ENVIRONMENT DIRECTORATE
JOINT MEETING OF THE CHEMICALS COMMITTEE AND THE WORKING PARTY
ON CHEMICALS, PESTICIDES AND BIOTECHNOLOGY

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Synthesis Report: OECD Workshop on Approaches to Support Substitution and
Alternatives Assessment

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Synthesis Report: OECD Workshop on Approaches to Support Substitution and Alternatives Assessment
About the OECD

The Organisation for Economic Co-operation and Development (OECD) is an intergovernmental organisation in which representatives of 35 industrialised countries in North and South America, Europe and the Asia and Pacific region, as well as the European Commission, meet to co-ordinate and harmonise policies, discuss issues of mutual concern, and work together to respond to international problems. Most of the OECD’s work is carried out by more than 200 specialised committees and working groups composed of member country delegates. Observers from several countries with special status at the OECD, and from interested international organisations, attend many of the OECD’s workshops and other meetings. Committees and working groups are served by the OECD Secretariat, located in Paris, France, which is organised into directorates and divisions.

The Environment, Health and Safety Division publishes free-of-charge documents in twelve different series: Testing and Assessment; Good Laboratory Practice and Compliance Monitoring; Pesticides; Biocides; Risk Management; Harmonisation of Regulatory Oversight in Biotechnology; Safety of Novel Foods and Feeds; Chemical Accidents; Pollutant Release and Transfer Registers; Emission Scenario Documents; Safety of Manufactured Nanomaterials; and Adverse Outcome Pathways. More information about the Environment, Health and Safety Programme and EHS publications is available on the OECD’s World Wide Web site (www.oecd.org/chemicalsafety/).

This publication was developed in the IOMC context. The contents do not necessarily reflect the views or stated policies of individual IOMC Participating Organizations.

The Inter-Organisation Programme for the Sound Management of Chemicals (IOMC) was established in 1995 following recommendations made by the 1992 UN Conference on Environment and Development to strengthen co-operation and increase international co-ordination in the field of chemical safety. The Participating Organisations are FAO, ILO, UNDP, UNEP, UNIDO, UNITAR, WHO, World Bank and OECD. The purpose of the IOMC is to promote co-ordination of the policies and activities pursued by the Participating Organisations, jointly or separately, to achieve the sound management of chemicals in relation to human health and the environment.
Synthesis Report: OECD Workshop on Approaches to Support Substitution and Alternatives Assessment

Introduction

1. The OECD Ad Hoc Group on Substitution of Harmful Chemicals organised an expert workshop on Approaches to Support Substitution and Alternatives Assessment in Paris on 2-3 May 2018. The goal of this workshop was to exchange experiences on policy, regulatory and other approaches used to support alternatives assessment and the substitution of chemicals of concern.

2. The workshop covered the following topics:
   - approaches that have been used to support alternative assessments and substitution
   - the strengths of the approaches and challenges to design and implementation, and how these challenges have been overcome
   - linking innovation, in particular in science and technology, and progress in substitution and alternatives assessment. How innovation policy is helping to further develop the field
   - how can countries and other entities work together to facilitate data sharing and other collaborative efforts, such as sharing the results of alternatives assessments.

3. The workshop also included updates on the OECD Substitution and Alternatives Assessment Toolbox and discussions on ideas for further development.

4. This workshop is the second in a series of workshops organised by the OECD on Substitution and Alternatives Assessment. The first workshop was organised in May 2015 at the OECD in Paris. One of the conclusions from the 2015 workshop was the need for countries to learn from each other and share information on policy, regulatory and other approaches used to support substitution. The OECD Ad Hoc Group conducted a Cross Country Analysis collecting information directly from countries and stakeholders through a survey. Information collected was used as background material to prepare for this workshop. Results from the survey, with added information from this 2018 workshop, will be published in a separate report.

5. This report summarises the main conclusions from the workshop. It does not necessarily represent the views of the OECD or a consensus among participants. The expert workshop agenda is in the Annex A to this report. Affiliations of participants are as of May 2018. Annex B compiles the presentations made at the workshop.

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Approaches to Support Substitution and Alternatives Assessment across Countries

6. Approaches have been developed across countries and by different stakeholders to support substitution and alternatives assessment. Examples of these approaches were presented at the workshop. Some of the presentations were updates on progress made since the last OECD workshop on Substitution and Alternatives Assessment that took place in May 2015, others were introducing new initiatives. Challenges still remain such as the need for capacity building, and finding ways to manage uncertainties (risk trade-offs) and data gaps. Opportunities are arising such as the development of a “mind-set” in companies for sustainable substitution and engagement with senior leaders.

Building capacity within the stakeholder community

7. In 2015, the workshop identified a key need to bring support to stakeholders involved in alternatives assessment and substitution. This need was very much reiterated at the 2018 workshop. In the case of regulatory approaches, such as REACH and the California Safer Consumer Products (SCP) Regulations, the workshop highlighted that capacity development within the stakeholder community is necessary to supplement regulatory risk management actions with government support for the transition to safer chemicals. Ideally the use of alternatives assessment should be promoted to guide informed substitution long before authorities initiate restrictive risk management actions. This was one of the conclusions from a report presented at the workshop prepared by the University of Massachusetts Lowell for the European Chemical Agency (ECHA).

8. Whether approaches developed are policy, voluntary or regulatory, there is a need to create support for knowledge sharing, data sharing, sharing of information on existing and emerging alternatives and sharing of business opportunities.

9. ECHA’s strategy to support substitution has integrated capacity building as one of its key elements. It does so, for example, by stimulating interactions between stakeholders (with the organisation of workshops) and by promoting best practices throughout the community. ECHA also created a LinkedIn group to exchange information - Substitution to Safer Chemicals - European Information Sharing Network. France presented a recently developed decision tool to assist stakeholders in their substitution efforts. The guide was developed on behalf of the Ministry for Ecology and Solidary Transition by a working group co-led by industry and public experts and with participation from a wide range of stakeholders. The guide is based on a wide set of criteria (hazard, risk, performance, risk/benefit, feasibility, socio-economic aspects) and aims to go beyond comparative hazard assessment and integrate risk/exposure. It also provides guidance for addressing uncertainties and data gaps. The guide aims to be used broadly and has been developed in a way that it is accessible to small and medium sized enterprises (SMEs) and non-specialists.

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3 The Guidance on Substitution can be found at the following website : https://substitution.ineris.fr/en/guidance-substitution.
Engaging in a less “specialist discussion”

10. The workshop discussed the need for developing more inclusive approaches that allow for engagement with non-or less-specialists.

11. In addition to technical frameworks and tools, there is a need for high level guidance and capacity building activities for stakeholders with different levels of expertise. This type of guidance should not be academic but provide information, for example, on the different steps to participating in substitution - being involved in risk assessment, seeking relevant information and knowledge, and implementing substitution practices.

Developing a “mind-set” for substitution – involving senior leaders

12. The workshop emphasised that the field of substitution is at a stage where commitment is necessary from senior leaders to progress in an efficient and sustainable manner. For example, the work done by the University of Massachusetts Lowell⁴, promotes activities that will lead to a mind-set change so that “substitution thinking” is part of normal business decision-making. Senior leaders have the authority to influence the direction and culture of their organisation, and they have the opportunity to put substitution at the heart of corporate strategies.

13. The workshop also discussed the need for senior leaders to understand the risk to human health and the environment posed by chemicals in their organisation. The issue of prevention at the workplace for handling dangerous substances was also raised at the workshop with the presentation of training material developed by the EU-OSHA⁵. Senior leaders should be aware of all possible actions that could be taken to minimise risk. Substitution should always be considered as an option and this would also help anticipating regulations and restrictions. It is key that substitution be part of a long-term strategy and be sustainable – avoiding regrettable substitution should also be at the centre of corporate thinking.

14. The 2015 workshop had mentioned that there were a number of examples of companies with a strong corporate involvement in substitution. These examples could be used to support the development of corporate-level guidance. Public authorities may have an important role to play in supporting awareness-raising at the corporate level.

Helping consumers, businesses and purchasers find safer products

15. A presentation was made by the Safer Choice Programme in the United States, in which the EPA’s expertise in evaluating chemicals has been used to create a label for safer products. The focus of this programme is on certifying safer products based on stringent requirements for chemical ingredients that meet the Safer Choice criteria. There are now more than 2000 certified products from 500 partners⁶. Safer Choice certified products are for a wide range of applications: household and facility cleaning, and automotive and outdoor. The label means that products have been verified by a trusted government agency

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⁴ For more information, see https://www.uml.edu/Research/Lowell-Center/Chemicals-Materials-Products/Alternatives-Assessment/AlternativesAssessment.aspx.
and that they contain only safer chemical ingredients. The Safer Choice Programme also maintains the Safer Chemical Ingredients List (SCIL) of more than 900 chemicals, which constantly evolves and expands\(^7\).

**Integrating Substitution in Efforts for Sustainable Chemistry and the Circular Economy**

16. The workshop highlighted the importance of integrating substitution in wider efforts for the sound management of chemicals, in particular sustainable chemistry and the circular economy. The Dutch National Institute for Public Health and the Environment through its Centre for Safety of Substances and Products is working on key topics in relation to substitution:

- What is safe and sustainable design?
- How to deal with legacy substances?

17. The centre has developed a tool, the Sustainability Method Selection Tool\(^8\), that can help, amongst other things, evaluate how sustainable a substitution option maybe. The centre also includes discussions and research on bio-based products as potential alternatives to hazardous chemicals taking a full life cycle approach.

18. The German Environment Agency (Umweltbundesamt – UBA) also developed a decision tool for substance manufacturers, formulators and end users of chemicals to help them make sustainable choices on chemicals – the Guide on Sustainable Chemicals\(^9\). The guide describes criteria which can be used for a first assessment of the sustainability of substances and mixtures. An online tool was developed based on the guide with automated functions, called Sub-Select\(^10\). There was also a presentation of the International Sustainable Chemistry Collaborative Centre (ISC3)\(^11\) that aims to support transformation toward sustainable chemistry. ISC3 provides a platform where all players from policy, civil society, industry and academia can come together to exchange and develop innovative solutions. The ISC3 is an international organisation hosted by GIZ (the Deutsche Gesellschaft für Internationale Zusammenarbeit) on behalf of the German Federal Ministry for the Environment and the German Environment Agency.

19. The work of the International Union of Pure and Applied Chemistry (IUPAC) was also presented, in particular the role of the Interdivisional Committee on Green Chemistry for Sustainable Development\(^12\). It works as an independent international network to promote exchange of information in relation to green and sustainable chemistry.

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\(^7\) See, [www.epa.gov/saferchoice/safer-ingredients](http://www.epa.gov/saferchoice/safer-ingredients).


\(^12\) See, [https://iupac.org/](https://iupac.org/).
“Safer” Criteria and Trade-offs

20. Throughout the workshop discussions the concept of the need to identify “safer” criteria but also the various factors that would need to be traded off and the decision-logic that could be applied was raised. This can include trade-offs such as hazard, exposure, level of functionality, cost of substance or process change, marketing trade-offs (e.g. colour) etc. Also raised where how standards can impact decision. Criteria for alternative assessment and identifying what is safer product or safer chemical are needed, but in the context of a decision framework which includes broader trade-off considerations and potential thresholds and benchmarks.

