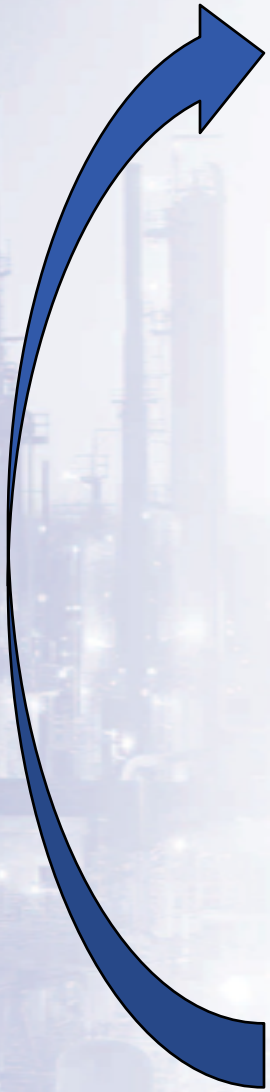
concawe

An Introduction to CONCAWE:
How Does CONCAWE Work?

Ken Rose
Technical Coordinator
Fuels Quality and Emissions

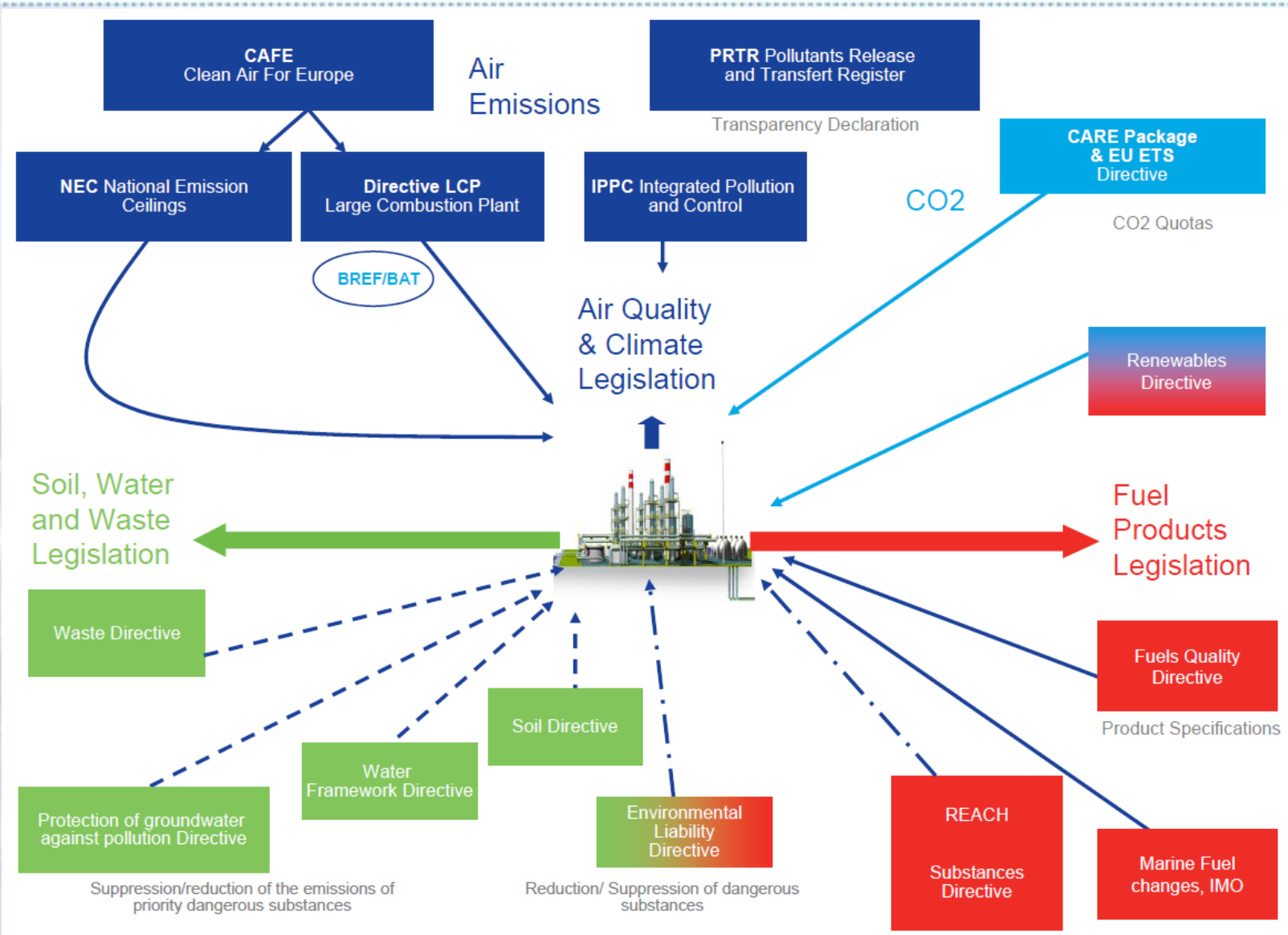
14th March, 2011

How Does CONCAWE Work?



- Identify gaps in knowledge and data
- Evaluate existing literature to clarify uncertainties
- Design robust study to address gaps
- Obtain funding from CONCAWE Management Group
- Tender study with external labs or contractors
- Select best contractor based on capabilities and costs
- Execute study
- Interpret results
- Document and report findings
- Identify gaps in knowledge and data

EU Legislative Initiatives Impacting Refining



Refinery Technology Support

- Gate-keeping on refinery technology developments
- Maintenance of a sophisticated LP model of European refining
  - Up to 9 regions, each represented by an aggregate refinery
  - Capacity and supply/demand database covers EU-27+2
  - Capability to dig deeper into a single region (up to 9 refineries)
- Studies on
  - Impact of legislative measures on EU refineries in terms of costs and CO_2 emissions
    - Sulphur-free automotive fuels
    - PAH reduction in diesel
    - Sulphur reduction in jet fuel
  - Potential implications of residual marine fuel sulphur reduction
  - Consequences of oil product demand changes on EU refineries
- Work on European Emissions Trading Scheme (EU ETS)
  - CO_2 monitoring and reporting Guidelines
  - Benchmarking performance for allocation of free CO_2 allowances
  - Impact of ETS on refineries
- CCS: potential applications in refineries
- JEC Well-to-Wheels and Biofuels programmes:
  - Assistance with modelling of EU vehicle fleet and fuels
  - Modelling refinery GHG emissions related to production of road fuels

