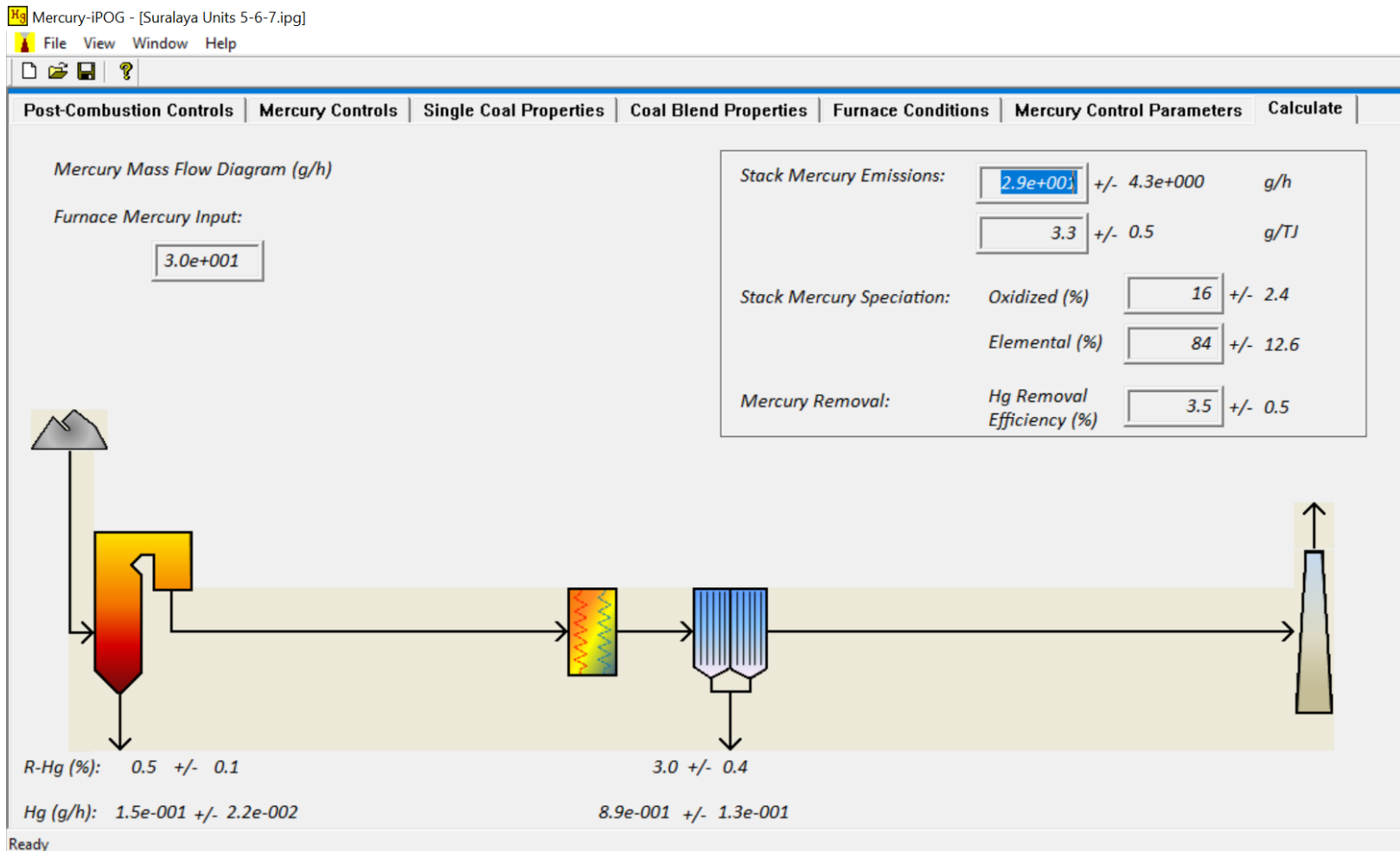
Example of iPOG Calculations - Results



- Based on input parameters, iPOG estimates stack emissions of Hg
- Estimates of elemental and oxidized stack emissions
- Estimates of Hg outflows from furnace (bottom ash) and ESP (flyash)

