Training Course on Pollution, Health and Safety Management in ADB Projects

Water Management Module

November 21-22, 2018

Training Agenda – Day 1

Time	Session/Topic
08:30 – 09:00	**Registration**
09:00 – 09:15	**Introduction to the Module and Overview** *Francesco Ricciardi, Environment Specialist, SDES*
09:15 – 09:30	**Safeguard Policy Statement (SPS) Requirements and International Standards** *Francesco Ricciardi, Environment Specialist, SDES*
09:30 – 09:50	**Example Study** *Gerard Pijcke, Hydroinformatics Institute* • How can ADB benefit from water quality modelling?
09:50 – 10:00	**Coffee Break**
10:00 – 10:45	**Introduction to Water Quality Modelling** • What is water quality? • What is modelling? • Why do we need water quality models? • What are applications of water quality models?
10:45 – 11:30	**Basic Theory of Water Quality Modelling** • What are important definitions and jargon in water quality modelling? • What are important model settings and characteristics to take into account?
11:30 – 12:00	**Q and A**
12:00 – 01:30	**Lunch**
01:30 – 02:15	**Data and Data Collection** • What are important considerations in aligning data collection with modelling? • How does date reliability impact models? • What are the challenges in operational models and real-time date feeds?

Time	Session/Topic
02:15 – 03:00	**Interpretation of Model Results** • What is calibration and validation? • What are important tests to be carried out with a water quality model? • What is model uncertainty and how can we describe it?
03:00 – 03:15	**Coffee Break**
03:15 – 03:45	Presentation by XXXXX (Wastewater)
03:45 – 04:15	**Future Challenges in Water Quality** • What are the impacts of climate change and anthropogenic drivers on water quality? • What are microplastics and emerging contamination
04:15 – 04:45	Terms **of References for Water Quality Modelling Consultant** • What does a consultant look for when reviewing ToR?
04:45 – 05:00	**Q and A / End of Day 1**

ADB

Training Agenda – Day 2

Time	Session/Topic
08:30 – 09:00	**Registration**
09:00 – 09:15	**Introduction and Overview for the Day's Topics** *Francesco Ricciardi, Environment Specialist, SDES*
09:15 – 10:15	**Introduction to Environmental Flows (EFlows): History, underlying concepts and methods/levels of assessment** *Cate Brown, Southern Oceans*
10:15 – 10:30	**Q and A**
10:30 – 10:45	**Coffee Break**
10:45 – 11:45	**Managing EFlows Assessment**
11:45 – 12:00	**Q and A**
12:00 – 01:30	**Lunch Break**
01:30 – 02:15	**How does development affect the Hydrologic Cycle?** ADB invests in Water, Transport, Energy, Heath, Education and Finance Sectors, to facilitate socio economic development in Developing Member Countries along its Operational Priorities. These development activities affect the hydrologic cycle, which is ubiquitous. Water is a finite but renewable resource. Its quality and quantity dimensions affect all aspects of socio-economic development, and socio-economic development affect quality and quantity dimensions of water. In this session, examples of how water affect socio economic development, and how socio-economic development affects water will be discussed. *S.A. Prathapar, Senior Water Resources Specialist, SDCC*
02:15 – 02:45	**Review of Selected Case Studies** *Cate Brown*
02:45 – 03:15	**Case Studies**
03:15 – 03:30	**Q and A**
03:30 -	**Coffee Break / End of Training**

ADB

Overview

Water quality status across Asia

ADB

Water Pollution in Asia

Increasing Pollution

- Rapid economic growth in many developing countries has increased the amount of pollution entering the world's waterways, with dire consequences for poor communities who rely on local water sources for their health and economic well-being.

Economic Losses

- Many developing economies suffer economic losses equivalent to 2–4 percent of gross domestic product (GDP) from deaths and illnesses due to environmental degradation caused by pollution. Yet, secrecy about the type and amount of industrial pollutants discharged in these countries is still the norm (World Bank 2012)

People affected

- Contaminated water is a root cause of death, disease, and disability across the world, with more than 2 billion people still using polluted water for domestic purposes and livelihood activities (UN-Water 2013).

ADB

In China, the water you drink is as dangerous as the air you breathe

Nearly half the country has missed its five-year water quality targets, Greenpeace research shows - so what can be done about water pollution?