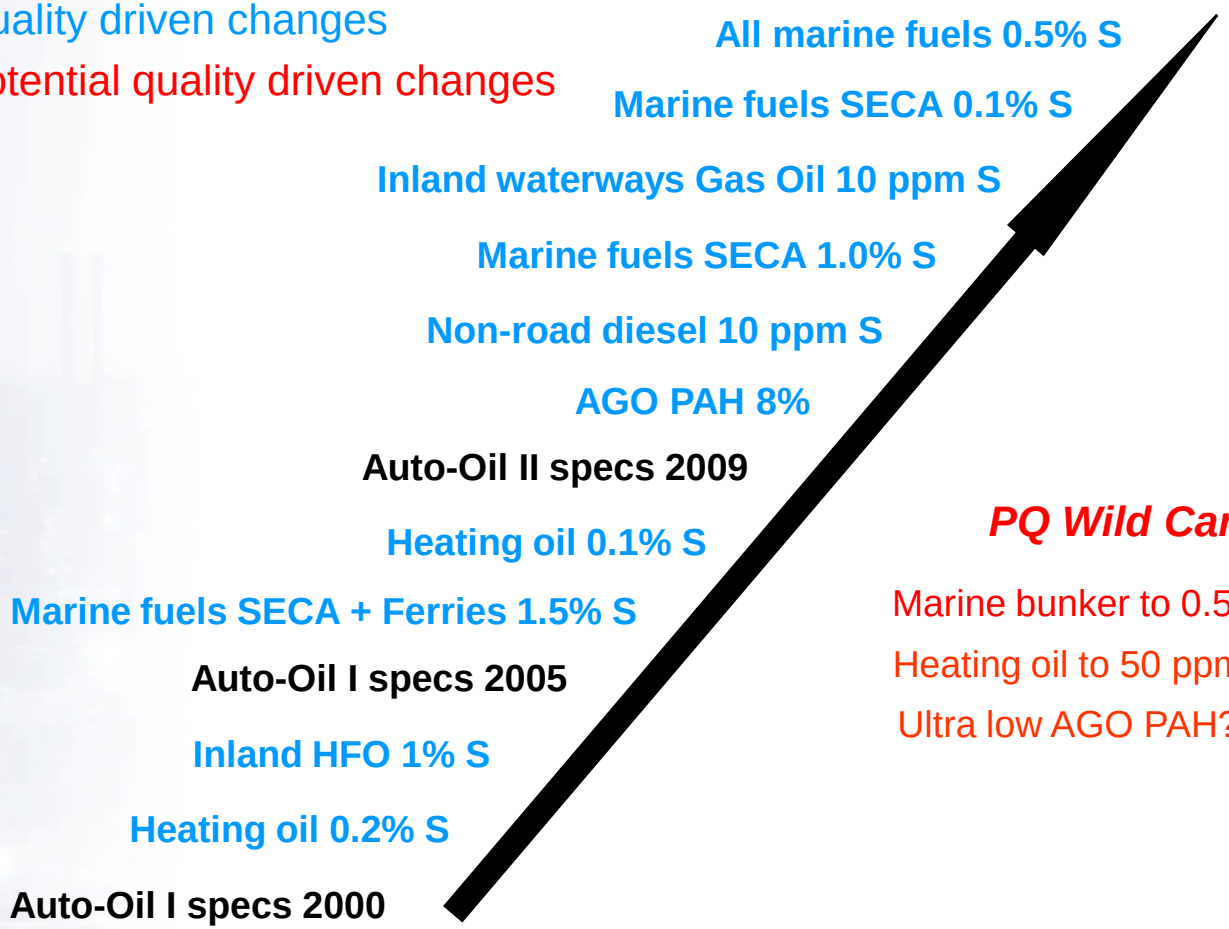
CONCAWE Model of EU refineries: 2000 to 2020
Evolution of product specifications

Year 2000 base case

Demand driven changes

Quality driven changes

Potential quality driven changes



PQ Wild Cards?

Marine bunker to 0.5% S distillate?

Heating oil to 50 ppm S?

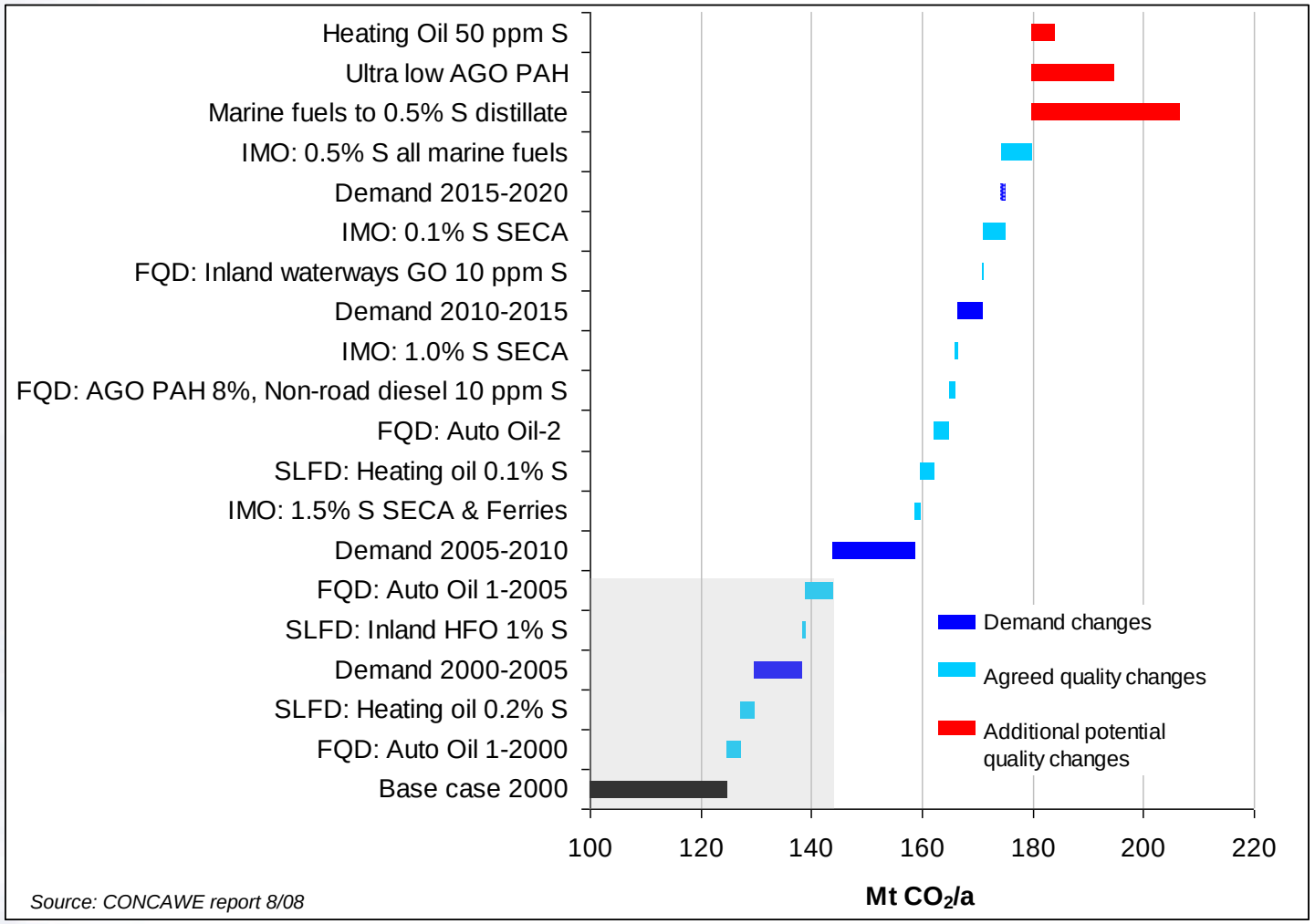
Ultra low AGO PAH?