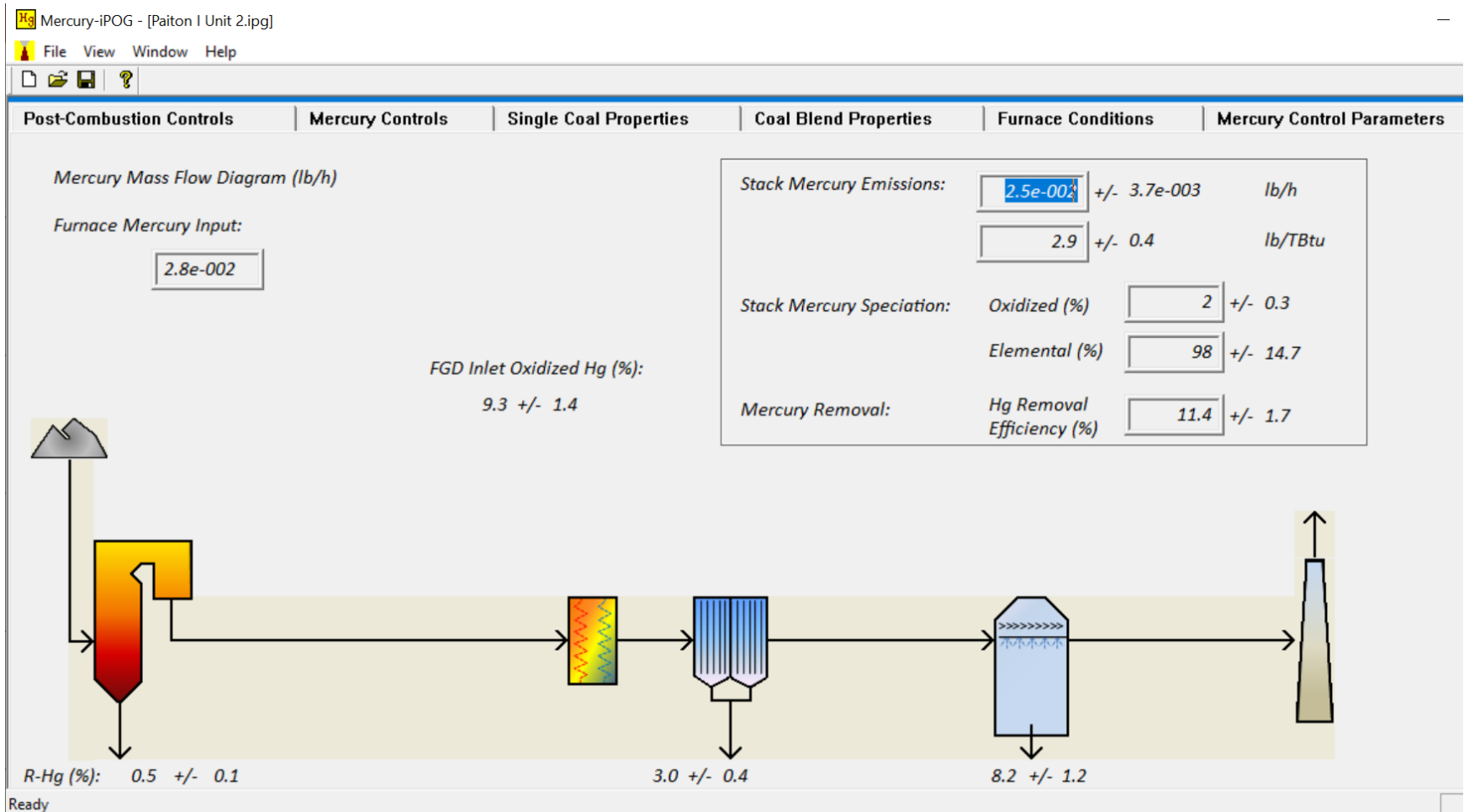


Suralaya Unit 6 - iPOG Analysis





Paiton I Unit 2 - iPOG Analysis





Ombilin Unit 1 - iPOG Analysis

Mercury-iPOG - [Ombilin Unit 1 2.ipg]

File View Window Help



Post-Combustion Controls | Mercury Controls | Single Coal Properties | Coal Blend Properties | Furnace Conditions | Mercury Control Parameters | Calculate

Mercury Mass Flow Diagram (g/h)

Furnace Mercury Input:

5.1e+000

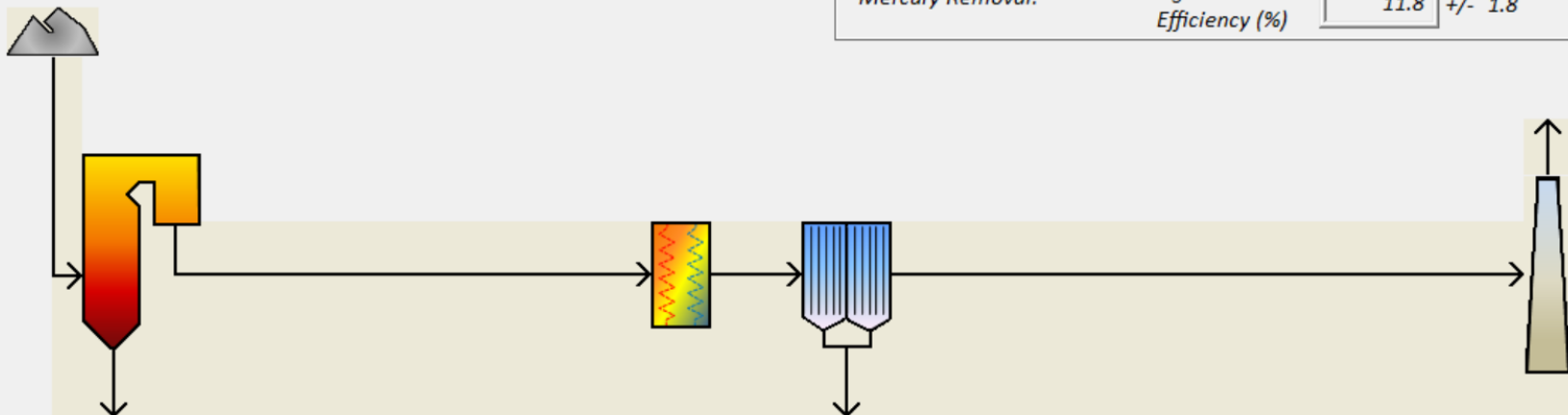
Stack Mercury Emissions: +/- 6.7e-001 g/h

+/- 0.5 g/TJ

Stack Mercury Speciation: Oxidized (%) +/- 6.8

Elemental (%) +/- 8.2

Mercury Removal: Hg Removal Efficiency (%) +/- 1.8



R-Hg (%): 0.5 +/- 0.1

11.4 +/- 1.7

Ready



Scope of iPOG Analysis

What these considerations are meant to be

- Qualitative ranking of emission for units where enough data is available to do so
- Selection methodology for reduction of Hg emissions
- Initial platform for discussions with stakeholders

What these considerations are not meant to be

- An attempt to build Hg or SO₂ emission inventory
- Quantitative prediction of emissions
- Policy tool for NIP implementation
- Regional compliance tool

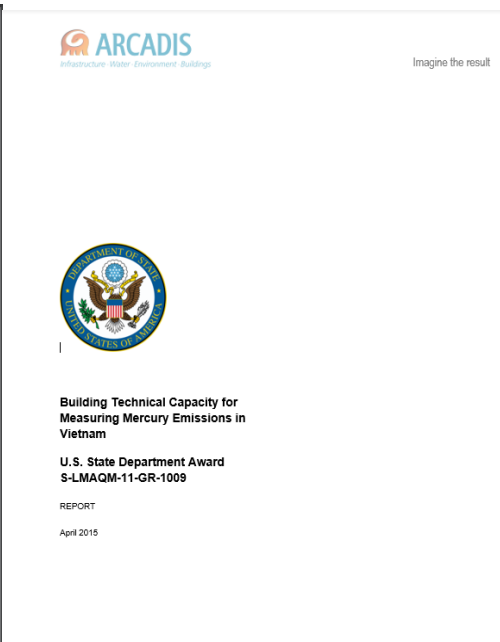


Other POG/iPOG Project Use Examples



Process Optimization Guidance: Overview and Application

Presentation at the Ministry of Natural Resources and Environment of the Russian Federation
Moscow, Russia
December 1, 2010



THE CLEAN COAL CENTRE, THE UN COAL PARTNERSHIP AND CLEAN COAL

DR LESLEY SLOSS FRSC FIENVSCI

MERCURY TRAINING WORKSHOP COLOMBIA, DEC 2018

IEA CLEAN COAL CENTRE

Presentation during the Pollution Control Department – UNEP Meeting Mercury Emissions from Coal-fired Power Plants Bangkok, Thailand 21 June 2016

Presentation at the Seminar on Mercury Emission Control from Coal Combustion Beijing, PR of China March 22, 2011

Wojciech Jozewicz

Presentation at the: Ministry of Natural Resources and Environment Mercury Emissions Workshop HaLong City, QuangNinh Province, VietNam 09 December 2016



Summary

- Hg emissions from coal-fired units in Indonesia were estimated with iPOG using augmented data from 2017 study and 2020 database
- Based on iPOG analyses, three coal-fired units have been selected for detailed studies in Indonesia
- iPOG analyses were used during numerous projects funded by UNEP and USDOS
- The iPOG tool is available as a free download from the UNEP website



Thank you for your attention



6. Partners updates on events and projects



7. Any other issue



8. Closing remarks

*Rodges Ankrah, Environmental Protection Agency, United States of America
Co-chair of the Partnership Advisory Group*