Information and data sharing to support Alternatives Assessment and Substitution

21. The 2015 and 2018 workshops both discussed issues linked to the quality of data available to perform alternatives assessment and to support informed decision about substitution. There is a lack of comprehensive datasets and difficulties, in particular in a regulatory context.

22. The workshop mentioned that the availability of comprehensive datasets was in particular missing for:
   - toxicological data
   - exposure data
   - product ingredient and chemical quantity information
   - life cycle inventory data
   - public health and environmental costs.

23. What brings complexity into achieving a “successful” substitution is scientific uncertainty and also often the large amount of related substances. There is sometimes a “rush” into finding “easy to implement” alternatives, without broader investment in research to alternative candidates. This creates a continuously evolving situation, in particular from a regulatory standpoint, with new risks/issues arising from new substances with sometimes limited data to evaluate those risks. For example, one of the lessons learnt from the work of the Stockholm Convention, was the importance of information sharing across a variety of stakeholders to create a consensus on the pros and cons of alternatives. Exchanging information and experiences was seen as a key way for managing uncertainties along the substitution process.

24. It was also mentioned that countries across the world are sometimes at different stage vis-a-vis the production or use of a particular chemical of concern. There are also different capacities available to engage in substituting/phasing out of a particular chemical. Experience from the Stockholm Convention highlighted how global policy can take into account different situations/capacities in different parts of the world and would allow engaging in a global coordinated effort for finding sustainable alternatives to particular chemicals. The workshop also suggested strengthening the links between academia and policy, for example by engaging with institutions such as IUPAC.
25. The question was raised on how to make sure that information sharing activities support sustainable substitution and “make a difference”? Countries at the workshop identified that there should be a focus first on shared priorities to maximise results. To identify these shared priorities, participants suggested the development of a list of priority/reviewed chemicals per country where there is activity associated with alternatives assessment and substitution projects. This list could be hosted in the OECD Substitution and Alternatives Assessment Toolbox (OECD SAAToolbox).

26. The workshop also raised the importance of facilitating business to business interactions for exchanging on existing alternatives. When solutions exit, they should be shared with interested parties. At the workshop the tool developed by ChemSec called the MarketPlace\textsuperscript{13} was presented. The MarketPlace is a free of charge business to business website where buyers and sellers of alternatives to hazardous chemicals can interact.

Identification of Low Priority Substances

27. A session at the workshop focused on the identification of low priority substances under the EU’s REACH and the U.S.’s Toxic Substances Control Act (TSCA) as a way to support better policy and regulation design.

28. As part of an EU integrated regulatory strategy for sustainable chemicals management\textsuperscript{14}, ECHA’s goal by 2020 is to determine if substances registered above 100 tonnes need further regulatory risk management action, if they need further data generation, or if they are currently of low priority for further regulatory work. The focus of the work is to identify priority substances for further regulatory action, however as a consequence it allows bringing more clarity on those substances that are currently of low priority for regulatory action. In ECHA’s prioritisation scheme, substances are considered of low priority when there is:

- A low hazard profile: the substance is likely to be non-hazardous based on currently available information.
- Low exposure: the substance has low potential for exposure to humans and release to the environment based on currently available information.
- Low added value for risk management measures: the substance is considered to be sufficiently regulated.

29. The priority of a substances is defined at one point in time and may be revisited if new information on hazard or uses become available. Progress reports on the Roadmap for SVHC Identification and Implementation of REACH Risk Management Measures give an overview of progress in addressing substances of concern\textsuperscript{15}.

30. The US EPA presented a process for identifying potential candidates for low priority substance designation under TSCA. The purpose of this prioritisation is to

designate chemical substance as either high priority for further risk evaluation or low priority for which risk evaluation is not warranted at this time. By December 2019, the US EPA must designate at least 20 chemical substances as high priority and 20 chemical substances as low priority. Priority is considered according to:

- hazard and exposure potential (including consideration of persistence and bioaccumulation, potentially exposed or susceptible subpopulations and storage near significant sources of drinking water)
- conditions of use or significant changes in the conditions of use
- volume or significant change in the volume of the chemical manufactured or processed.

31. Within the US EPA’s context, the following definitions apply under the Lautenberg amendments to TSCA:

- **High-Priority Substance**: “a chemical substance that the Administrator concludes, without consideration of costs or other non-risk factors, may present an unreasonable risk of injury to health or the environment because of a potential hazard and a potential route of exposure under the conditions of use, including an unreasonable risk to potentially exposed or susceptible subpopulations identified as relevant by the Administrator”.

- **Low-Priority Substance**: “if the Administrator concludes, based on information sufficient to establish, without consideration of costs or other non-risk factors, that such substance does not meet the [High-Priority] standard”.

32. The US EPA’s Safer Chemical Ingredients List could be a useful starting point for identifying candidates for low priority substances, with the expansion of chemical profiles on the list to account for: the conditions specified in the Lautenberg Amendments to TSCA that are broader than those included for the SCIL listing.

33. In this session again, the workshop emphasised that there should be more opportunities for data sharing across countries on chemicals and priorities. The workshop discussed the value of aligning criteria that would help public authorities in identifying and defining what is a safer chemical. The OECD, through its Working Party on Hazard Assessment, has a project on international best practices for identification of priorities for risk assessment. The goal of this project is to capture and examine the different prioritisation schemes in place internationally, or being developed, to identify commonalities and differences in the approaches being used, lessons learnt and areas for improvement. These efforts to discuss high priorities will also contribute to the identification of low priority substances.

**Integrating Substitution in Innovation**

34. In many presentations, the link between substitution and innovation was emphasised. Making substitution part of innovation strategies has taken significant importance since the last workshop in 2015.

35. A discussion on the role of innovation in substitution started by looking at how innovation policy could or should be designed to encourage the adoption of sustainable substitute chemicals and technologies. Discussion was based on work done by the OECD.
Science, Technology and Innovation Directorate. The following principles were mentioned to characterise policy design:

- **Stringency/Ambition**: how ambitious is the policy objective – relative to how grave is the concern linked to a chemical.
- **Depth**: does the measure provide incentives over the range of all possible outcomes – i.e. can innovators benefit from radical innovation. Policy should avoid that incremental innovations “crowd out” more far reaching innovation.
- **Predictability/Credibility**: how certain and credible is the signal given by the policy – i.e. will the elaborated policy framework stay in place and allow for investments in sunk costs to be recovered for those undertaking the risky (and irreversible) investments associated with R&D; how strong is the message that the chemical will stop being used.
- **Flexibility**: how much space is provided to identify new technologies and methods to meet the service – what is meant by ‘functional equivalence’, what are the incentives for “search”?
- **Neutrality**: Are chemicals with impacts on environmental and health outcomes treated in an undifferentiated manner – is the policy encouraging the emergence of new players to avoid “lock-in” situations?

36. The workshop emphasised that adequate policy design and a strong political support are needed to support sustainable substitution, with coordination across ministries in charge of chemicals management and innovation.

37. A number of initiatives were presented such as the Safe Chemicals Innovation Agenda in the Netherlands that aims to create support for a research agenda to enable safe design of chemicals\(^\text{16}\); and the Danish Partnership for Substitution and the Eco-Innovation Programme that aim to fund, amongst other things, research projects for substitution of hazardous chemicals in products and processes.

38. The workshop highlighted the complexity and time needed to innovate when there is not an “on the shelf” alternative and when the alternative involves a variety of competencies. An example was shown of the development at DOW of an alternative substance as flame retardant. Flame retardants cover a wide range of chemistries and technologies used to inhibit ignition and flame spread in a product where fire performance is required or needs enhancement. Some halogenated flame retardants have been designated as hazardous substances. Following the principles of “Responsible Care” and product stewardship, the chemical manufacturer initiated research for more sustainable flame retardants.

39. What was considered by DOW as a suitable alternative would need to meet the following criteria:

- a low toxicity

\(^{16}\) See, [https://www.chemischstoffendoederegeld.nl/nieuws/workshop-safe-chemicals-innovation-agenda](https://www.chemischstoffendoederegeld.nl/nieuws/workshop-safe-chemicals-innovation-agenda)
• its performance as a flame retardant
• its behaviour as a foam
• performance as a foam
• economically viable

40. Out of 100 candidates, only one met all of the criteria set by the company: Polymeric Flame Retardants. Seven years of research and development were needed to find the alternative.

41. The workshop suggested that innovation strategies could focus more on applications and sectors rather than on specific chemicals.

Moving toward Alignment in Substitution and Alternatives Assessment Practices: Next steps for the OECD Ad Hoc Group

42. The workshop concluded that alternatives assessment and substitution practices are at the stage where exchange across countries is critical, in particular on:
• priority chemicals
• hazard and exposure data
• available knowledge on alternatives
• experience in alternatives assessment and substitution practices
• business opportunities
• information on policy and regulatory approaches used to support substitution and innovation.

43. To develop in a sustainable manner, the field should promote consistency of priorities and practices across countries with a reinforced dialogue on successes and challenges.

There are also opportunities as substitution practices develop to engage with senior leaders both in companies and in public authorities to assure a strong support and commitment for a sustainable development of the field.

44. Workshop participants proposed as a next step the following activities that could help support a global dialogue:

• **share information on substitution and alternatives assessment priorities across countries:**
  Developing a list of priority chemicals for substitution per country. These lists could be hosted in the OECD SAAToolbox and regularly updated.

• **Communication of regulatory, policy and other approaches for substitution**
  The OECD Ad hoc Group is finalising a cross country analysis on regulatory, policy and other approaches for substitution that will become available in the third quarter of 2018. The report will be disseminated but also options considered for how these approaches can be represented in the OECD SAAToolbox.
• **Identify key considerations for ‘safer’ chemicals including for decision-analysis/risk trade-offs**

The Ad Hoc Group could develop guiding principles/guidance on key considerations for identifying ‘safer’ chemicals, taking into account other trade-offs in a decision-analysis framework. The development of such a guidance could be the focus of the next workshop of the Ad Hoc Group. If the term “safer” alternatives was mainly used at the workshop, there was also mention made of “sustainable” alternatives and “safe-by-design”, these different scopes could be further discussed by the group.

• **Share approaches and build collective capacity**

Continue regular exchange between members of the OECD Ad Hoc Group with teleconferences and face to face meetings to discuss specific issues.