Refinery Technology Support

Source: CONCAWE report 8/08

EU refineries CO_2 emissions pathway to 2020

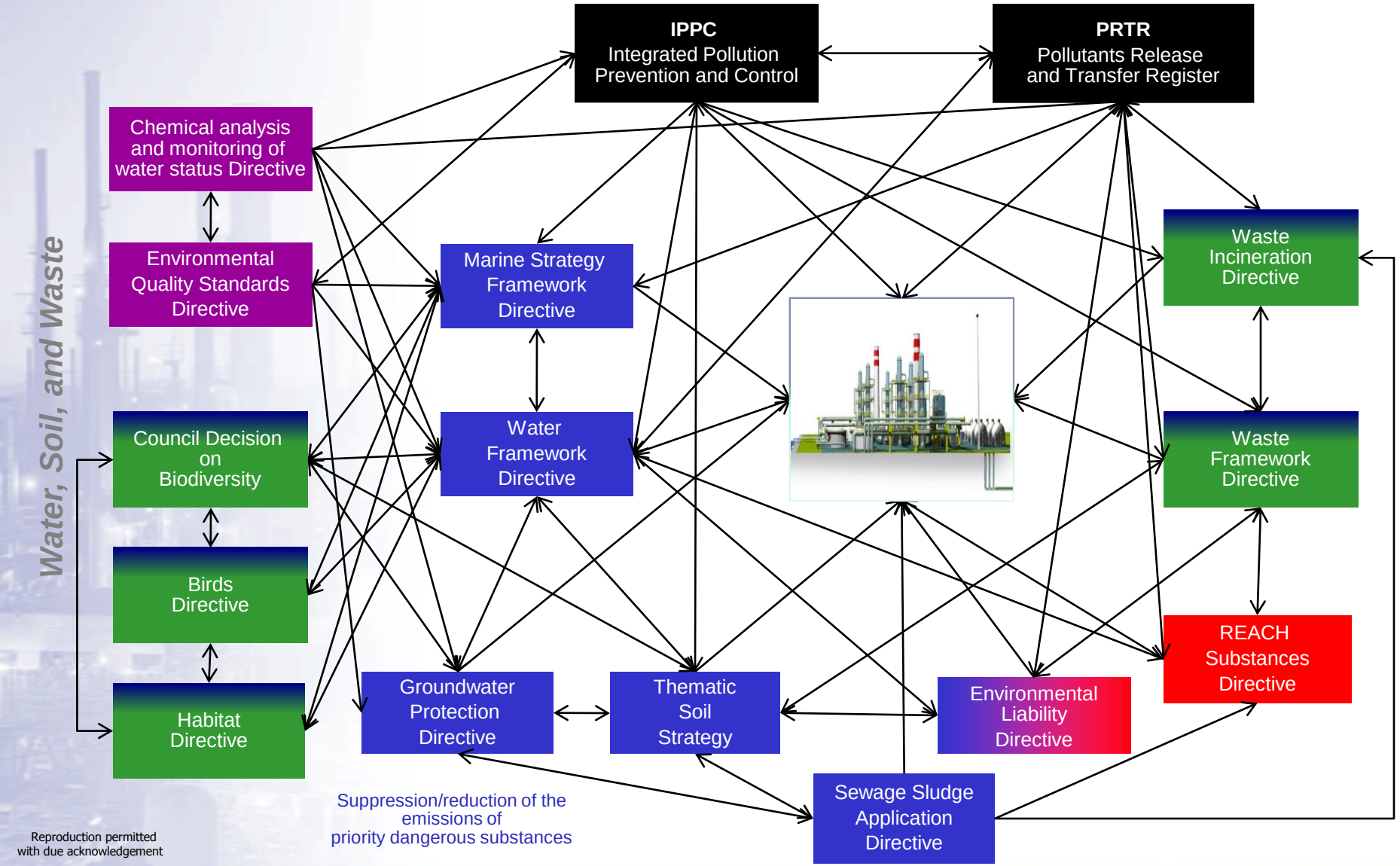
Refinery Technology Support



Source: CONCAWE report 8/08

These figures assume constant energy efficiency frozen at the 2005 level

concawe Water, Soil and Waste: Legislative Environment



Water, Soil, and Waste

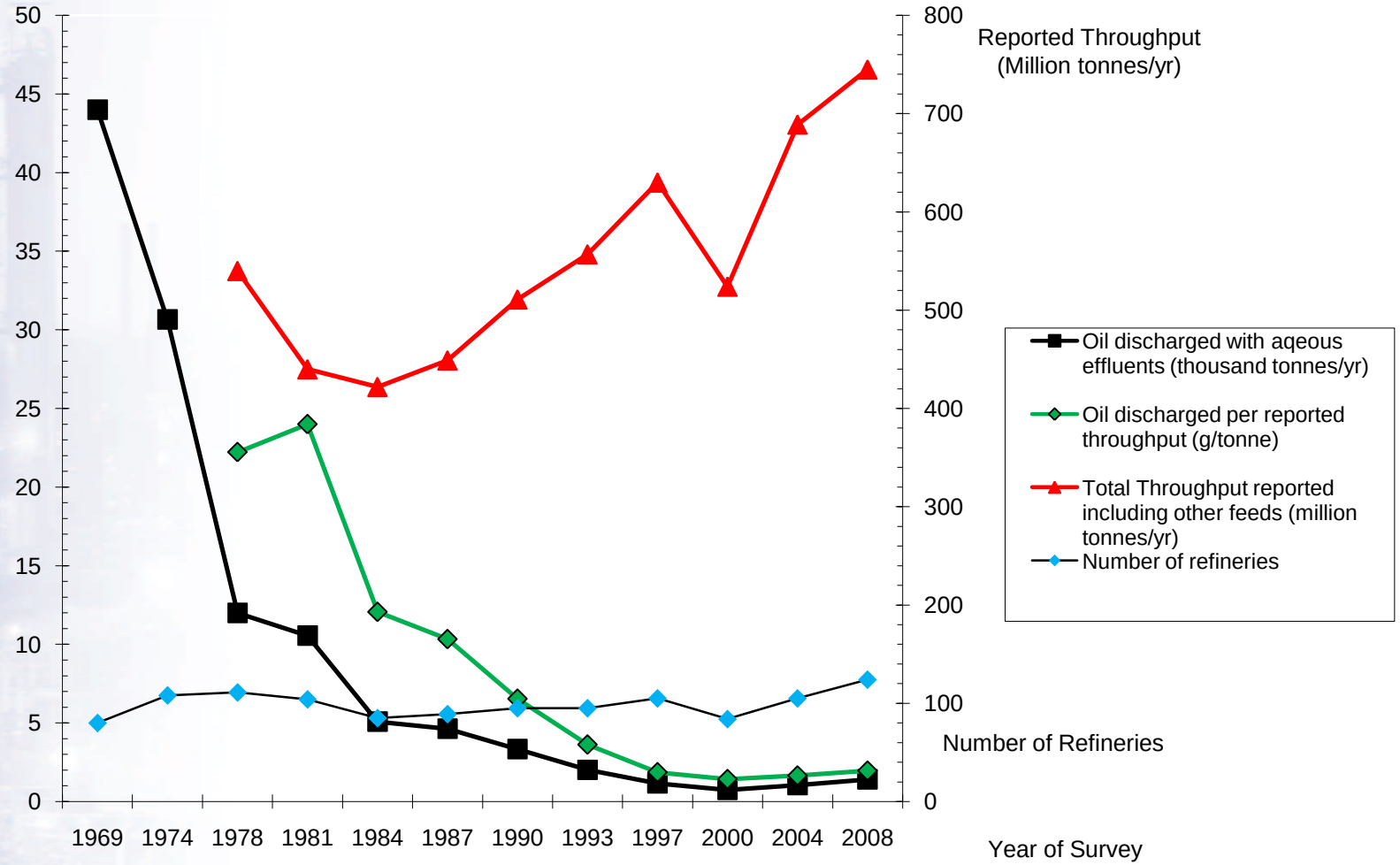
- Water Framework Directive (WFD)
  - Environmental Quality Standards (EQS)
  - Emission Requirements
- Marine
  - Marine Strategy Framework Directive
  - Direct and indirect impacts on the marine environments
    - Oil Spills
    - Coastal impacts from downstream operations
- Whole Effluent Assessment (WEA)
  - Refinery Effluent Toxicity
  - OSPAR Scientific Advocacy
- Groundwater
  - Groundwater Daughter Directive
  - Downstream Petroleum Site Risk Assessments
- Oxygenates (MTBE, ETBE, Ethanol, Other)

Water, Soil, and Waste

- Industrial Emission Directive (IED) / IPPC
  - Refinery BREF