▲ A rubbish-strewn beach in Anquan village. China suffers from widespread wate
unbridled economic growth. Photograph: STR/AFP/Getty Images

Asians are in the dark about the region's water pollution crisis

Asia's industrial boom is exacerbating water pollution in the region, but research shows the rural poor have little information about who is polluting their water, the toxins they are exposed to, and the resulting health impacts.

nba Island, Indonesia. Industrial facilities release upwards of 400 million tons
ar, but downstream rural communities may not always have access to
Asian Development Bank, CC BY-NC-ND 2.0

More than half of south Asia's groundwater too contaminated to use - study

Salinity and arsenic affect 60% of underground supply across vast Indo-Gangetic Basin, according to research published in Nature Geoscience

▲ Fifteen to twenty million wells extract water from the Indo-Gangetic basin every year. Photograph: Rajesh Kumar Singh/AP

Sixty per cent of the groundwater in a river basin supporting more than 750 million people in Pakistan, India, Nepal and Bangladesh is not drinkable or usable for irrigation, researchers have said.

Facts!

ADB

Villagers living in Wat Nong Fab, Thailand, near the Map Ta Phut industrial region, worry that water pollution is affecting their health.

Numerous petrochemical facilities and other companies discharge waste into the groundwater, contaminating the wells and streams that people rely on for drinking water and farming. Although community members suspect that pollution levels are dangerously high, they cannot substantiate their claim and have had trouble getting access to facility-specific, local water pollution data held by government ministries.

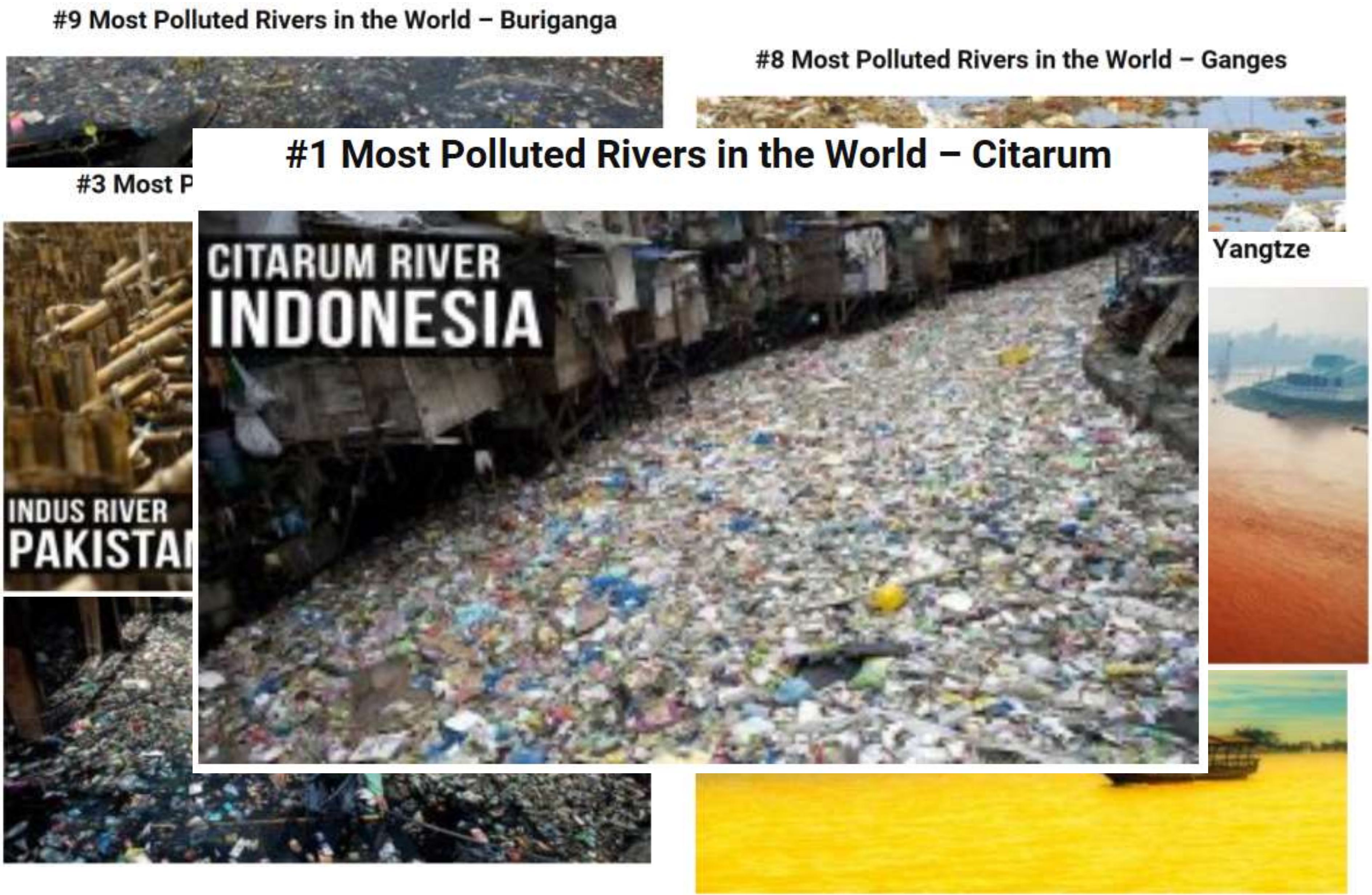
In Indonesia, local shrimp farmers in the Serang area of Java have been witnessing the decline of the Ciujung River for 20 years as pulp and paper and textile facilities have moved into their area.

