

SUBSTITUTION OF HAZARDOUS CHEMICALS

November 2017

Version 1.4

LEARNING OUTCOMES & RESOURCES

Learning Outcomes

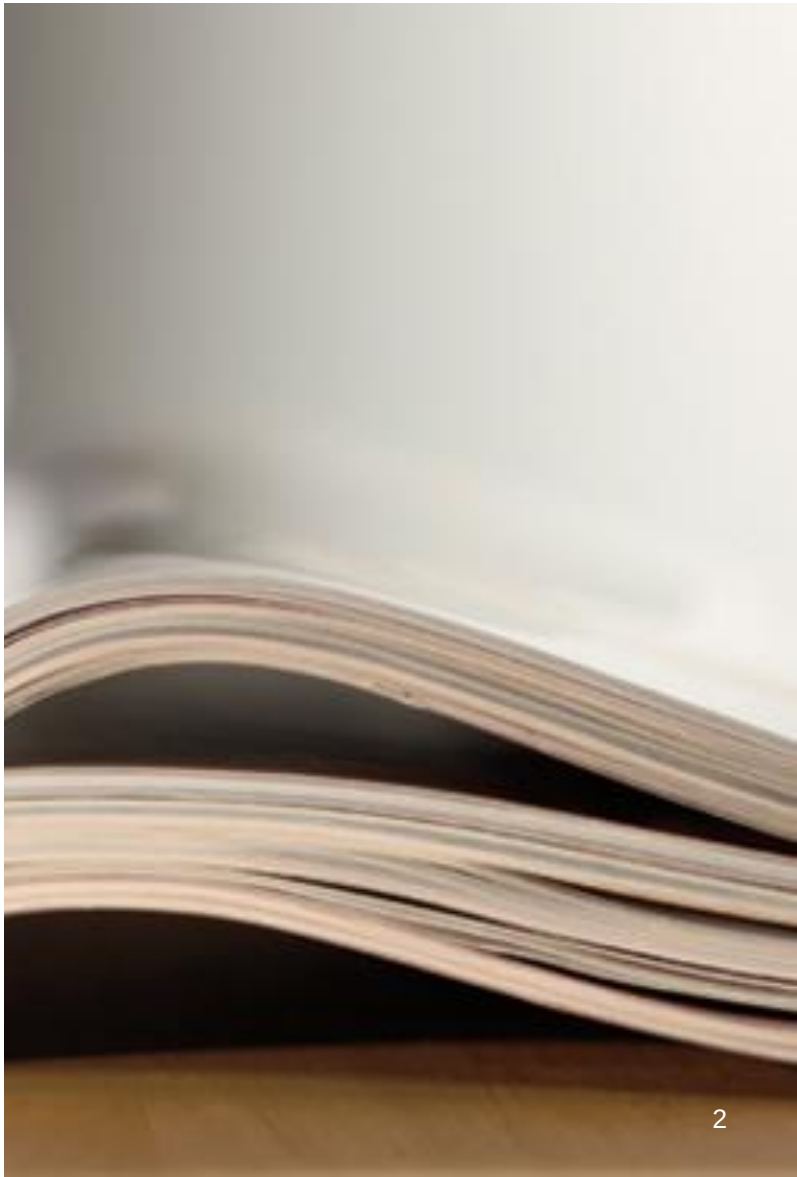
- Introduction to the six steps to chemical substitution.
- Learn about substitution examples from the industry.

Resources

- www.subsport.eu
- www.rewe-group.com

Workbook

Refer to complimentary excercises in your workbook.



THE PROBLEM

Why has “advancing towards zero discharge of hazardous chemicals” become a key topic in the textile industry today?

Brainstorm as a group and take notes in your workbook, exercise (15-1).

Six Steps To Substitution

QUIZ

Which are the 6 steps to chemical substitution?

STEP 1 - DEFINE THE PROBLEM

- Describe hazards and useful properties of these chemicals.
- Ask your suppliers and/or use *reliable sources* to check hazards.
- Describe the function of the substance and the operational parameters (pH, temperature, etc), quantity, equipment.

Reference: www.subsport.eu

STEP 2 - SET SUBSTITUTION CRITERIA

- Set criteria to eliminate alternatives that are not safer or not safe enough.