  - Common Waste Water BREF
  - Monitoring BREF
- Collection of Refinery Emission Data
  - Oil discharge analysis
- Soil
  - Thematic Soil Strategy
  - Contaminated Site Management
- Waste
  - Waste framework Directive
  - Waste Oils
- REACH
  - (Risk Assessment Data for Water)

Refinery effluent data

- Data gathered since 1969 on oil in water

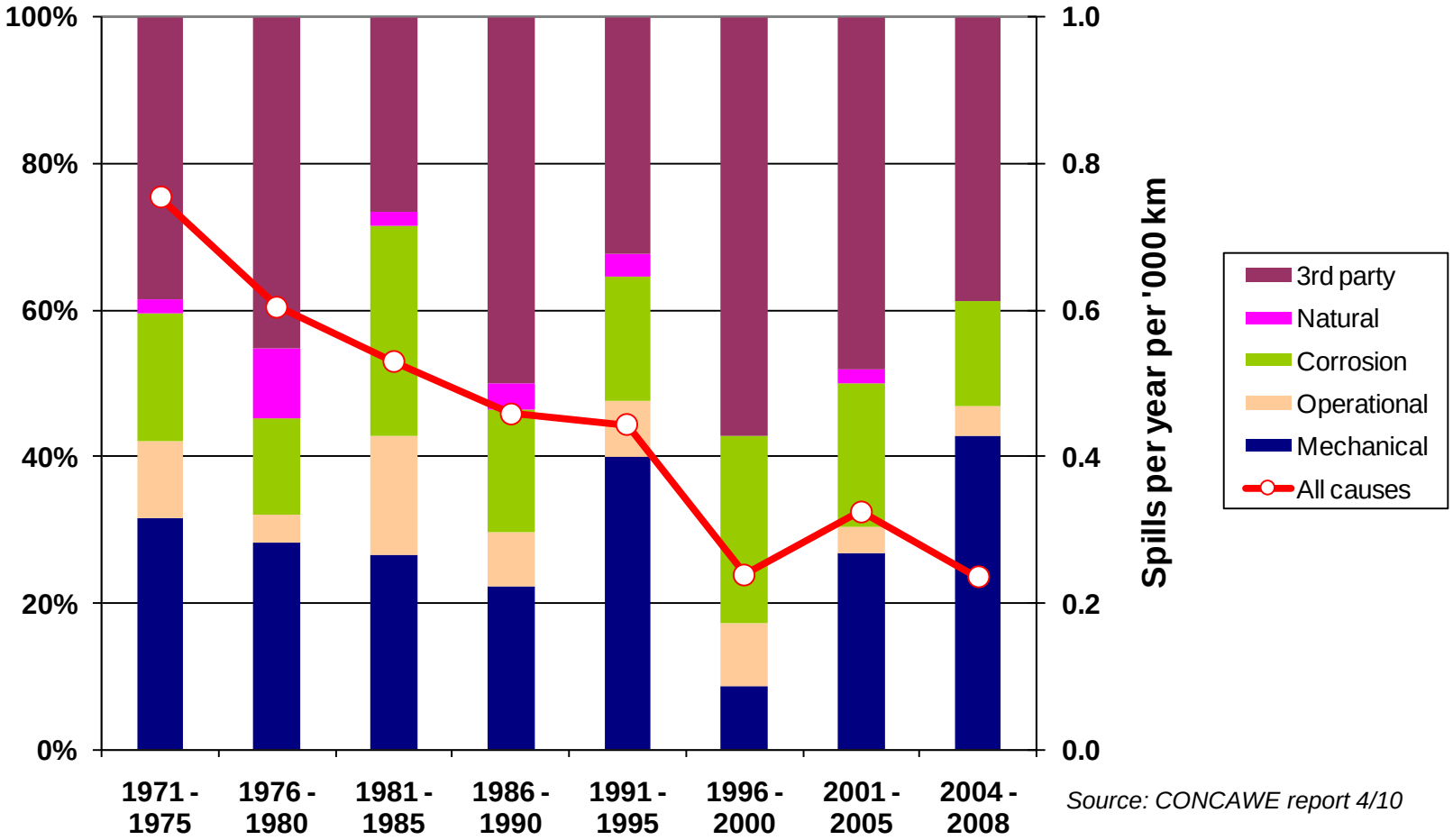


Water, Soil, and Waste

Oil Pipelines

- Annual survey of (on-shore) oil pipeline spills
  - The second longest running CONCAWE activity (since 1971)
- 37-year overview report issued in 2009
- Pipeline operators exchange seminar every 4 years (2010-2014)
- Regular exchange of information on technical developments, incidents and near misses
- Cooperation with EU institutions and other international bodies (e.g. UN-ECE) on issues related to pipeline safety and integrity
- Development of guidelines and industry best-practice to reduce and limit the consequences of third party interference