• **Continue to identify information that should be shared and ways to do so**

For example, identify what types of alternatives assessment and substitution information could be shared more, mechanisms for data sharing and other value-added information that could be included in the OECD SAAToolbox.
Annex A. Draft Agenda, OECD Expert Workshop On Approaches To Support Alternatives Assessment and Substitution

To be held at the OECD Conference Centre, 2 rue André Pascal, Paris
Room CC6
2 - 3 May 2018

**Day 1 - Wednesday 2 May 2018**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>09.00 - 9.10</td>
<td><strong>Opening remarks by the Workshop Chairs and the Secretariat</strong></td>
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<td></td>
<td>– Clive Davies, US EPA and Denis Mottet, ECHA</td>
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<td>– Eeva Leinala, Principal Administrator, OECD</td>
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<td>09.10 - 13.00</td>
<td><strong>Session I: Approaches to Support Substitution and Alternatives Assessment across Countries</strong></td>
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<td>Aim: To share information, best practices and challenges regarding approaches</td>
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<td>▪ <strong>Update on ECHA’s Substitution Strategy</strong>: Denis Mottet, Risk Management Implementation Unit, ECHA</td>
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<td>▪ <strong>Perspectives from the Safer Choice Program, United States EPA</strong>: Clive Davies, Branch Chief, US EPA</td>
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<td>▪ <strong>California Safer Consumer Products Regulations</strong>: Xiaoying Zhou, Senior Hazardous Substances Engineer, Department of Toxic Substances Control</td>
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<td>▪ <strong>Guidance to Support Substitution</strong>: Jean Marc Brignon, Head of Unit, INERIS, France</td>
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<td>▪ <strong>Netherland’s Approaches to Support Substitution</strong>: Susanne Waaijers Van der Loop, Bureau REACH, National Institute for Public Health and the Environment</td>
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<td>▪ <strong>Activities of the German Environment Agency to Stimulate Substitution</strong>: Christopher Blum, Sustainable Chemistry Scientific Officer, UBA, Germany</td>
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<td>▪ <strong>Activities in Canada</strong>: Sarah Vanden Hoven, Healthy Environments and Consumer Safety Branch, Health Canada <em>and</em> Jake Sanderson, Science and Technology Branch, Environment and Climate Change Canada</td>
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<td><strong>Q&amp;A Session</strong></td>
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<td>• How to further support substitution and incentivize industry to engage in substitution?</td>
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<td>• Policy frameworks, regulation and enforcement, information and voluntary initiatives: What are the elements that countries should prioritise?</td>
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<td>• How best to integrate international initiatives with national, state, and/or local initiatives?</td>
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Lunch break 13.00-14.00

14.00 – 15.00

Discussion of Draft Report - Cross Country Analysis on Approaches to Support the Substitution of Chemicals of Concern

OECD Secretariat to present the main conclusions from the draft report

Related efforts to identify activities to support substitution: Molly Jacobs, University of Massachusetts Lowell, US

Discussion with the workshop participants to gather feedback and additional information (with the goal of sharing a revised report after the workshop)

15.00 – 18.00 (with a coffee break from 16.00-16.20)

Session II: Experience in Sharing of Information on Alternatives and Substitution

Aim: Lessons learned from initiatives to gather and share information on alternatives

- **Identification and 'Marketing' of Alternatives - ChemSec’s Market Place**: Theresa Kjell, Senior Policy and Business Advisor, ChemSec
- **Identification and Documentation of Alternatives - Learnings from the Stockholm Convention**: Kei Ohno Woodall, Secretariat of the Basel, Rotterdam and Stockholm Conventions, United Nations Environment Programme
- **Training Material to Support the Use of Best Prevention Practices at Work Places - the Case of Substitution of Dangerous Substances**: Lothar Lieck, Prevention and Research Unit, European Agency for Safety and Health at Work
- **Experience from Sharing Information on Alternatives from the OECD SAAToolbox Case Studies Section**: Emily Connor, Abt Associates

Q&A

How to mobilise resources and strengthen sharing of information on alternatives and substitution projects/challenges?

How can information on alternatives be shared throughout the supply chain?

What are the barriers/challenges to sharing information on alternatives across countries/sectors? How can we overcome them?

What are the success stories and lessons learned from existing initiatives for sharing information on alternatives?

Day 2 - Thursday 3 May 2018

09.00-10.30

Session III: Identification of Low Priority Substances

Aim: In regulatory schemes, low priority or exempted substances are sometimes referred to as a source of potential alternatives. Information sharing to understand this potential alignment/misalignment.
- **Identifying potential candidates for Low-Priority Substance designation under the Toxic Substances Control Act (TSCA):** Lauren Sweet, Toxicologist, US EPA

- **Substances of low priority under ECHA’s regulatory strategy:** Denis Mottet, Risk Management Implementation Unit, ECHA

- **Quick update on project in Working Party on Hazard Assessment on International best practices for identification of priorities for risk assessment:** Eeva Leinala, OECD

**Q&A**

**10.30 - 13.00** *(with a coffee break from 11.15 to 11.30)*

**Session IV: Innovation to Support Substitution**

**Aim:** Sharing of Practical and policy approaches regarding innovation in the context of alternatives

- **Introduction:** Nick Johnston, Structural Policy Division, OECD Directorate for Science, Technology and Innovation

- **Netherland’s Safe Chemicals Innovation Agenda:** Jochem Vander Waals, Ministry of Infrastructure and the Environment, the Netherlands

- **The Danish Partnership for Substitution and Eco-Innovation Programme:** Sidsel Dyekjær, Danish Environmental Protection Agency, Denmark

- **Experience in the Development of Alternative in Response to Regulation:** Christine Lukas, EH&S Product Stewardship & Fire Safety Manager, Dow Building Solutions

- **Green substitutes of chlorine chemistry - examples of how dangerous chemicals can be domesticated:** Pietro Tundo, IUPAC

**Q&A**

- What are the product-chemical combinations that would benefit from activities that support informed substitution?
- What are the priorities for innovation?
- How to link innovation, in particular in science and technology, and progress in substitution and alternatives assessment?
- How substitution efforts could be integrated in funding programmes for innovation and scientific R&D?
- How to support building industry capacity to assess alternatives and identify opportunities for innovation through the supply chain?

**Lunch Break 13.00 – 14.00**

**14.00-15.00**

**Session V: Synergies with other OECD Working Areas on Chemicals**

Eeva Leinala, OECD

- Sustainable Chemistry - Design of Sustainable Plastics from a Chemicals Perspective
- Socioeconomic assessment in the context of chemicals management
- Global PFC Group
- Data sharing
- Development of assessment approaches
15.00 – 15.30
Session VI: OECD SAAToolbox - Possible Additions and New Functionalities

Emily Connor, Abt Associates

| Coffee Break 15.30 – 15.50 |

15.50 - 16.50
Session VII: Moving Toward Alignment in Substitution and Alternatives Assessment Practices

Aim: Identification of the opportunities for alignment?

● How do we define alignment and goals, and what are necessary procedures to align across countries and sectors?
● What are the substances countries are working on in terms of substitution? Opportunities for collaboration on the assessments?
● Are there opportunities for identification of criteria for identification of substitutes?
● Other opportunities for harmonisation/alignment?

16.50-17.30
Session VIII: Next Steps for the OECD Ad Hoc Group

END OF THE MEETING
Annex B. Presentations Made at the OECD Workshop on Approaches to Substitution and Alternatives Assessment, 2-3 May 2018

*Mottet, Dennis. Strategy to Promote Substitution to Safer Chemicals Through Innovation, ECHA.*
SYNTHESIS REPORT: OECD WORKSHOP ON APPROACHES TO SUPPORT SUBSTITUTION AND ALTERNATIVES ASSESSMENT

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**Capacity building**

**Supply chain workshops**
- Learn from others
- New ideas
- Identify gaps and training or research needs

**Supply chain workshops Examples**
- Finnish chrome platers workshop Finland, January 2017
- Flame retardants in home textile Belgium, 16 January 2018
- Durable water and oil repellents in textile Belgium, 5 June 2018
- Antifouling paints in recreational boats Netherlands, 5 October 2018
- Others under preparation

**Stakeholders identifying topics**
- Calling stakeholders (Member States, industry associations, etc.) to identify topics of interest for organising substitution supply chain workshop
- Collaboration between Member State Competent Authorities, industry associations and other stakeholders - ECHA can support

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**Access to funding and R&D support**
- Fostering technical and financial support
- Easier access
- Ensure safe chemistry is considered in funding criteria
- At EU and national level

**Access to funding and R&D support**
- Stakeholders searching or providing support on substitution (finance, R&D, technical)
  - Can search or fill in ECHA's list of resources - available soon on our website

**REACH and CLP data for sustainable substitution**
- Aim: avoid regrettable substitution
- Make use of our data for substitution
REACH and CLP data for sustainable substitution

- Which REACH and CLP data would be useful from a substitution perspective?
- A workshop dedicated to this issue will be organised second half of 2018

Analysis of alternatives and substitution Networking

- Aim
  - Share experience
  - Inform about ongoing initiatives
  - Enhance collaboration
- Multi-stakeholder networks
- Join our LinkedIn group: Substitution to Safer Chemicals - European Information Sharing Network to exchange news on substitution

New substitution pages to come soon

Another example of capacity building/information sharing:
webinar on tools to support substitution to safer chemicals – 18 April 2018

<table>
<thead>
<tr>
<th>Topic</th>
<th>Title</th>
<th>Speaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:15</td>
<td>Opportunities and ECHA's strategy to support substitution to safer chemicals</td>
<td>Adam Szefer, ECHA</td>
</tr>
<tr>
<td>11:30</td>
<td>Landscape of methods and tools to support transition to safer chemicals: lessons learned</td>
<td>Emilchir &amp; Petti, Institute of Environmental Chemistry, Loughborough University, UK</td>
</tr>
<tr>
<td>11:30</td>
<td>Chemical view of the OECD Substitution and Alternatives Assessment Toolkit</td>
<td>Audra Coveny, AEH Intergovernmental Council for the Assessment of Alternatives (COE) and AEC Intergovernmental Council for the Assessment of Alternatives (IAE)</td>
</tr>
<tr>
<td>12:00</td>
<td>Challenging Helsinki: dating site for safer alternatives</td>
<td>Peter Sprenger, ChemCentre</td>
</tr>
<tr>
<td>12:00</td>
<td>Using ECHA's data to support substitution</td>
<td>Artur Smolen, ECHA</td>
</tr>
</tbody>
</table>

Click here for recording and presentations

More information

- Our substitution strategy
- Newsletter article
- Mailing list for people willing to be contacted about substitution-related topics and activities
- Functional mailbox: substitution@echa.europa.eu

Thank you!
denis.mottet@echa.europa.eu
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SYNTHESIS REPORT: OECD WORKSHOP ON APPROACHES TO SUPPORT SUBSTITUTION AND ALTERNATIVES ASSESSMENT
United States Environmental Protection Agency, Approaches to Support Substitution and Alternatives Assessment: Perspectives from the U.S. EPA’s Safer Choice Program

Outline
- Alternatives Assessments
- Product Labeling
- Safer Chemical Ingredients List

Background on U.S. EPA’s Alternatives Work
Goals
- Safer chemical ingredients is focus
- Life cycle impacts are considered
- Protecting consumers, worker, and the environment

Central Elements
- OPPT technical tools and expertise
- Multi-stakeholder participation

Approaches
- Alternatives Assessments (AA)
- Safer Choice Labeling Program

What are Design for the Environment (DfE) Alternatives Assessments?
- Evaluation of chemicals that provide a given functional use via comparative hazard assessment
- Can complement regulatory actions
- Involves stakeholders from across the spectrum of interested parties
- Provides the information on hazard from literature and models

Past Projects
- Nonylphenol Ethoxylates (2012)
- Flame Retardant Alternatives to decalBDE (2014)
- Flame Retardant Alternatives to HBCD (2014)
- Flame Retardants in Flexible Polyurethane Foam (2015)
- Flame Retardants in Printed Circuit Boards (2015)

What are the Steps to DfE Alternatives Assessments?
1) Determine needs
2) Gather information
3) Involve stakeholders
4) Identify alternatives
5) Assess hazard and consider exposure*
6) Apply economic and life-cycle context
7) Apply the results

*incorporating comparative exposure assessment is an area for improvement
Flame Retardants in Flexible Polyurethane Foam
- Project evaluated pentabromodiphenyl ether (pentBDE) and a number of functional alternatives.
- Children's blood levels have dropped since pentBDE was phased out of production in 2004, according to study conducted by Columbia University.