Community members have held numerous protests, petitioned local enforcement ministries, and even brought a lawsuit to court to address the perceived impact of declining water quality and to demand that the companies be held responsible for the pollution of the river. Yet even after a Ministry of Environment audit of the river's main waste contributor found multiple problems with facility practices, shrimp fishermen's catches have fallen dramatically, and the river remains polluted.

In Mongolia, herders living outside the booming capital, Ulaanbaatar, fear that the Tuul River's rapidly deteriorating water quality is making their livestock sick.

Customers have complained about the taste of the meat purchased. The herders believe that gravel mining and the city's poor wastewater treatment have released pollutants into the water. But without documentation of water contamination or general information about the companies that own the mines in their area, these herders struggle to justify their concerns to government officials and don't have the information they need to try and stop more mines from coming into the area.

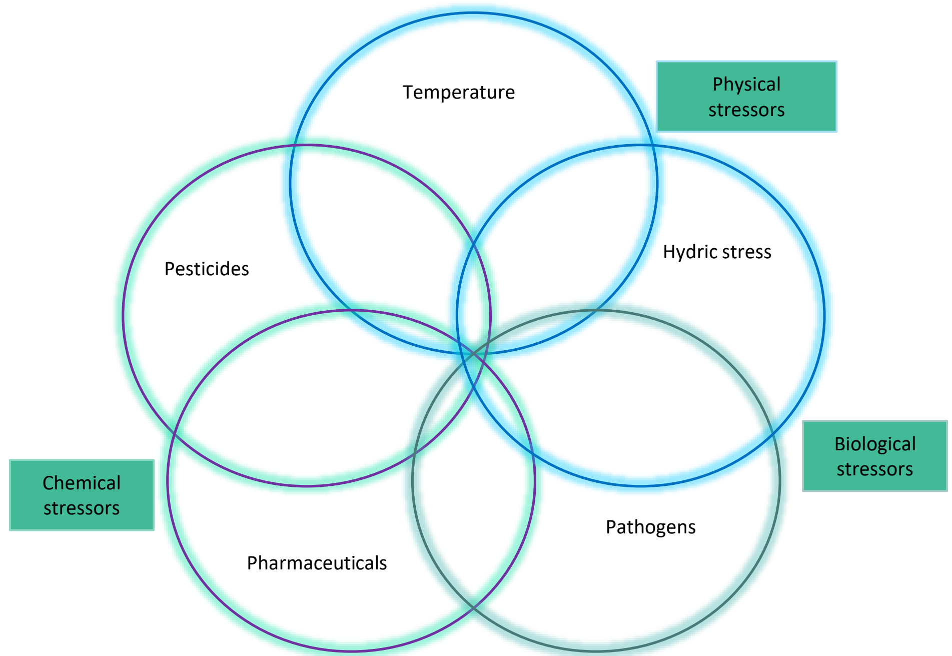
Facts!