Cold pipeline spillage frequency by cause



Safety

Safety

- In the 90s mostly dedicated to follow up of development of Seveso II Directive
  - Announced revision in 2015 will
- Today a relatively low key activity
  - Collection of Safety Statistics (Since 1993)
  - General exchange of information
- Safety data gathering for 2010 and onwards
  - More alignment with other organisations
  - A small Project team of SMG members has elaborate this item and SMG endorsed the additional indicator for reporting for 2010 and onwards
  - A recognised Process Safety Performance Indicator is selected
    - American Petroleum Institute PSPI (RP-754)
    - Already used by a large number of CONCAWE members
    - Developed with input from many CONCAWE Member Companies

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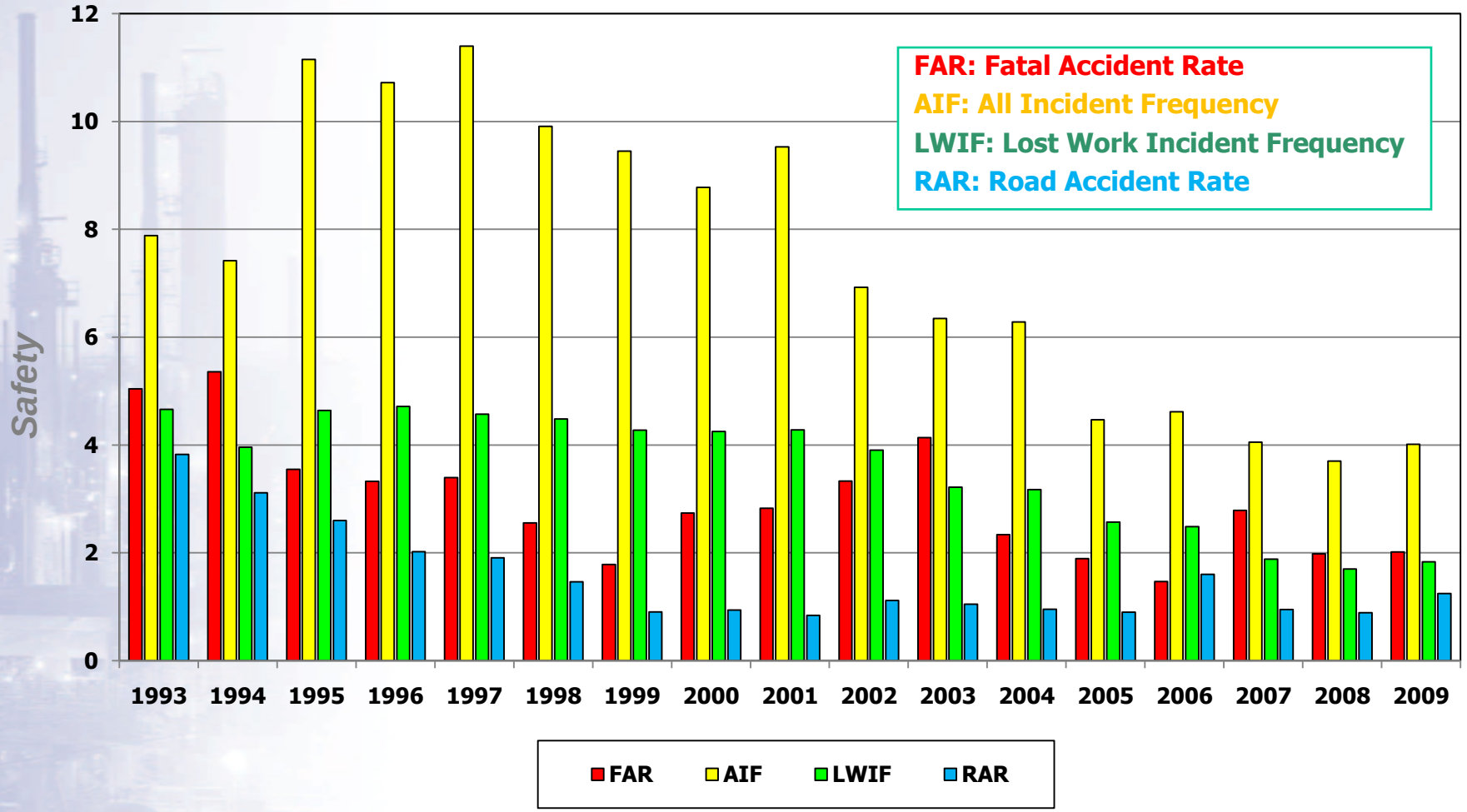
Safety

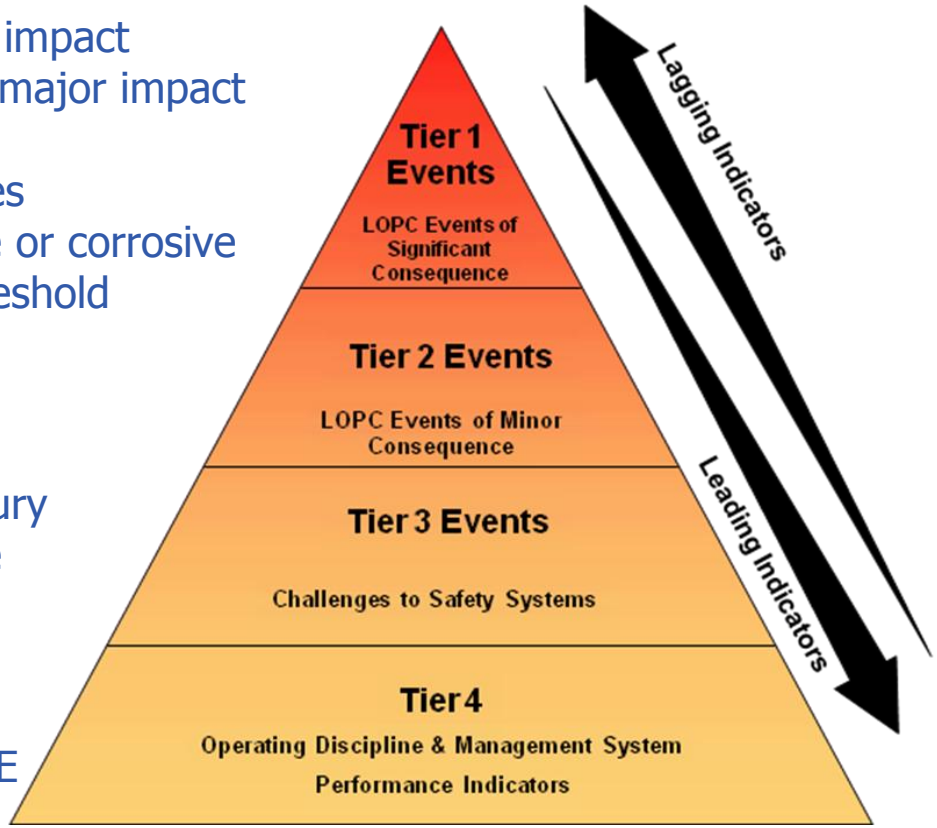
Historical evolution of main safety performance indicators
Yearly data for the whole European downstream industry