Reference: www.subsport.eu

STEP 3 - SEARCH FOR ALTERNATIVES

- Search within your own company.
- Search on internet, ask authorities, professional associations, NGOs, trade unions.
- Look for *alternatives* already tested and implemented, this may lower the innovation costs and risks.
- You may also ask your supplier for safer alternatives. But first, search within your own company.

Reference: www.subsport.eu

STEP 4 - ASSESS AND COMPARE ALTERNATIVES

- Assess all alternatives with the same method/tool for comparability.
- Analyse costs (can you afford it?) and the cost/benefit.
- Select the alternative which are safer, feasible and fit with the nature and dimension of your problem.

Reference: www.subsport.eu

STEP 5 - CONDUCT PILOT EXPERIMENT

- Pre-evaluate risks.
- Test substitution on a smaller, pilot scale.
- Plan the technological and organisational changes needed.
- Assess substitution as regards to functional performance, impact on workers, environment or consumers.
- Pay attention to possible shift of risks and the necessary control measures.
- Consult employees.

STEP 6 - IMPLEMENT AND IMPROVE

- Think what other measures would be needed when implementing substitution at full capacity.
- Update your supply chain and inform your downstream users.
- Collect extended feedback from workers and clients.
- Identify points to improve.
- Promote your achievements.

Reference: www.subsport.eu

Substitution Examples

USE SUBSPORT TO LEARN FROM PEERS

SUBS PORT
Substitution Support Portal

MOVING TOWARDS SAFER ALTERNATIVES

- Home
- News
- Newsletter
- About the Portal
- Substitution Steps
- Substitution in Legislation
- Identifying Substances of Concern
- Restricted and Priority Substances Database
- Case Story Database
- Substitution Tools

Support for Substitution

Substitution of hazardous chemicals is a fundamental measure to reduce risks to environment, workers, consumers and public health.

Legislation encourages you to substitute, this site will show you how.

Read more

Latest News

GreenScreen® is 10 years old!

Publications & tools | 31.03.2017

GreenScreen® for Safer Chemicals was launched in 2007 and has become a widely recognised tool for assessing chemical hazards, identifying chemicals of concern, and selecting safer chemicals. It is a method of comparative Chemical Hazard Assessment that can be used for identifying chemicals of high concern and safer alternatives.

Read more

Substitution Steps

Substitution may be fast and easy or a more complex process. Generally it includes the following steps:

1. Define the problem
2. Set substitution criteria
3. Search for alternatives
4. Assess and compare alternatives
5. Experiment on pilot
6. Implement and improve

Read more

Search SUBSPORT

- Website
- Restricted and priority substances database » link
- Case story database » link