#9 Most Polluted Rivers in the World – Buriganga
#8 Most Polluted Rivers in the World – Ganges
#1 Most Polluted Rivers in the World – Citarum
CITARUM RIVER
INDONESIA
#3 Most P
INDUS RIVER
PAKISTAN
Yangtze

Multiple stressors and aquatic ecosystems

- Impact of **human activities** on aquatic ecosystems:
  - **Chemical stressors**: excessive nutrients, pharmaceutical products (antibiotics, analgesics), industrial chemicals, personal care products…
  - **Physical stressors**: excessive radiation, increased temperature, flow alterations.
  - **Biological stressors**: pathogens, toxins …

Multi-stress context



SPS Requirements

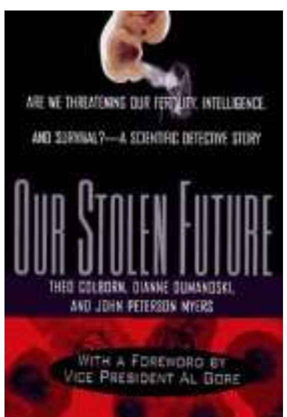
Compliance & Peace of Mind

ADB

Safeguard Policy Statement

- ADB-financed projects need to meet environment safeguard requirements related to water quality impacts
- Review of EIA and IEE has shown that projects need to **better reflect the intent of SPS to apply international good practice**
- Projects need to **look beyond basic compliance**, incorporating environmental sustainability into project design.
- Large quantities of new "emerging" pollutants are discharged – often untreated – in surface and groundwater bodies. **Pollution evolves faster than standards and legislation!**

(1964)



(1996)

ADB

Water Pollution Sources

What all that acronyms actually mean and why we should monitor them (or not)

ADB

Physico-Chemical Parameters – measurable on-site

- pH
- Dissolved oxygen (mg/l and % saturation)
- Temperature (°C)
- Turbidity (NTU)
- Salinity (mg/l)

Indirect evidences of contamination

Low pH → discharge of acids

Low DO → excess of nutrients

High Turbidity → soil erosion

Basic Laboratory Tests

- BOD_5 - COD
- Nutrients (TN/TP)
- Oil&Grease
- Total Suspended Solids (TSS)
- Microbiological Parameters (*Eschericia coli)*

Required by most environmental standards (inexpensive quick tests)

BOD/COD → presence of organic/inorganic contamination

TN/TP → nutrients (wastewater of agricultural runoff)

Oil&Grease → Oil Leaking

TSS → Soil erosion, uncontrolled dredging

E. coli → untreated wastewater

ADB

Advanced Laboratory Tests

- Heavy Metals
- Pesticides (herbicides/insecticides)
- Hydrocarbons
- PCDD/PCDFs
- Radionuclides