Source: CONCAWE report 7/10

Process Safety Performance Indicator

- API Guide to Report Process Safety Incidents (2008)
- ANSI/API Recommended Practise 754 (April 2010): Process Safety Performance Indicators For The Refining And Petrochemical Industries
  - Tier 1: Loss Of Primary Containment
    - Leading to fires with major impact
    - Leading to Explosions with major impact
    - Leading to a fatality or LWI
    - Resulting to public measures
    - Release of toxic, flammable or corrosive substances above a set threshold
  - Tier 2 LOPC
    - Leading to a minor fire
    - Leading to an explosion
    - Leading to a recordable injury
    - Release of toxic, flammable or corrosive substances below a set threshold
  - Tier 3 & 4 are local
    - Not reportable to CONCAWE



Safety

Petroleum Products – Scope of activities

- Engaged in EU Chemicals legislation, product stewardship issues
- REACH Regulation 1907/2006
  - Prepared member companies for implementation
  - Prepared member companies for sharing of information in SIEFs
  - Represented in ECHA committees, meetings of the Competent Authorities and Partner Expert Groups (input to development of guidance)
  - Developed assessment methodologies for petroleum substances
- Classification & Labeling guidance for petroleum substances
  - CLP Regulation and Dangerous Substances Directive
- Safety of white mineral oils in food-related applications
  - Dossier seeking food additive approval for high viscosity white mineral oils has been submitted to the European Food Safety Agency

What are REACH and GHS?

- REACH
  = Regulation 1907/2006 for the Registration, Evaluation and Authorisation of (new and existing) Chemicals
  - Replaces and expands on several pieces of current legislation on new and existing substances and preparations
  - "License to operate"

- GHS
  = The Globally Harmonised System for classification and labelling of substances
  - Developed by the UN
  - Adopted in EU as the Classification, Labelling and Packaging Regulation
    - In force as of December 2010 - after a transitional period until 2015, will replace former legislation on C&L (DSD, DPD)

CONCAWE's Role

REACH & GHS

- Assisted members and non-members with their REACH registrations in 2010
  - Completed preparation of common parts of registration dossiers (both mandatory and optional) incl. classification under GHS
  - Managed mandatory data sharing and sharing of common parts of dossiers with non-Member Companies
  - Prepared guidance and templates for non-common parts of dossiers
- Looking forward
  - Assist member companies with potential issues arising from dossier evaluations
  - Monitor (and react to) developments related to Restrictions and Authorisation that would impact on petroleum substances

CONCAWE's Fuels & Emissions: Strategy

Fuels Quality and Emissions

1. Anticipate the impact of future legislation and vehicle trends on fuel quality requirements and refining
   - Legislation
   - Emissions Regulations
   - Vehicle and Fuel Trends

2. Provide technical input to future fuel specifications
   - Product Specifications
   - Government and Industry Working Groups
   - Represent Oil Industry Technical Positions

3. Conduct CONCAWE research to impact course of future specifications
   - Biofuels
   - Vehicle and Fuel Trends
   - Interfaces with Air Quality and Health
   - Interface with Refining on GHG emissions and WTW

- Leverage in-house resources through relevant external programmes
  - Collaborative Research Programmes (JRC-EUCAR-CONCAWE)
  - FP7 Programmes (OptFuel, SWAFEA)
  - European Technology Platforms (ERTRAC, SAFIER)
  - *In 2010, ~110K€ additional direct funding and ~22.6M€ leveraged funding*

New Legislative Objectives and Many Options

Fuels Quality and Emissions

Modern Engine Systems

Petrol Spark Ignition
+ Port Fuel Injection
+ Direct Injection
Diesel Compression Ignition
+ Direct Injection

Modern Fossil Fuels

- 10 ppm Sulphur Fuels
- DVPE Reductions
- Cetane Number
- Additive Technology

Urban Air Quality

(CO, HC, NOx, Ozone, Noise)

and

Energy/GHG Reduction

(CO_2, CH_4, N_2O)

Alternative Engines and Powertrains

Advanced Combustion
+ HCCI, CAI
Plug-in Hybrids & Hybrids
Battery Electrics
+ Hydrogen and Fuel Cells

Advanced Aftertreatment

Alternative Fuels

Bio-fuels
+ 1st and 2nd Generation
Compressed Gases
+ LPG, CNG
+ DME, Biogas, H_2

Advanced Aftertreatment

Fuels & Emissions Research Areas

Technical Coordination and Monitoring

- Emissions Legislation and Fuel Specifications
- Technical Support to CEN/TC19 Standardisation Activities
  - Aviation and Marine Fuel ad hoc groups
  - SWAFEA Consortium on Alternative Fuels for Aviation
- Technical Support to Bio-energy Certification Activities (CEN/TC383 and ISO/PC248)

Own Research and Monitoring Activities

- Fuels for Gasoline Engines
- Fuels for Diesel Engines
- Fuels for Advanced Combustion

Collaboration and Strategic Activities

- FEMG Input to the Refinery Technology Support Group
- JRC/EUCAR/CONCAWE (JEC) Programmes
  - Well-to-Wheels ad hoc group
- FP7 Programmes (Optimized Fuels for Europe (OptFuel)
- European Technology Platforms (ERTRAC and Biofuels)
- MIT Consortium: “Future Vehicle Technology and Fuels”

The JEC Consortium: A Short History

The JEC Research Consortium was initiated in 2000 by:

- JRC: Joint Research Centre of the European Commission
- EUCAR: European Council for Automotive R&D
- CONCAWE: Research Association of the European Oil Refining Industry

JEC Consortium Activities:

- **2000-2011: Projects Completed**
  - Well-to-Wheels (WTW) Study Versions 1, 2b, and 2c
  - WTW Study Version 3: Tank-to-Wheels (TTW) (http://ies.jrc.ec.europa.eu/about-jec)
  - WTW Study Version 3: Well-to-Tank (WTT) and Well-to-Wheels (WTW)
  - Impact of ethanol on vehicle evaporative emissions (SAE 2007-01-1928)
  - Impact of ethanol in petrol on fuel consumption and emissions
  - JEC Biofuels Programme for a 2020 time horizon

- **2011+: Projects under discussion**
  - 2011+: Revision of WTW Study (Version 4)