Safer Choice Program
- Focus on safer chemical ingredients
  - With provisions for performance, packaging, and ingredient disclosure
  - Verifies and reviews all ingredients up the supply chain
  - Leverages EPA's expertise in evaluating chemicals

Safer Choice-Certified Products
- More than 2,000 certified products from 500 partners
  - ~700 Retail
  - 1,300+ Industrial & Institutional

Safer Choice Product Types
- Household & Facility Cleaning
  - All-Purpose Cleaners, Appliance Cleaners & Rinse Jugs
  - Automatic Dishwashing Products
  - Carpet Cleaners & Floor Care Products
  - Degreasers
  - Dish Detergents & Soaps
  - Granite/Stone/Countertop Cleaners
  - Kitchen/Countertop Cleaners
  - Laundry Detergents, Fabric Softeners
  - Mattress Toppers
  - Paint Strippers
  - Pipe Cleaners
  - Pest Control Products
  - PVC Cleaners
  - Window/Tire Cleaners
  - Window/Wall Cleaners
- Health & Beauty
  - Hand Soaps
- Automotive & Outdoor
  - Janitorial Cleaning Products
  - Automotive Parts Cleaner
  - Car Care Products
  - Engines
  - Exhaust
  - Radiator Coolant
  - Snowmobile Products
  - HVAC Maintenance
  - Marine/RV Cleaners
  - Outdoor Furniture Cleaners
  - Potty Cleaners
- Food Additives

What does the Safer Choice label mean?
- Verification by a trusted government agency that products contain only safer chemical ingredients and that they:
  - Are safer for families, pets, communities, and the environment
  - Are safer for workers and work places
  - Perform comparably to conventional products
  - An appealing label that customers can trust
  - Facilitates rapid decision-making

Survey of Consumer Awareness
In a survey of 2,000+ adult U.S. residents in February 2016:
- 40% of consumers reported familiarity with the program.
- 35% of consumers say they have seen the Safer Choice label on store shelves.
Zhou, Xiangying. *A Framework for Implementation: Seeking Safer Alternatives for Consumer Products, Department of Toxic Control Substances*
Where is Alternatives Analysis headed?

Product information for consumers
Use restrictions on chemicals and consumer products
Product sales prohibition
Engineered safety measures or administrative controls
End-of-life management requirements
Advancement of green chemistry and green engineering

Alternatives Analysis Guide Coverage
- AA framework
- Product requirements and alternatives
- Relevant factors
- Impact assessments
- Screening of alternatives
- Exposure
- Life cycle impacts
- Economic impacts
- Informational needs in AA
- Selection of alternatives
- Self-evaluation of AA

Stakeholder survey: training needs in AA

Review of existing AA examples

Lessons learned from AA Example Review
- Scope and level of details
- Product performance and chemical function
- Identification of alternatives: chemical drop-in alternatives
- Most focus on public health impacts and human health toxicological endpoints
- The role of exposure assessment in the AA
- Life cycle thinking and life cycle based analysis
- Economic impacts assessment
- Decision making with data gaps and uncertainty
- Transparency and reasonable justification
Methodological Challenges
- Comprehensive scope
- Multidisciplinary tools
- Qualitative and quantitative
- Screening level and in-depth analysis
- Data-driven and value-driven

Information Challenges
- Unavailability of comprehensive data set
  - Toxicological data, especially ecological hazards
  - Exposure data
  - Product ingredient and chemical quantity information
  - Life cycle inventory data
  - Public health and environmental costs
- Quality of data
- Temporal and spatial information
- Ways to address data gaps
- Reliability and robustness in regulatory context

Opportunities for Improvement
- Frameworks and tools - harmonization or orchestration
- Integration of results, not methods
- Comprehensiveness and relevance
- Collaboration on data sharing
- Transparency and open dialog

Thank you!

Questions or comment?
Xiaoying.Zhou@ethc.ca.gov
Brignon, Jean-Marc. French Guidance to Support Substitution, INERIS

General context in France
Concern over endocrine disruptors and need to avoid regrettable substitution expressed during the National Environmental Conference in 2014
3rd National Public plan for Environmental Health aims to reduce exposure to endocrine disrupting chemicals
National Strategy for Endocrine Disrupting chemicals
Final guidance addressing all chemicals

Goals of the guidance
Provide a logic framework to avoid regrettable substitution
A decision tool based on a wide set of criteria (hazard, risk, performance, risk/benefit, feasibility, socio-economic aspects)
On behalf of the Ministry for the Ecological and Solidary Transition, working group co-led by industry and public experts (MEDEF/INERIS) and with participation of all stakeholders (ministries, public experts, industry, NGOs)
To be used by all stakeholders

Main challenges
Go beyond comparative full hazard assessment tools and integrate risk/exposure (to avoid risk transfer)
Provide tools and solutions in case of uncertainties and missing information (especially for hazard of new alternatives)
Adress all concerns from QSAR models (missing hazard data) to decision process for substitution in industry organisations

Main orientations
Adress missing data and information on alternatives (especially hazard)
AND
Remain accessible to all the audience including SMEs

Broad view/ end-user perspective on functionality : non-chemical alternatives and materials, modifying function
Adress the management of the « substitution project » in the guide
Provide information and guidelines on how to decide on multiple criteria
Give access to resources

Lists of chemicals of concern
Information on hazard (existing classification and models for all types of hazards) and exposure assessment data and models
Endocrine disruption assessment
Technical resource centers by sector
Access to financing for the substitution project

Thank you for your attention!

Contact:
Jean-Marc Brignone | jean-marc.brignone@inries.fr

How to find the guide?

https://substitution.inries.fr/en

Unclassified
Waaijers-van der Loop, S., Verhoeven, J., Wouters, M. Approaches to support substitution, Dutch National Institute for Public Health and the Environment
SYNTHESIS REPORT: OECD WORKSHOP ON APPROACHES TO SUPPORT SUBSTITUTION AND ALTERNATIVES ASSESSMENT

Unclassified
Biobased alternatives for substances of concern?

Biobased substances may give sustainable advantage:
- Renewable resources & safe alternatives?

Targeted studies (Wageningen Research University) for substitutes:
- The biobased replacement potential of hazardous substances
- BPA in thermal paper
- Polar Aprotic Solvents (PAS) (i.e. NMP, DMAC & DMP)

Bio-based alternatives for substances of concern (SoC)?

Findings & future work:
- List of bio-based substances (or classes) that may reach high production volumes
- Biobased alternative(s) for several SoC (incl. in thermal paper)
- Biobased alternatives for PAS but more R&D needed; tox scan currently in progress (RIVM & EU ReSolve)

Lessons learned:
- Companies may prefer business as usual (own network) to find a market for their alternative instead of public consultation (ECHA)
- Functionality remains difficult to assess (from outside)

REACH restriction and application for authorisation

- Evaluation of dossier/applications include analysis of alternatives by ECHA RAC and SEAC
- Questions to be answered
  - Are alternatives available?
  - Are alternatives safe?
  - Are alternatives technically feasible?
  - Are alternatives economically feasible?
- Prepare ourselves for these evaluations
  - Analysis of alternatives for BPA in thermal paper
  - Analysis of alternatives for phthalates in various applications
- Information brought up in Public Consultation

Thank you for your attention!

We love knowledge & sharing. Contact us!

susanne.reallers@nvm.nl
@susanne_reallers

www.nvm.nl/en
https://www.chemischstoffenspoedigereeld.nl/content/overzicht-organische-stoffen

SYNTHESIS REPORT: OECD WORKSHOP ON APPROACHES TO SUPPORT SUBSTITUTION AND ALTERNATIVES ASSESSMENT

Unclassified
Vanden Hoven, S., Sanderson, J. A Look at Informed Substitution in Canada’s Chemicals Management Plan and Beyond, Government of Canada
Recent Activities Related to Informed Substitution

- University of Massachusetts Lowell (Joel Tickner and Molly Jacobs) to conduct a scan of the global landscape of informed substitution policies, methods and tools to have a better understanding of what activities exist.

- The work focused on 3 main tasks:
  - Review policies and approaches taken by authorities internationally to support substitution among chemical manufacturers and users.
  - Provide a comparative overview of tools and methods for alternatives assessment.
  - Characterize global challenges and critical data gaps for advancing chemical substitution.

- A report summarizing options for Canada to advance informed substitution is currently being drafted by the same authors.

Expert Paper: International Scan

- Commisioned University of Massachusetts Lowell (Joel Tickner and Molly Jacobs) to conduct a scan of the global landscape of informed substitution policies, methods and tools to have a better understanding of what activities exist.

What We Heard – CMP Science Committee

- The focus of the CMP Science Committee meeting was on ecological and chemical science considerations related to informed substitution, specifically:
  1. Considering opportunities for supporting informed substitution in the CMP.
  2. Integrating opportunities for informed substitution, including: publication of position formulations; growing in force, ability to scale, development of a Hazard Substances List; and conclusion of agreements on alternatives assessment.
  3. Exploring comparative chemical hazard evaluation tools.
  4. Reducing work has already been done in this area – advancements in new approaches and methodologies will require continuing assessment.
  5. Building on CMP work and information to date.
  6. Make information generated and tools developed more accessible.
  7. Use CMP data to validate existing models.
  8. The SC encouraged the Department to continue to work with other jurisdictions to identify opportunities for data sharing, creating consistent databases, and to work towards formalizing a generic-informed substitution paradigm.

What's Next


- Lessons learned from other jurisdictions will help answer key questions and shape this document, particularly with respect to roles and responsibilities:
  - What are the health and environment and climate change Canada best placed to do domestically?
  - What Canadian stakeholders are best placed to affect change?
  - Where can we contribute internationally?

Questions?
Baucher, Marie-Ange., Cross-Country Analysis, OECD

Cross Country Analysis: Aim and methodology
- Better understand approaches across countries and by stakeholders to support AA and substitution;
- Questionnaire used to collect experiences (in 2017);
- Responses from: Canada, Denmark, Germany, Luxembourg, Netherlands, US, US - State of California, EU, EEB, ChemSec, University of Massachusetts Lowell and IUPAC.