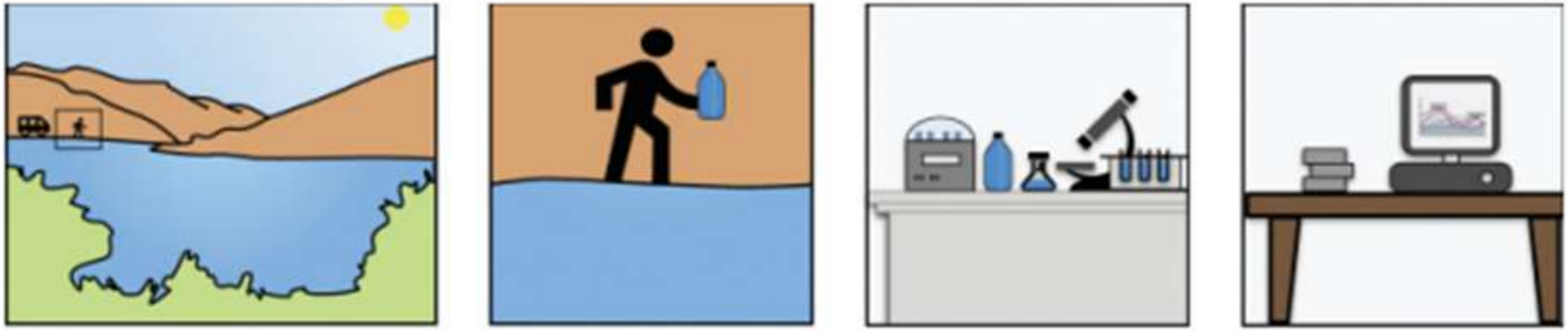
↓

<u>Required by specific environmental standards</u>

Normally low concentration but high toxicity

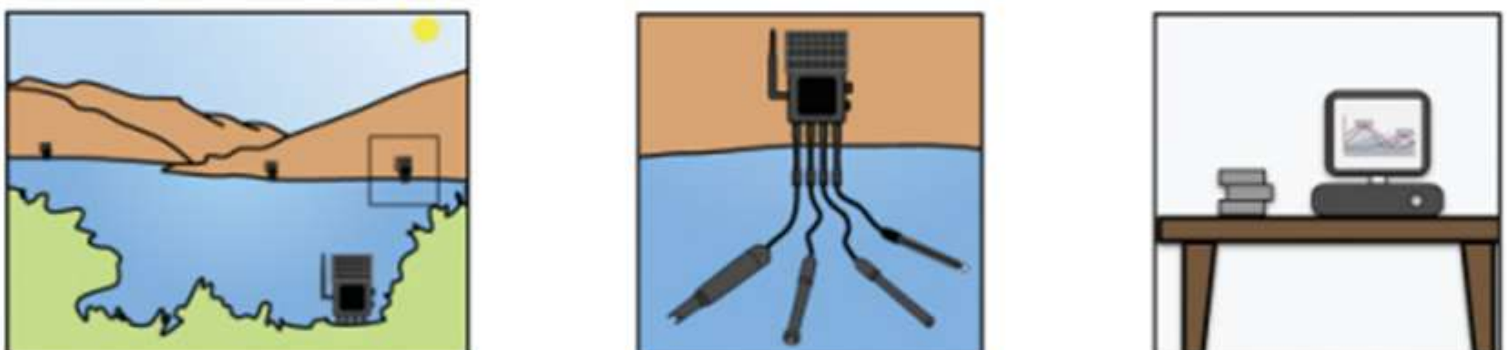
Bioaccumulable

More expensive and time-consuming tests



(a) TMLB WQM approach

(b) TMIS WQM approach



(c) Wireless sensor network-based WQM approach

International Journal of
Environmental Research and Public Health

MDPI

Review

Wear and Tear of Tyres: A Stealthy Source of Microplastics in the Environment

Pieter Jan Kole [1], Ansje J. Löhr [1], Frank G. A. J. Van Belleghem [1,2] and Ad M. J. Ragas [1,3,*]

1 Department of Science, Faculty of Management, Science & Technology, Open University of The Netherlands, 6419 AT Heerlen, The Netherlands; PJ.Kole@studie.ou.nl (P.J.K.); Ansje.Lohr@ou.nl (A.J.L.); Frank.vanBelleghem@ou.nl (F.G.A.J.V.B.)

2 Zoology: Biodiversity and Toxicology, Centre for Environmental Sciences, Hasselt University, BE 3590 Diepenbeek, Belgium

3 Institute of Water and Wetland Research, Faculty of Science, Radboud University Nijmegen, 6525 AJ Nijmegen, The Netherlands