Air Quality

- One of the oldest activities of CONCAWE and still a key area.
- Scope includes assessing:
  - Emissions to air from manufacturing and from fuel use
  - The impact of those emissions on the environment
  - Methods to abate emissions; their cost and effectiveness
  - The environmental and health benefits of their abatement
- Context:
  - Air pollution is a multi-pollutant, multi-sector problem
  - Addressed on scales:
    - Local (air quality standards for primary pollutants)
    - Regional (ozone concentrations due to photochemical reaction)
    - International (acidification/eutrophication from long range transport)
    - Hemispheric/Global (climatic effects of short-lived radiative forcers)
  - Refinery emissions are only a small part of the overall problem
  - Policy solutions impact:
    - Refinery operations
    - Products

Air Quality

- **AQMG + 6 Special Task Forces**
  - **Techno-Economic Issues**
    - Context of Sector in National Emission Ceilings and participation of NEC review for EU and UN-ECE
  - **Modelling**
    - Understanding and contributing to effects and integrated assessment modelling
    - Refinery impacts in the context of the Air Quality Directive Review
  - **Cost-Benefit Analysis**
    - Argumentation for the justification or otherwise of emission controls
  - **Refinery BREF revision**
    - Participation in the Sevilla process. Revision of refinery BREF and assessment of BAT conclusions on operations and investments
  - **Refinery emission quantification and reporting**
    - E-PRTR - guidance and analysis
    - Develop new information on emission estimation/determination
  - **Marine Fuels**
    - Environmental Impacts of Ship Emissions
    - Assessment of Emission Control Areas applications

Air Quality

2013: the "Year of Air Quality in Europe"

Air Quality

- **European policy process is building up for a lot of action on Air Quality related issues**
  - **2011 – 2012**
    - Refinery BREF
    - BAT conclusion adoption under the Industrial Emissions Directive (IED)
    - Start revision of Thematic Strategy on Air Pollution (TSAP)
    - Gothenburg Protocol Review => new emission ceilings including particles
  - **2012**
    - Review of 50 MW lower limit in the IED
    - Work on review of Refinery emissions for IED Annex V (ELVs)
    - Work on Air Quality Directive Review
  - **2013**
    - New Thematic Strategy
    - New National Emissions Directive
    - New Air Quality Directive
    - New Annex V to the IED

Health Management Group (HMG) Strategy

Health

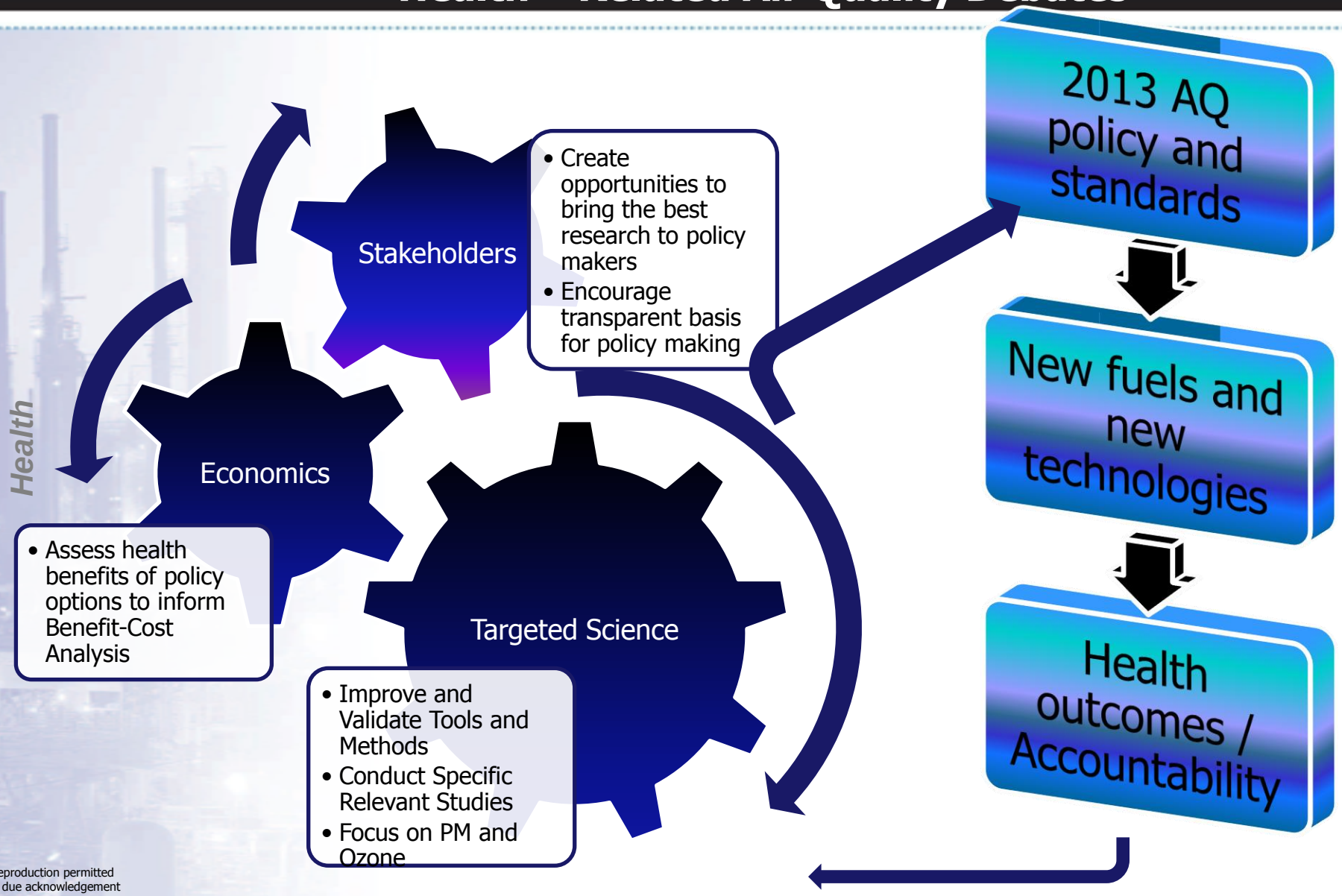
- Primary role is to identify key product and occupational health-related issues and opportunities
- REACH compliance - Provide interpretation of new ECHA Guidance and assessment of feedback from / response to registrants, ECHA and Member States
- Provide CONCAWE members with advice, guidance and support on the significance of these issues and opportunities based on a scientific and professional evaluation
- Develop and implement technical approaches to address critical issues and opportunities
- Disseminate factual information and scientific/professional opinion to relevant regulatory authorities in order to assist them in developing evidence-based regulations and legislation

HMG 2011 Work Plan - Principle Themes

Health

1. **REACH Compliance Support**
   - Hazard , Exposure , Risk (H/TSG + H/STF-29 + HMG)
   - Key interactions with PPMG; Key role in CONCAWE RDCG
2. **Health Impact of Air Pollution (PM and Ozone)**
   - Benefit-Cost Analysis
     - Health Benefit (H/STF-27)
     - "Cost" considerations (collaborate with AQMG/STF-66)
3. **Petroleum Product Health Hazard Classification / Occupational Health Regulations & Issues**
   - Ongoing 're-look' at the health impact of petroleum substances by society, technical, advisory and/or regulatory bodies
   - Develop data and engage in technical discussions with technical organizations and advisory and regulatory bodies
4. **Benzene Risk Assessment**
   - New research methodologies are being developed by the research community and applied in benzene studies
     - Regulators will consider the new data and re-assess
   - Coordinating extensive epidemiologic pooled analysis (2006-2011)

CONCAWE Contributions to EU Health – Related Air Quality Debates



How Does CONCAWE Work?