Programmes and initiatives to support AA and substitution

A combination of regulatory and voluntary approaches
- Widespread use of voluntary approaches;
- Regulation is a strong driver but not sufficient;
- Voluntary initiatives reduce the risk of regrettable substitution & encourage a more sustainable vision of change;
- Multi-stakeholders approaches

Main goals of the voluntary approaches
- Engage with a variety of stakeholders, in particular industry;
- Send signals to industry on what is expected of them (for example in response to a regulation) and bring support and knowledge, e.g.
  - Providing tools and platforms to support substitution;
  - Advancing science and innovation through the supply chain;
  - Setting standards;
  - Protecting the population and the most exposed.

Focus of regulatory approaches
- REACH and other relevant EU regulations;
- US State of California - the California Safer Consumer Products (SCP) Regulations;
- Workers protection regulations linking to substitution
All approaches per country/stakeholder in Annex A

EVALUATING THE IMPACT OF APPROACHES AND CHALLENGES TO DESIGN AND IMPLEMENTATION

Successes in implementation

- Regulations and policy are key incentive for AA;
- Collaborative approach between industry, government (federal/state/local) and NGOs;
- Support R&D and innovation in relevant areas to increase the availability of alternatives;
- Access to tools and guidance & facilitation of supply chain communication and information on possible alternatives;
- Creating a stimulating environment for companies to proactively adopt AA and green chemistry - “embedding substitution thinking into standard business practice”;
- Partnerships - sponsorship programmes, in particular for SMEs;
- Having contact points in countries who can answer queries from companies and provide support.

Challenges to implementation

- Regrettable substitution - often by a substance structurally related;
- Some companies, in particular SMEs, can lack knowledge, access to information and/or resources;
- Complexity of supply chains;
- Some sectors might be more difficult to engage with than others (confidentiality);
- Risk trade-offs;
- Lack of relevant data, in particular hazard data;
- Lack of training and tools to support the regulated community.

Evaluation of the benefits and costs

- In most cases approaches had not been evaluated because recently developed;
- Evaluating benefits and costs of voluntary approaches can be a challenge;
- Obvious benefit - assuring a sustainable substitution practice.

Considering new approaches

- Approaches to involve a whole supply chain (sector specific);
- Platforms where companies can directly exchange on availability of alternatives (such as the Market Place from ChemSec);
- Linking technology innovation research programmes with safer chemical/material assessments;
- Thinking in terms of circular economy for chemicals management.
**LINKING SUBSTITUTION AND INNOVATION**

- Almost all respondents indicated that sponsorship programmes were established in their country linked to green chemistry/sustainable development. Often link is not sufficiently clear that these can encourage AA and substitution;
- According to the responses received, programmes in place to support substitution have already shown great successes in terms of innovation - both in the case of regulatory and voluntary approaches.

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**HOW CAN COUNTRIES WORK TOGETHER TO FACILITATE DATA SHARING AND OTHER COLLABORATIVE EFFORTS?**

- OECD SAAToolbox and Ad Hoc Group:
  - Collecting experience from OECD projects and other networks to draw practical guidance/good practices;
  - Harmonization of criteria to identify a low concern/safer substance;
  - Tools/guidance to support industry in alternatives assessment;
  - Prioritising product-chemical combinations that would benefit from activities that support informed substitution.

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**WHAT TYPES OF DATA SHOULD BE PRIORITISED?**

- Data associated to each chemical to be provided in a harmonized format (e.g. by using the IUCLID tool based on the OECD Harmonised Templates format);
- Engage with government and corporate management at higher level;
- Stronger link between substitution and innovation;
- The importance of a sector specific approach when it comes to collaboration - to stimulate communication along the supply chain.

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**MOVING THE FIELD FORWARD**

- Data on availability of alternatives and AA (e.g. examples of assessment, successful innovation);
- Hazard information - ecological hazards, esthetics endpoints;
- Exposure data, public health and environmental costs data;
- Product ingredient and chemical quality information;
- Life cycle inventory and impact assessment data;
- Experimental, read across, and new approach methodology (NAM) data.
What types of data should be prioritised?
For the generation of data:
• Data on alternatives could be characterised according to “safer” criteria, for example harmonised criteria that the OECD could help develop;
• The Ad Hoc Group could seek for opportunities to collaborate with other OECD groups to enhance data sharing efforts;
• More opportunity to engage with industry would be of added value;
• ECHA database very valuable tool: efforts could be made to make this database more accessible.

How can approaches to alternatives assessments be further harmonised across countries?
Areas for harmonisation:
• Hazard – a minimum dataset requirement, possible criteria thresholds;
• Identify areas of priority with regard to uses of chemicals;
• Groups of chemicals where the need or possibility for substitution are strong;
• Socio-economic analysis;
• The development of green metrics (associated, for example, with major issues such as climate change and resource scarcity).

How can approaches to alternatives assessments be further harmonised across countries?
• Opportunities for incorporating relative hazard/relative risk rankings into group assessments;
• Developing harmonised approaches to AA for use by industry and supported by governments;
• Regulatory requirements can make harmonisation challenging across countries, but there could be a consistent set of steps, data sources to be reviewed, and a minimal set of required endpoints to assess;
• Existing international frameworks, such as the Stockholm, Rotterdam, and Minamata Conventions, the SDGs, SAICM and areas where OECD is active could be starting points for identifying priority areas for further alignment or harmonisation.

Next steps
• Discussions and conclusion from this workshop added to the cross country analysis;
• If additional countries/stakeholders would like to participate in cross country analysis – please contact the secretariat;
• Publication of the report by end of the year.
Jacobs, M., Insights from assessments of opportunities to advance alternatives assessment and informed substitution efforts, University of Massachusetts
ECHA 2017 Report: Regulation a key substitution driver in the EU, yet lack of programme capacity support among MS authorities
• REACH considered dominant driver of substitution in the EU among stakeholder surveyed for our 2016 report.
• Minimal staff commitment that work on substitution

| FTs in MS authority that work on hazardous chemical substitution initiatives |
|------------------|------------------|
| Response         | (N=38)           |
| 0-1              | 50%              |
| 1-2              | 33%              |
| 3-5              | 25%              |
| 6-8              | 0%               |
| 8-12             | 0%               |
| More than 12     | 13%              |

Programme capacity support: also a challenge for US agencies

Theme 2: Successes, Regulation/policy an important substitution incentive
Additional insights:
• Regulatory actions that restrict the use of priority toxic chemicals of concern should be linked to provisions for an evaluation of alternatives to avoid regrettable substitution

2017 Report to ECCC - Regulatory policy landscape for substitution and alternatives assessment is growing, but challenges exist
• Few substitution policies have detailed alternatives assessment requirements
  • Exceptions: REACH authorisation/restrictions, biocides, CA SCP
  • New policies responding: WA state’s new ban on PFAS in food packaging, AA required before the ban
• Data challenges exist related to who conducts the AA?
• Majority of policies have focused on individual chemicals or chemical classes and product types rather than on functional uses of chemicals

Theme 3: Linking Substitution and Innovation
Additional Insights:
• Very few model examples of innovation programs linked to substitution priorities (Denmark’s Eco-Innovation is one)
• On the funding side: Significant $ in technological innovation support, but these funds are not incentivizing innovations in safer chemistry (but could)
• On the investigator side: Innovation/green chemistry research on safer alternatives is not routinely aligned with regulatory priorities
• Recent efforts (Netherlands, ECHA’s substitution strategy) reframing substitution in innovation terms

Moving forward
Capacity
• Infuse “substitution thinking” [mindset change] into aligned govt’ programs/industry business operations/technical resource centers

Collaboration
• Enhance networking and collaboration on solutions for specific functions/materials of concern
• Share data, testing, and implementation experience
• Collaboration is also needed on driving consistency/alignment in methodological approaches

Moving forward
Alignment
• Dialogue about policy/program successes and challenges with the goal of developing “best practices” in policy and programs that support informed substitution
• Consistency in AA steps, data sources, and end points reviewed to enhance international consistency/comparability

Integration and Innovation
• How does informed substitution get more effectively integrated into efforts around sustainable chemistry, the circular economy, plastics?
• What role can OECD play in convening dialogue on technical and innovation support and R&D needs for informed substitution

Unclassified
Kjell, Theresa., *Marketplace: The dating site for safer alternatives*, Chemsec
WHAT IS AN ALTERNATIVE?

- Any solution to replace hazardous chemicals
- Drop-in chemical, technological solution, process or material
- SIN Listed chemicals are banned...

HOW ARE ALTERNATIVES ASSESSED?

- Advertiser responsible that the product fulfils the criteria
- "No" assessment
- Third party labels and certifications
- User ranking

THE PROJECT

- Initiated 2016
- Going official May 2017
- Three-year roll-out
- Advisory Council
- Target groups – investors policy makers
- Networking events
Woodall, Kei Ohno., Identification and Documentation of Alternatives - Learnings from the Stockholm Convention, UN Environment

### Evaluation of alternatives to chemicals proposed for listing

- Any Party may submit a proposal for listing a new chemical.
- The POPs Review Committee determines whether the proposal satisfies the screening criteria (persistence, bioaccumulation, potential for long-range transport, adverse effects).
- If so, the Committee prepares a "risk profile" and decides whether the chemical is characterized as a POP such that global action is warranted.
- If so, the Committee prepares a "risk management evaluation" document containing socio-economic considerations associated with possible control measures.
- Based on the "risk profile" and "risk management evaluation" documents, the Committee makes a recommendation to the COP on listing of a chemical in Annex A, B and/or C, with or without exemptions.