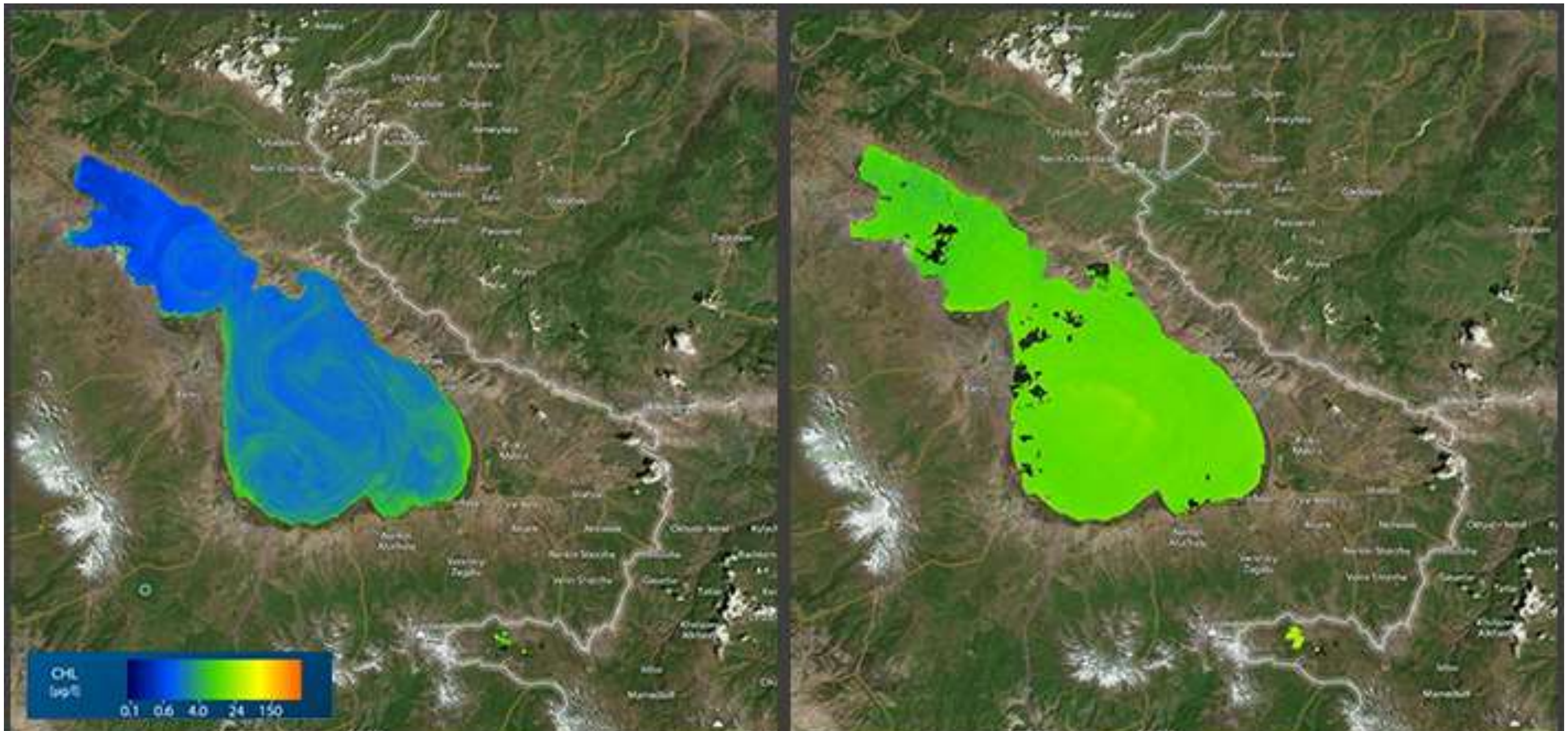
* Correspondence: Ad.Ragas@ou.nl; Tel.: +31-24-365-3284

Academic Editor: A. Dick Vethaak
Received: 31 July 2017; Accepted: 16 October 2017; Published: 20 October 2017

Abstract: Wear and tear from tyres significantly contributes to the flow of (micro-)plastics into the environment. This paper compiles the fragmented knowledge on tyre wear and tear characteristics, amounts of particles emitted, pathways in the environment, and the possible effects on humans. The estimated per capita emission ranges from 0.23 to 4.7 kg/year, with a global average of 0.81 kg/year. The emissions from car tyres (100%) are substantially higher than those of other sources of microplastics, e.g., airplane tyres (2%), artificial turf (12–50%), brake wear (8%) and road markings (5%). Emissions and pathways depend on local factors like road type or sewage systems. The relative contribution of tyre wear and tear to the total global amount of plastics ending up in our oceans is estimated to be 5–10%. In air, 3–7% of the particulate matter ($PM_{2.5}$) is estimated to consist of tyre wear and tear, indicating that it may contribute to the global health burden of air pollution which has been projected by the World Health Organization (WHO) at 3 million deaths in 2012. The wear and tear also enters our food chain, but further research is needed to assess human health risks. It is concluded here that tyre wear and tear is a stealthy source of microplastics in our environment, which can only be addressed effectively if awareness increases, knowledge gaps on quantities and effects are being closed, and creative technical solutions are being sought. This requires a global effort from all stakeholders; consumers, regulators, industry and researchers alike.

Keywords: tyre wear and tear; microplastics; particulate matter; tyre rubber

Open Questions



Chlorophyll-a levels in Lake Sevan on 26 August and 04 September 2016.
IIWQ World Water Quality Portal, UNESCO / EOMAP

IFC EHS Guidelines

Good practices and monitoring requirements

Sanitary Sewage Discharge

Table 1.3.1 Indicative Values for Treated Sanitary Sewage Discharges[a]

Pollutants	Units	Guideline Value
pH	pH	6 – 9
BOD	mg/l	30
COD	mg/l	125
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Oil and grease	mg/l	10
Total suspended solids	mg/l	50
Total coliform bacteria	MPN[b] / 100 ml	400[a]

Notes:

[a] Not applicable to centralized, municipal, wastewater treatment systems which are included in EHS Guidelines for Water and Sanitation.