Management Group	Chair Co-Chair	Technical Coordinator
Refinery Technology	Nick Edwards (ConocoPhillips)	Alan Reid
Water, Soil and Waste	Graham Whale (Shell)	Klaas den Haan
Oil Pipelines	Peter Davis (British Pipeline Agency)	Klaas den Haan
Safety	Vasso Moukrioti (Hellenic Petroleum)	Klaas den Haan
Petroleum Products	Duncan King (BP)	Bo Dmytrasz
Fuels Quality and Emissions	Liesbeth Jansen (KPI) Gerd Hagenow (Shell)	Ken Rose
Air Quality	Jane Brown (BP)	Pete Roberts
Health	Chris Money (ExxonMobil)	Gary Minsavage

Health Back-up Slides

Petroleum Product Health Hazard Classification and Occupational Health Regulations

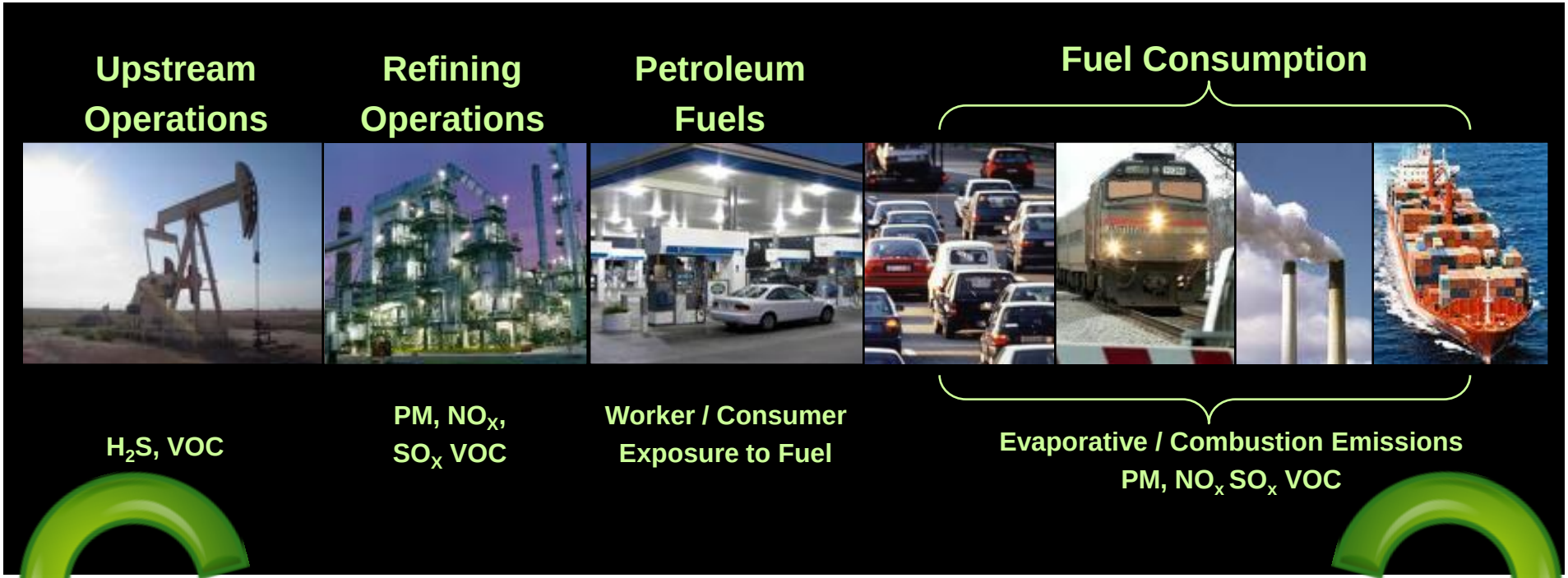
- Legislative
  - There are a host of advisory and regulatory bodies that have plans to formally assess the hazard/risk of petroleum substances themselves (IARC, DECOS, MAK, etc…)
    - Potential for lack of harmonization across member states
  - IARC decisions regarding carcinogenic potential is widely accepted
    - Other agencies adopt IARC decision
    - Impact SDS globally – classificaiton, warning, labelling
- Informing pending health risk technical debates is a key focus of HMG
  - REACH discussions - Annex XV proposal; DNEL vs. OEL discussions; etc…
  - "Mineral Oil" – PAH content in packaging
  - White Oils – PAH content; Acceptable limits
  - PAH-containing substances that are used in consumer articles
  - Bitumen – cancer discussions; application of DNEL for irritation
  - Diesel exhaust – cancer discussions
  - Benzene – cancer and risk estimate discussions
  - New health endpoints of concern for petroleum substances

Benzene Risk Assessment

Health

- Background
  - Various organizations continue to plan benzene hazard / risk assessments
  - Gasoline REACH Risk Management Measures (RMMs) are driven by CONCAWE / industry application of debated Benzene Exposure Levels
    - a significant lowering of the values used in the dossier would impact RMMs associated with manufacture, distribution, formulation and use of gasoline/naphthas
- Industry Trends
  - Generally, the trend is lowering of exposure
  - Discussions re: feasibility of reducing benzene content of fuels
- Latest Developments
  - IARC reviewed the carcinogenic potential of benzene in October 2009
  - Discussions within various advisory and regulatory organisations continue
  - REACH gasoline/naphtha dossiers risk characterization driven by benzene content
- CONCAWE Contribution
  - Funding projects such as Benzene Pooled Analysis to identify real risks and develop data to inform regulatory and advisory bodies
  - Two additional studies recently completed and published in peer-reviewed journals
- Next Steps
  - Conclude 'Benzene Pooled Analysis' in 2011 (peer-reviewed publications 2011)
  - Ongoing consideration by CONCAWE HMG if it is appropriate to use the Pooled Analysis data for a Unit Risk Estimate (URE) update and if it warrants an immediate follow-on study

2013: Year of "Air Quality in Europe"



Health Impact of Air Pollution

Health - REACH Compliance Support

- Hazard
  - REACH DNELs: Provide data to support "informed assessment factors" for petroleum substances
  - Further progress the use of non-animal based hazard assessment approaches for petroleum substances and categories
- Exposure
  - Method development for dermal exposure assessment of petroleum substances
  - Evaluate the utility of modelling and monitoring approaches
  - Develop appropriate monitoring approaches for petroleum substances
  - Better characterize nature of control systems