### Developing “Risk management evaluation” document

- RME is developed based on information specified in Annex F submitted by Parties and others.
  - Efficacy and efficiency of possible control measures in meeting risk reduction goals
  - Alternatives (products and processes)
  - Positive and negative impacts on society of implementing possible control measures
  - Waste and disposal implications
  - Access to information and public education
  - Status of control and monitoring capacity
  - Any national or regional control actions taken

### Annex F: Information on socio-economic consideration

- Alternatives (products and process)
  - Technical feasibility
  - Costs, including environmental and health costs
  - Efficacy
  - Risk
  - Availability
  - Accessibility

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SYNTHESIS REPORT: OECD WORKSHOP ON APPROACHES TO SUPPORT SUBSTITUTION AND ALTERNATIVES ASSESSMENT

Unclassified
SYNTHESIS REPORT: OECD WORKSHOP ON APPROACHES TO SUPPORT SUBSTITUTION AND ALTERNATIVES ASSESSMENT

Unclassified
Specific exemptions recommended for PFOA and related compounds

- For five years:
  1. Manufacture of semiconductors or related electronic devices:
     a) Equipment or fabrication plant-related infrastructure containing fluoropolymers
        and/or fluorosurfactants with PFOA residues;
  2. Legacy equipment or legacy fabrication plant-related infrastructure:
     maintenance;
  3. Photographic coatings applied to films;
  4. Textiles for oil and water repellency for the protection of workers from dangerous
     liquids that comprise risks to their health and safety;

- For ten years:
  1. Manufacture of semiconductors or related electronic devices:
     a) Refurbishment parts containing fluoropolymers and/or fluorosurfactants with
        PFOA residues for legacy equipment or legacy refurbishment parts;
  2. Until 2030:
     1. Use of PFOA production for the purpose of producing pharmaceutical
        products

Further evaluation of information on PFOA applications

- Membranes intended for use in medical textiles, filtration in water treatment, production processes and effluent treatment
- Transported isolated intermediates in order to enable reprocessing in another site than the production site
- Medical devices
- Implantable medical devices
- Photo imaging sector
- Automotive industry
- fire-fighting foams

Challenges in collecting information at the global level

- Evaluation primarily dependent on information submitted by Parties and other stakeholders
  - Different levels of political commitment
  - Different levels of national capacity and awareness for information collection
  - Large, complex, tiered, global supply chains
  - Numerous related substances (lack of CAS numbers...)
  - Confidential Business Information
  - Small and Medium-sized Enterprises

Challenges in assessing and documenting information on alternatives

- Limited information, scientific uncertainty
  - Information becomes outdated fairly quickly, situation continuously changes
- Limitation in expertise
  - Building consensus on pros and cons of various alternative products and processes
  - Evaluating socio-economic impacts of introducing alternatives in various sectors
  - Deciding a global policy, taking into account different situation/capacity in different parts of the world

Challenges in introducing alternatives

- Cost implications, technical feasibility, time required
  - Fire-fighting foam;
  - Insulation materials in buildings;
  - Wood preservatives used in utility poles
- Long service-life and need for spare parts
  - Automotive industry; Aerospace industry
- Stringent regulations, standards to meet
  - Flame retardants
  - Medical devices

Learnings from the experiences of the Stockholm Convention

- Similar chemicals, similar applications/sectors, similar alternatives, similar problems, similar solutions
- Information and engagement of stakeholders is essential
  - Industry, Civil Societies, Academia, Government, International Organizations...
  - Information exchange platform: Clearing House Mechanism
- Sustainable chemistry, life-cycle consideration, avoid regrettable substitutions
- Review, update, adjust, learn from lessons
- Communicating findings (science-policy interface)
Lieck, Lothar., Training Material for Substitution, European Agency for Safety and Health at Work
### Campaign Info Sheets

**What are dangerous substances at workplaces?**

- Any substance (gas, liquid or solid) that poses a risk to workers’ health:
  - Chemicals, e.g. in paints, glues, disinfectants, cleaning products or pesticides
  - Process-generated contaminants, e.g. welding fumes, silica dust or combustion products like from hot processes or e.g. diesel exhausts
  - Naturally occurring materials like grain dust, asbestos or crude oil
  - Degradation products and waste

### The training material

**Task 1**

- Development of a modular set of training materials supporting the introduction of the STOP principle in enterprises of the EU for participants.
- The following requirements have to be taken into account:
  - The material should be modular to allow different time frames: At least the following time frames should be covered: half a day, one day, two days and three days.
  - The modules should focus on the OSH legislation and introduce only shorty into related legislation (CLP, REACH, transport, waste, biocides).

### The training material

**Task 2**

- Development of a modular set of training materials supporting the introduction of the STOP principle in enterprises of the EU for trainers.
- This includes in addition to the material for participants:
  - Information on the practical and logistical preparation of the seminar including checklists, corresponding with different time schedules (half a day, a day, two days, three days)
  - Proposal of the practical organisation of group work
  - Additional content on background, explanation of different legislations and information on good prevention practices for certain typical workplace exposures.
Connor, Emily., Experience from Sharing Information on Alternatives from the OECD SAAToolbox Case Studies Section, ABT Associates
Ideas for Enhancements

- Continue to add case studies
  - Please continue to send ideas!
- Additional features to add value?
  - Central database with a list of reviewed chemicals by country, with links to information and findings as available.
  - Other ideas?

Thank You!

For more information:

Emily Connor
emily_connor@abtassoc.com
301-347-5197
Sweet, Lauren., Identifying Potential Candidates for Low-Priority Substance Designation Under the Toxic Substances Control Act (TSCA), US Environment Protection Agency
Stakeholder Comments from Public Meeting

- SCIL is a good starting point.
  - Incorporate statutory considerations.
  - Risk-based process
  - All conditions of use
  - Storage near significant sources of drinking water
- Focus on full-green circle chemicals.
  - Half-green circle chemicals may be an area of data generation.
- Consider chemicals evaluated by other government agencies

Forward Thinking

- SCIL could be a useful starting point for identifying candidates for low-priority substances under TSCA
- Opportunities for data sharing among cross-country government agencies

Questions

Lauren Sweet
Sweet.lauren@epa.gov

Clive Davies
Davies.clive@epa.gov
Mottet, Dennis., Substances of low priority under ECHA’s integrated regulatory strategy, European Chemicals Agency
Low priority substances in a nutshell
- EU authorities’ work focuses on identifying substances that require
- Further information generation or
- Further regulatory risk management

As a by-product we can clarify which substances are currently of low priority for further regulatory work
- Based on currently available information -> regular review of the priority status needed (changes in uses/exposure or new hazard information)

Industry is responsible for safe use and these substances may require further company level actions

ECHA
(De)prioritisation
- Two types of priority for action
  - Priority for further regulatory risk management
  - Priority for data generation

The focus of the work is to identify priority substances for further regulatory work, however this work also results in more clarity on which substances are currently of low priority for further action.
- Substances are considered of low priority for (further) action
  - Low hazard – the substance is likely to be non-hazardous, based on available information
  - Low exposure – the substance has low potential for exposure to humans and release to the environment based on currently available information
  - Low added value of risk management measures – the substance is already adequately regulated

ECHA
(De)prioritisation
- Priority is given to those substances registered for consumer or professional uses or with article service life.
- However, low priority substances may get priority for further action if structurally similar to known substances of concern to avoid regrettable substitution
- (De)prioritisation is applied through all processes from screening, generation of data (compliance check (CHC)), substance evaluation (SEv) to regulatory management option assessment (RMoA)

The priority of a substance is defined at one point in time and may be revisited if new information on either hazard or uses becomes available

ECHA
Concluding on a substance
- High priority
- Uncertain
- Low priority

ECHA
Concluding on a substance by 2020
- High priority
- Uncertain
- Low priority

ECHA
Few examples - screening
- 1,3-dichlorobenzene:
  - suspicion of PBT/vPvB properties
- Manual screening of Member States concluded that the substance is currently of low priority for action under REACH
  - Not PBT/vPvB
  - Uses unlikely to lead to significant exposure to humans or releases to the environment

Unclassified
Few examples – RMOA (Regulatory management option assessment)

- Quinoline
  - Harmonised classification as carcinogen 1B
  - Uses falling in the scope of authorisation under REACH
- Concluded "no need to initiate further regulatory risk management action at this time"
  - Only used in industrial processes at a limited number of sites and at low to medium tonnage
  - Unlikely to be present in articles
  - National enforcement and existing worker legislation and industrial emissions legislation should continue to contribute to controlling the relevant exposures/emissions

More information.....

- Progress reports of the Roadmap for SVHC Identification and Implementation of REACH Risk Management Measures which gives an overview of the progress in addressing substances of concern
- Integrated regulatory strategy

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Facebook.com/EU_ECHA
Johnstone, Nick., Alternatives Assessment and Product Innovation, OECD

The process

1. **Identify “alternatives” (actual and potential) which are “functionally equivalent”**
2. **Collect qualitative information from relevant “stakeholders”**
3. **Assess the “economic suitability” and “adverse impact” of identified alternatives**

Issues for consideration (1): functionally equivalent alternatives

- At the heart of alternatives assessment is the notion of identifying substitutables which are “functionally equivalent”.
- However, in the absence of revealed prices (or a market in which the product of concern is no longer available), this can not be known.
- Moreover, for many products which have multiple uses (multipurpose chemicals), the extent of substitutability is likely to vary widely across different applications.
- The result may then focus on chemical-by-chemical substitution in different applications, i.e., a consequent bias for incremental > fundamental innovations.
- A good policy induces “similar” across as wide a range of alternatives as possible, and by as many agents as possible, innovations as “mushrooms”.

Issues for consideration (2): The population of substitutes

- In a 21st-century world (above and beyond the environmental and health externalities), a world of sunk costs and imperfect information, it is difficult to assess the benefits and costs of a phase-out.
- Significant risk that there may be a bias towards fearing “existing” (but potentially hazardous) rather than “new”.
- However, imperfect information is a pervasive problem.
- The substitutability is likely to have a mixed benefit of alternative impacts, whose values are not known with certainty, and which can be easily compared.
- “Technical Information” on product attributes can not tell you how it is valued by users/consumers (or net present value of impacts above).
- The regulatory intervention is likely to put in place incentives for innovation (“Carrots”) which will have unforeseen consequences at both points above.
The “Young” (and the “unborn”) are the Vehicles of Disruption

Average patent radicalness

Source: Bliven, Nart and Laurence (2015). Note — patentness is defined as to where it is not “young” i.e. not in a period after previous inventions or skills other than to one. Similar criteria for “vulnerable” i.e. benefits of technologies upon which it relies. Young is defined as less than median age

Conclusion: General Principles of policy design in order to encourage more benign (health and environment) technology invention and adoption

- Stringency/intensity: how stringent is the policy objective relative to “BPU” i.e. how great is the concern, and why
- Depth: does the measure provide incentives over the range of all possible outcomes — i.e. can inventors benefit from radical innovations, ensure that incremental innovations don’t “lose out” more far-reaching innovations?
- Predictability/credibility: how certain and credible is the signal given by the policy — i.e. will the elaborated policy framework stay in place and allow for investment in such costs as be recurred for those undertaking the risky (and irreversible) investments associated with BPU?
- Flexibility — how much space is provided to identify new technologies and methods to meet the service — i.e. what is meant by “functional equivalence” and is there some way of making heterogeneous impacts commensurable? What are the incentives for “search”?
- Neutrality — agents with impacts on environmental and health outcomes are treated in an undifferentiated manner. Could the “unborn” be subject to “risk”?