[b] MPN = Most Probable Number

Acidity

Organic/Inorganic load

Nutrients

Hydrocarbons

Turbidity

Fecal contamination

ADB

Health Care Facilities

Table 2. Effluent Levels for Health Care Facilities		
Pollutants	**Units**	**Guideline Value**
pH	S.U	6 - 9
Biochemical oxygen demand (BOD_5)	mg/L	50
Chemical oxygen demand (COD)	mg/L	250
Oil and grease	mg/L	10
Total suspended solid (TSS)	mg/L	50
Cadmium (Cd)	mg/L	0.05
Chromium (Cr)	mg/L	0.5
Lead (Pb)	mg/L	0.1
Mercury (Hg)	mg/L	0.01
Chlorine, total residual	mg/L	0.2
Phenols	mg/L	0.5
Total coliform bateria	MPN[a] / 100ml	400
Polychlorinated dibenzodioxin and dibenzofuran (PCDD/F)	Ng/L	0.1
Temperature increase	°C	<3[b]

Notes:

[a] MPN = Most Probable Number

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity

Heavy metals, multiple sources

Disinfection, residuals

Incomplete combustion, extremely toxic

ADB

Thermal power generation

Table 5 - Effluent Guidelines (To be applicable at relevant wastewater stream: e.g., from FGD system, wet ash transport, washing boiler / air preheater and precipitator, boiler acid washing, regeneration of demineralizers and condensate polishers, oil-separated water, site drainage, coal pile runoff, and cooling water)	
Parameter	mg/L, except pH and temp
pH	6 – 9
TSS	50
Oil and grease	10
Total residual chlorine	0.2
Chromium - Total (Cr)	0.5
Copper (Cu)	0.5
Iron (Fe)	1.0
Zinc (Zn)	1.0
Lead (Pb)	0.5
Cadmium (Cd)	0.1
Mercury (Hg)	0.005
Arsenic (As)	0.5
Temperature increase by thermal discharge from cooling system	• Site specific requirement to be established by the EA. • Elevated temperature areas due to discharge of once-through cooling water (e.g., 1 Celsius above, 2 Celsius above, 3 Celsius above ambient water temperature) should be minimized by adjusting intake and outfall design through the project specific EA depending on the sensitive aquatic ecosystems around the discharge point.
Note: Applicability of heavy metals should be determined in the EA. Guideline limits in the Table are from various references of effluent performance by thermal power plants.	

Will be discussed in more detail in the modelling part

ADB

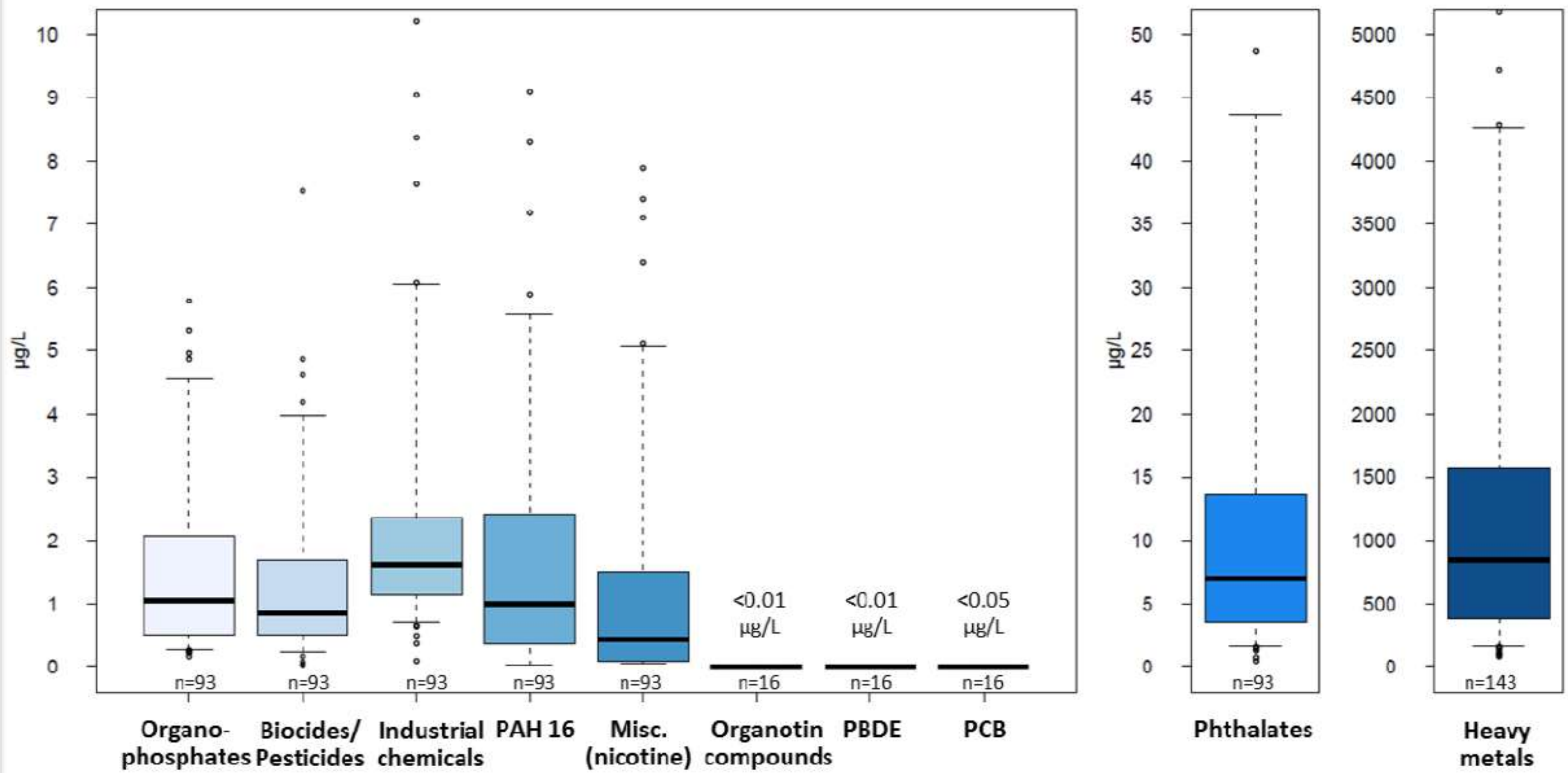


Figure 1: Concentrations of micropollutant groups (sum of all micropollutants per group, see Table 1) in stormwater of 5 different catchment types.

pollution which has been projected by the World Health Organization (WHO) at 3 million deaths in 2012. The wear and tear also enters our food chain, but further research is needed to assess human health risks. It is concluded here that tyre wear and tear is a stealthy source of microplastics in our environment, which can only be addressed effectively if awareness increases, knowledge gaps on quantities and effects are being closed, and creative technical solutions are being sought. This requires a global effort from all stakeholders; consumers, regulators, industry and researchers alike.

Keywords: tyre wear and tear; microplastics; particulate matter; tyre rubber

Why the Mundra power plant has given Tata a mega headache

The birth pains of 'ultra mega power projects' in India have pitched a conglomerate against a small fishing community - and put the World Bank on the defensive

▲ Locals say the Tata Mundra plant's waste outlet expels a plume of hot water, destroying mangroves that are a nursery for fish and a natural barrier against cyclones. Photograph: Tata

The Association for the Struggle for Fishworkers' Rights (Mass), a community group representing the Wagher, says that the Mundra plant has damaged the villagers' livelihoods, in effect displacing them economically. They say the Mundra plant's waste outlet expels a plume of hot water, destroying mangroves that act as a breeding ground for fish and a natural barrier against cyclones.

They also say that ash from the coal plant settles on fish left out to dry, rendering them inedible. The Wagher claim that pollution from the power station causes them chest and other body pains.

The World Bank claims that the projects it finances are subject to stringent oversight procedures, including assessments of potential environmental or social damage. The Mundra plant was no different, it says, and was designated a category-A project - signifying "potential significant adverse social and/or environmental impacts that are diverse, irreversible or unprecedented".

“ *Are we doing it wrong?*

What do we need to solve?

Sampling

- Is our sampling strategy robust enough? (E.g. B.A.C.I)

Baseline

- Natural fluctuation in water systems are significant.

Control sites

Do we have at least one control point? (e.g. upstream, downstream far enough?

THANK YOU