An example: Incumbent-Biased Incentives: Incidence of Benefits of R&D Tax Incentives

Bear partiality of information in mind

- The increasingly partial nature of government information and expertise in a complex world => places a premium on intelligent policy settings
- The importance of wide stakeholder participation, but also a recognition of their “vested” interests in terms of the information provided
- But “stakeholders” include those who are not presently represented in the market.
- The role of “standards” in increasingly interdependent (and internationalised) economic systems.
- Enjoys the issue of rent-seeking via preferential access and influence
- So => process (governance), evaluate (benefits and costs), and communicate (multidisciplinarity)
Waals Van-der, Jochem., Safe Chemicals Innovation Agenda, Ministry of Infrastructure and Water Management
SYNTHESIS REPORT: OECD WORKSHOP ON APPROACHES TO SUPPORT SUBSTITUTION AND ALTERNATIVES ASSESSMENT

Key concepts

From substitution to Safe-by-Design

Drop-in substitution: replacement by similar chemicals

Safe design of chemicals, materials and products:
- other chemical group
- other materials
- other processes
- non-chemical solutions

Components of SbD:
- design for lower toxicity – related aspects: design for degradation, reuse/recyclability, lower energy and resource use
- considering lifecycle

Focus on function

ECHA definition

The technical function describes the role that the substance fulfills when it is used (what it actually does in a process, mixture or article and the benefits it confers)

This provides the opportunity to consider other options than replacement of chemicals by other chemicals only

Relevant aspects per theme

1. Relevance for health and the environment
2. Scientific and technical challenge
3. Level of substitution
   - Molecular
   - Material/process/product/service
4. Economic rationale and EU competitiveness aspects
5. Contribution to other sustainability aspects
6. Estimated research maturity level
7. Key stakeholders

Research themes

Main themes:
1. Repelling water, grease and dirt
2. Fire safety
3. Preservation
4. Plastisizing
5. Dispersing agents
6. Solvents
7. Curing agents

Other potential themes:
A. Assessment methods and tools
B. Legacy contamination
C. Circular economy
D. Bio-based chemistry
E. Surface protection
F. Fertilizers
G. Pesticides
H. Energy storage

Thematic:
- material/process/product/service

Results
Examples of research directions

Plasticising:
- Molecule: alternative chemical groups to phthalates
- Material: (biobased) alternative plastics

Fire safety:
- Molecule: health and environment impacts of halogen-free chemicals (persistence, bioaccumulation etc.)
- Material: polymers with intrinsic flame retardant function
- Process: reduce need for flame retardant materials in design of buildings

Feedback from stakeholders

- Support for methodology
- Support for focus on functionality, applications and sectors, rather than on specific substances
- Distinguish essential from non-essential uses
- Consider assessing R&D needs based on risks, not hazards
- Consider other barriers than technical or scientific (e.g. economic, institutional or organizational)
  - Include outcomes in a comprehensive strategy

Emerging elements of Safe by Design strategy in EU

- Education and R&D infrastructure
  - Participate in development - research schools
- Data and standards
  - Accessible and reusable tocolal data - prospective standards for safe or sustainable
- Activate demand and supply
  - Procurement
  - Innovation challenges - monitoring step-up

How to implement Safe by Design

- Transform themes into projects/programmes with common approach:
  - Participation of entire value chain
  - Include all alternatives
  - Involve civil society
  - Neutral facilitator
  - Address market barriers - not only R&D
  - Learn and adjust
  - Workshops ECHA strategy could be starting point - pilot in The Netherlands: antifouling pleasure craft (5 October)
  - Results feed into regulations (restrictional authorisations)

Important steps in innovation projects

Define scope in participatory context before actual R&D:
1. Build trust among participants
2. Specify concern health and environment (volumes, exposure etc.)
3. Specify functions and user requirements; discuss essential and non-essential uses – involve civil society
4. Define system boundaries: chemical, material, process, service levels (if needed: split into separate projects)
5. Investigate specific R&D questions at each level
6. Report data accessible and reusable to enable improving SBD tools
7. Address market barriers and implementation (financial arrangements etc.)
### Political and stakeholder support needed

**Discussion:**
- In European Council formations
- Between ministries responsible for chemicals and innovation
- With key innovation actors/platforms

**Other:**
- Attention to issue in Global Chemicals Outlook?
- Use global networks such as post-SAICM framework

### More Information

- [https://www.chemischstoffen.oogregeld.nl/nieuws/workshop-safe-chemicals-innovation-agenda](https://www.chemischstoffen.oogregeld.nl/nieuws/workshop-safe-chemicals-innovation-agenda)

- Report will be uploaded in June

- Jochem.vanderwaals@minlenm.nl
Dyekjær, Sidsel., The Danish partnership for substitution and the Eco-innovation Programme, Danish Environment Protection Agency.
SYNTHESIS REPORT: OECD WORKSHOP ON APPROACHES TO SUPPORT SUBSTITUTION AND ALTERNATIVES ASSESSMENT
Challenges in substitution projects

Experience from project on biocides in water based paints, etc.

Different solutions:
- Removal of some ingredients may reduce the need for biocides
- Adding other ingredients may reduce the need for biocides
- Some substances may boost the biocide – thus lower concentration necessary
- Lessons from the food industry are helpful – hygiene

Experience from other projects. Screening may show that potential alternatives:
- Turn yellow long after application
- Smell like soap or essential
- Turn out to be expensive as available only from Japan

Substitution timeline
- Identify problem
- Screen for alternative
- Assess and Decide
- Implement

- ✓ Technical Development
- ✓ Alternative Assessment
- ✓ Economic Considerations
- ✓ ...
A NATURAL CODING METHOD

What kind of projects should be funded?

- New innovation
- New solutions
- Funding critical
- Big company
- Large volume
- No risk of failure
- Substance in regulatory focus

Cooperation

- Important for Agency to be: Innovative
- Open for new solutions
- Clear on aim of programme
- Sharp on aim of project
- Ready to document your work
- Open for failure

Unclassified
Interdivisional Committee on Green Chemistry for Sustainable Development & International Union of Pure & Applied Chemistry, OECD EXPERT WORKSHOP ON APPROACHES TO SUPPORT ALTERNATIVES ASSESSMENT AND SUBSTITUTION

OECD Conference Centre, Paris  
2 - 3 May, 2018

Green Substitutes of Chlorine Chemistry  
Examples of how dangerous chemicals can be domesticated  
Pietro Tundo

Cl₂  
Electrolysis  
AlCl₃, SnCl₄, TiCl₄, SiCl₄, ZnCl₂, PCl₃, POCI₃, PCl₅, COCl₂, SOCl₂, etc...

Since the industrial revolution, chlorine remains an iconic molecule even though its production by the electrolysis of sodium chloride is extremely energy intensive.
Comparing CO₂ emissions in cement, iron, steel and chloro-alkali productions

<table>
<thead>
<tr>
<th>Chlor-alkali manufacturing</th>
<th>Cement</th>
<th>Iron and Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kg CO₂/Kg</td>
<td>1.5</td>
<td>0.95</td>
</tr>
</tbody>
</table>

World Production (2009) | Europe: 106 Mton; China: 215 Mton | 2.3 Boxes | 1.2 Boxes

Energy

- Chlorine industry gives a contribution comparable to the iron and steel industry in terms of CO₂ production/kg product
- Chlorinated molecules have both a direct (as GHGs) and indirect (CO₂ production) impact on climate change at a global level

Organic syntheses

The substitution of compounds where "chlorine is used in the making" means that we avoid electrolysis as primary energetic source; this however makes chemistry "without chlorine" considerably more difficult and illustrates why it has not been adopted before.

Unclassified

CONTENTS OF THE SPECIAL TOPIC ISSUE

30 Contributions dealing with:
- Part 1: Chlorine-free reagents
- Part 2: Chlorine-free catalysts
- Part 3: Carbonate chemistry
- Part 4: Chlorine-free solvents
- Part 5: Banage chloro-free methodologies
- Part 6: Metrics of chlorine-free syntheses

SYNTHESIS REPORT: OECD WORKSHOP ON APPROACHES TO SUPPORT SUBSTITUTION AND ALTERNATIVES ASSESSMENT
Chlorine-free reagents

Replacing benzyl chloride with benzyl alcohol in heterogeneous catalytic benzylation of aromatic compounds

N. Camino, H. Birner, P. Sammels, H. M. Cerem, M. J. Farnsworth

A novel halogen-free methodology for the synthesis of organophosphorus compounds

N. K. Gudorin, E. M. Artzner, and D. A. Schmogor

Acetylation of aromatics over acid zeolites: Seeking a viable alternative to Friedel-Crafts catalysts

M. Gudorin, I.-M. Couteard, P. Alagouni, M. Schmogor

Chlorine-free catalysts

Simple halogen-free synthesis of aryl cinnamates using Mo-Keggin heteropoly acids as catalyst

V. Palermi, O. M. Ruiz, J. C. Austrin, P. O. Wadsø, G. F. Bermejo

The use of Keggin heteropoly acids instead of the usual soluble acid catalyst (HBF₄, hydrochloric, etc.) contributes to a reduction in waste generation by allowing an easy separation and recovery without any loss of its catalytic activity.

Chlorine-free solvents

Chlorine-free alternative solvents include:

- solventless systems
- aqueous applications
- carbohydrate-based solvents (sweet/lose/twist)
- carbonate based solvents
- supercritical fluids
- ionic liquids (ILs)
### CONTENTS 1

- Catalytic Oxidant-Type Addition of Acyl C-H Bonds to C=O and C=N Bonds
  - Wang, Jing (et al.)
- The Halogen-Less Catalytic Transition Metal-Mediated Cross-Coupling Reactions: A Sustainable Alternative for Utilization of Organohalides
  - Demchuk, Oleg M. (et al.)
- Benign Chlorine-Free Approaches to Organophosphorus Compounds
  - Caporal, Maria (et al.)
- Hypophosphorous Acid and Its Salts as Reagents in Organophosphorus Chemistry
  - Visu, Jyothi (et al.)
- Catalytic Processes for Environmentally Friendly Methylene Diphenyl Diaminodiphenyl Ether Production
  - de Angelis, Alberto (et al.)

### CONTENTS 2

- Chlorine-Free Heterogeneous Acid Catalysts
  - Mota, Claudio Jose de Araujo
- Chlorine-Free Catalysis for the Synthesis of Diethyl Carbonate via Oxidative Carbonylation of Alcohols
  - Huang, Shaoying (et al.)
- Chlorine-Free Biomas Processing: Enzymatic Alternatives for Bleaching and Hydrolysis of Lignocellulosic Materials
  - Souza, Marcelo Fernandes (et al.)
- Substitution of Chloride Chemicals with Degradable Biocopolymers for Sedimentation of Suspended Particles in Water
  - Shevitz, Ehud
- A Green Method for Potentially Recycling Condensation Polymers: Ring-Chain Recycling
  - Hodge, Philip

### CONTENTS 3

- Polymers Beyond Chlorine
  - Meehan, A.
- Synthesis of Carbonate Compounds Using Carbon Dioxide and Carbon Dioxide-Derived Materials
  - Pajula, Sirjo-I. (et al.)
- Research Progress in the Phosphorus-Free and Direct Synthesis of Dimethyl Carbonate from CO2 and Methanol
  - Fu, Zhongwei (et al.)
- Industrial Production of Dimethyl Carbonate from CO2 in China
  - Wang, Xian Tan (et al.)
- Hafte-Free Synthesis of Cyclic and Polycarbonates
  - Ingram, Ian D. V. (et al.)

### CONTENTS 4

- Heterocyclic Synthesis Through C-N Bond Formation with Carbon Dioxide
  - Song, Guang (et al.)
- Beyond Chlorine Reagents: Organic Carbonate Chemistry
  - Jing, Haosheng
- Application of Organic Carbonates in Organic Transformation Catalyzed by Ionic Liquids
  - Wang, Shuchen (et al.)
- Linear and Cyclic Carbonates via Diethyl Carbonate Chemistry
  - Arizt, Pablo (et al.)
- State of the Art and Problems of Organochlorine Synthesis
  - Tregler, Vely (et al.)

### CONTENTS 5

- Disposal of Chlorine-Containing Wastes
  - Latava, Dietmar (et al.)
- Application of Green Metrics Analysis to the Synthesis of Diisopropanolamine (DIPA) – Comparison of Chlorine Versus Non-chlorine-Based Routes
  - Ardehali, John

Alkyl Carbonates are equivalent alternatives to Chloro derivatives
Dimethyl Carbonate is an Ambiphilic electrophile

Dimethyl carbonate: Properties

Chlorine-based S$_2$ chemistry

DMC-based S$_2$ chemistry

Some industrial processes involving Dimethyl Carbonate

Dimethyl Carbonate Industrial Uses
Some applications of DMC

- Solvent
- Lithium ion batteries
- Lubricant fluid
- Component of oxygenated gasoline
- Expanding system for polyurethane foams
- Solvent in a process for deasphalt and demetallating

Phosgene replacement

1. Polycarbonate production
2. methylisocianate

Polycarbonate industrial production

Methyl isocyanate via DMC

\[
\begin{align*}
\text{CH}_3\text{NH}_2 + \text{CH}_2\text{O}\text{COOCH}_2 &\rightarrow \text{CH}_2\text{O}\text{NHCOOCH}_2 + \text{CH}_3\text{OH} \\
\text{CH}_2\text{NHCOOCH}_2 + \text{CH}_3\text{OH} &\rightarrow \text{CH}_3\text{N}==\text{C}=\text{O} \\
\text{INSTEAD OF:} \\
\text{CH}_3\text{NH}_2 + \text{COCl} &\rightarrow \text{CH}_3\text{N}==\text{C}=\text{O} \\
\text{CH}_3\text{N}==\text{C}=\text{O} + \text{R}^+\text{OH} &\rightarrow \text{CH}_3\text{N}==\text{H}(\text{CO})\text{O-R'}
\end{align*}
\]

Nucleophilic replacement at the saturated carbon atom

Dimethyl carbonate: Reactivity

Methoxycarbonyl anion as leaving group

Unclassified
Methylation of Phenols, Thiophenols and Thiols under GL-PTC conditions

Catalytic bed (PEGs + K₂CO₃)

ArOH + DMC → ArOCH₃ + CO₂ + CH₃OH

Monomethylation of methylene-active compounds

<table>
<thead>
<tr>
<th>X</th>
<th>Ar</th>
<th>Conv. %</th>
<th>Selectivity in Nonmethylated</th>
<th>Product (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN</td>
<td>4-isobutylphenyl</td>
<td>99</td>
<td>99</td>
<td>Ibuprofen</td>
</tr>
<tr>
<td>CN</td>
<td>3-carboxymethylphenyl</td>
<td>100</td>
<td>&gt;99</td>
<td>Ketoprofen</td>
</tr>
<tr>
<td>COOCH₃</td>
<td>2-(6-methoxyphenyl)</td>
<td>100</td>
<td>&gt;99</td>
<td>Naproxen</td>
</tr>
</tbody>
</table>

Intramolecular cyclisations

Cyclic ethers by DMC-mediated intramolecular cyclisation

The case of isosorbide and dimethyl isosorbide
**Mustard carbonate analogues**

- Using DMC chemistry it was possible to domesticate well-known chemical weapons mustard compounds.
- These compounds resulted in new, unexplored, and safe molecules showing a good reactivity that might give open access to a variety of compounds previously not easily accessible.
- Symmetrical nitrogen-mustard carbonate can be used for the efficient synthesis of new families of azasulphur compounds previously not accessible.

---

**Coalescent efficiency**

High performance and very low impact coalescents for water-based coatings.

---

**4. Coatings: Experimental validation**

- Reference WB RESIN: styrene-acrylic emulsion, MPIF 96°C
- Film formation at 20°C
- Different percentage loadings of coalescent
- Evaluation of the film appearance according to the standard rating (24h after application)

**The co-solvent A exhibits optimal behaviour:**
- Its coalescent efficiency is higher than ButyloSol
- It's totally odourless with respect to the other solvents

---

**Toxicological characterization**

**Very Low Dangeroous, Toxicological Profile** of unsymmetrical derivatives of diallyl carbonates containing either functionalities that are analogous coalescent compounds commonly used in the field.

**Occupational Impact** is also enormously reduced, as a result of the nature of the compound and also due to the lower quantities.

---

**Toxicological Tests on the co-solvent A**

**RESULTS** (according to the OECD "Guidelines for Testing of Chemicals")

- Repeated dose toxicity (n=32, February 26th 2017)
- Acute oral toxicity (n=30, December 17th 2011)
- Skin irritation (n=30, February 26th 2017)
- Eye irritation (n=30, April 24th 2012)
- Skin sensitization (n=30, July 17th 1992)

Co-solvent A is classified as non-sensitizing.

---

**Conclusions**

- Some unsymmetrical derivatives of diallyl carbonates containing either groups have shown coalescence efficiency as co-solvents greater than compounds traditionally used and a comparable flexibility of application.
- High efficiency significantly reduces the amount of co-solvent required in preparations and thus reduce the environmental impact and costs.

Unclassified
The results have been reported in the document...

An independent, unaligned global organisation able to facilitate communication (e.g. Industrial Round Table, conference sessions)

A neutral dissemination route for information and “challenges” to the research community (e.g. perspectives, opinion pieces, books)
Leinala, Eeva., *Synergies with Other OECD Work Areas, OECD.*
Recent Background

- Joint Meeting and the Working Party on Integrating Environment and Economic Policies (WPIEEP) co-operation
  - develop better methods for quantification and monetisation of morbidity and environmental impacts of chemicals, and to make estimates of the social costs of these impacts of selected chemicals.

Workshops

- Workshop hosted by ECHA in Helsinki (July 2018),
  - current status of practice and methodologies for cost-benefit analysis of risk management measures
  - 5 papers and workshop report published

- Workshop hosted by Health Canada in Ottawa (August 2017)
  - Best Practices in Assessing the Social Costs of Selected Chemicals
  - Five case studies discussed and documented:
    - Phthalates
    - Perfluorinated compounds
    - Polychlorinated biphenyls (PCBs)
    - Formaldehyde
    - PFOS
    - Environmental health & Workshop reports developed

Areas of potential future work

- Identify the potentially most important health and environmental impacts with a focus on improve data on quantification and monetisation.
- Carry out new economic valuation studies across countries on both health and environmental endpoints.
- Conduct prospective analysis of little understood measures of health and environmental impacts in order to assess their importance within regulations.
- Develop more harmonised methodologies to ensure consistency in estimating costs for industry.
- Identify handling and communication of uncertainties in relation to both risk assessment and economic valuation, especially focussing on "how to assess" the economic value of non-chemical impacts and how to describe uncertainties and other uncertainties for decision-makers.
- Create a forum to share best practices across authorities to improve quantification of the benefits of chemicals regulations and and understanding of the cost of regulation.
- Consolidate existing databases and resources
- Measure the appropriate value of existing data to use in the context of chemicals management.

On-going forum for risk management discussions (including socioeconomic analysis)

WHO:
- Expert group for risk management discussions with an emphasis on socioeconomic factors

WHAT:
- Share experiences with risk management and economic assessments in chemicals management
  - Identification and documentation of best practices and practical approaches to further ensure that information needs of decision-makers are met.
- Share case studies, to derive "lessons learned".

WHEN:
- Meet face-to-face periodically (e.g. on a yearly basis). Typical workshops could also be identified for deeper analysis of areas with expert input
- A first face-to-face meeting could be held in early 2019 at OECD headquarters in Paris, or a similar country

Coordinated valuation study

Conduct coordinated valuation studies in relation to morbidity and environmental endpoints relevant to chemicals:

- Conduct one or several coordinated valuation studies of morbidity endpoints relevant to chemicals in different OECD member countries and possibly partner countries.
- Work collaboratively on how environmental endpoints can be valued and with a longer-term goal (e.g.) conduct a coordinated valuation study for environmental impacts.

- Initial project team established (will need an update); early work undertaken
- Just approved through two committees for future workplan
- Fundraising underway (multiyear project)
SYNTHESIS REPORT: OECD WORKSHOP ON APPROACHES TO SUPPORT SUBSTITUTION AND ALTERNATIVES ASSESSMENT

Unclassified
Structure

Working Party on Hazard Assessment

Ongoing Groups
Project Teams

OECD Harmonised Templates

- Standard data formats for reporting information used for the risk assessment of chemicals
  - properties or effects on human health and the environment
  - use and exposure
- Aimed at developers of database systems
  - prescribe the formats by which information can be entered into and maintained in a database
- Governments and industry are easily able to electronically exchange test study summary information.

http://www.oecd.org/ihd/templates/

Number of visits per economy (01 Jan. 2011 to 29 January 2018)

IUCLID (International Uniform Chemical Information Database)

- Free software application
  - Capture, store, submit, exchange data on chemical substances
  - Data storage format = OECD Harmonised Templates

http://www.chemportal.org
Methodologies for Hazard Assessment

- Development of harmonised novel methodologies for assessing the hazards of chemicals
  - ensure consistency
  - generate confidence and support for integrating novel tools and approaches into regulatory decision-making
  - increase the mutual acceptance of hazard assessments in order to avoid duplication of efforts

- Types of Output:
  - Case studies on using novel methods for regulatory decision-making
  - Application of Adverse Outcome Pathways
  - Integrated approaches to testing and assessment
  - QSAR Toolbox

OECD work on predictive toxicology and Adverse Outcome Pathways (AOPs)

OECD IATA Case Studies Project

Objective:
- Increase experience with the use of Integrated Approaches for Testing and Assessment by developing case studies, which constitute examples of predictions that are fit for regulatory use
- Create common understanding of using novel methodologies and the generation of considerations/guidance stemming from these case studies

Deliverables:
- Case studies followed by guidance documents on approaches

Further Information

- Website
  - http://www.oecd.org/chemicalsafety
- EHS Newsletters (sign up to receive automatically)
- Email: eevejaleinala@oecd.org

www.oecd.org/env/hazard/qsar

Unclassified
Connor, Emily., OECD SAATToolbox: Possible Additions and New Functionalities, Abt Associates
Leinala, Eeva., Next Steps- OECD Adhoc Group on Substitution, OECD

SYNTHESIS REPORT: OECD WORKSHOP ON APPROACHES TO SUPPORT SUBSTITUTION AND ALTERNATIVES ASSESSMENT Unclassified
Action?

What are the key considerations (criteria?) for alternatives assessment including for decision-analysis/risk trade-offs?
- Potential topic of next face-to-face meeting & develop a publication (e.g. guiding principles or guidance)

Action?

- Data sharing
  - Identify what specific to AA/substitution can we share more of
  - Update SAAToolbox with identified value-added information
  - Potential other mechanisms for data-sharing

Do you agree with these next steps?
Other priority areas to focus on?