Search » Overview

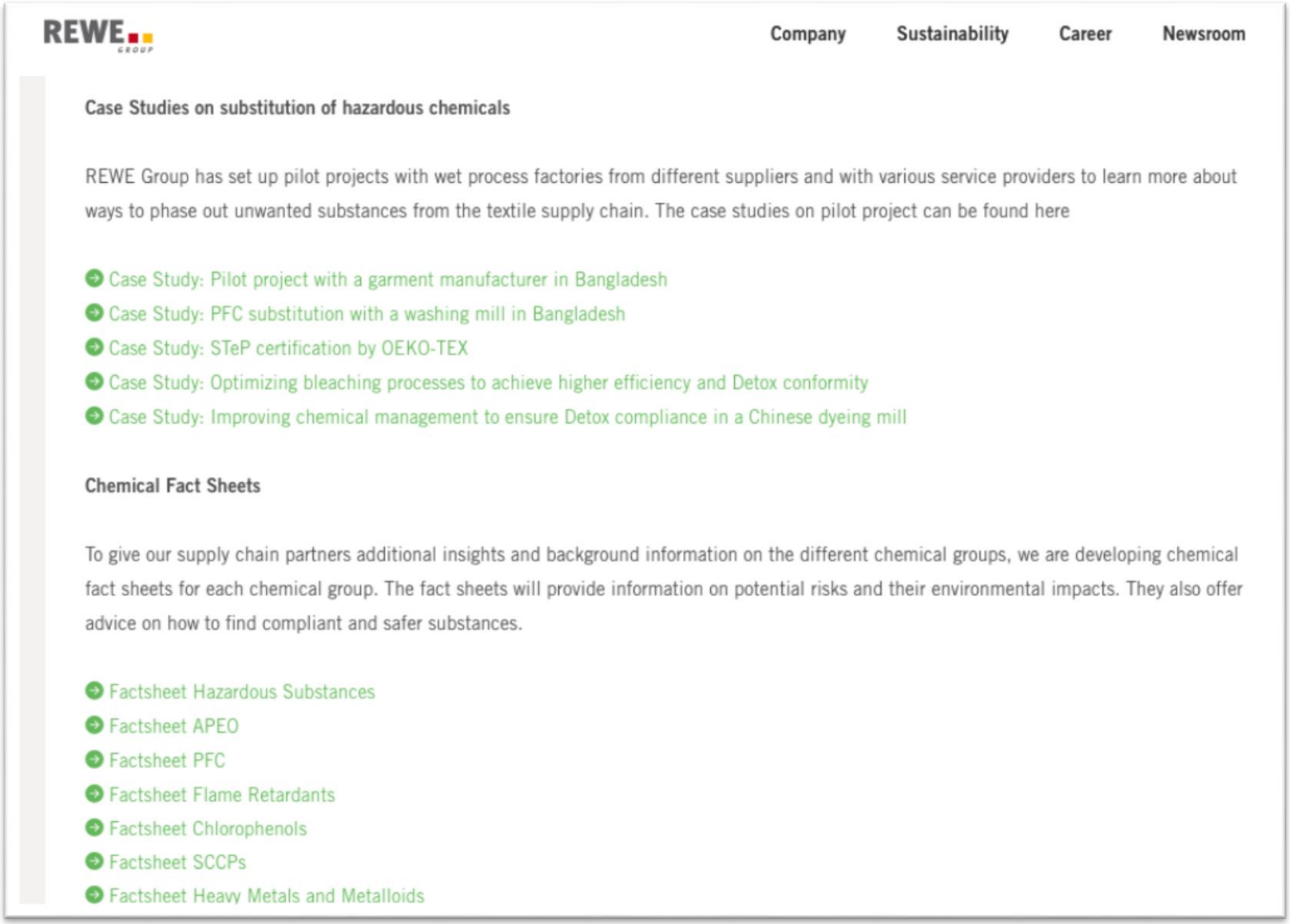
External substitution websites and databases

Search

Your contribution

Provide substitution examples
Provide feedback

LEARN FROM YOUR PARTNERS



REWE GROUP

Company Sustainability Career Newsroom

Case Studies on substitution of hazardous chemicals

REWE Group has set up pilot projects with wet process factories from different suppliers and with various service providers to learn more about ways to phase out unwanted substances from the textile supply chain. The case studies on pilot project can be found here

- Case Study: Pilot project with a garment manufacturer in Bangladesh
- Case Study: PFC substitution with a washing mill in Bangladesh
- Case Study: STeP certification by OEKO-TEX
- Case Study: Optimizing bleaching processes to achieve higher efficiency and Detox conformity
- Case Study: Improving chemical management to ensure Detox compliance in a Chinese dyeing mill

Chemical Fact Sheets

To give our supply chain partners additional insights and background information on the different chemical groups, we are developing chemical fact sheets for each chemical group. The fact sheets will provide information on potential risks and their environmental impacts. They also offer advice on how to find compliant and safer substances.

- Factsheet Hazardous Substances
- Factsheet APEO
- Factsheet PFC
- Factsheet Flame Retardants
- Factsheet Chlorophenols
- Factsheet SCCPs
- Factsheet Heavy Metals and Metalloids

Reference: www.rewe-group.com

CHLOROALKANES
(SHORT CHAINED CHLORINATED PARAFFINS, SCCP)

- **Classification:** Carcinogenic, very toxic to aquatic life.
- **Hazard Characteristics:** Suspected of causing cancer, endocrine disruptor, very toxic to aquatic life with long lasting effects, bio accumulating and very persistent.
- **Use:** Metal working lubricants, paints adhesives and sealants, rubber/flame retardants, textile/polymers (other than PVC), leather fat liquors and PVC plasticisers.
- **Alternatives:** Isopropyl phenyl diphenyl phosphate (IPPDPP) and Aluminium hydroxide (AH).
- **Technical feasibility:** IPPDPP as flame retardant does not present the same concerns for occupational health and environment as SCCP. AH can primarily be used as an alternative for SCCP in electrical equipment.
- **Economical feasibility:** IPPDPP has a significant higher cost.

Reference: www.subsport.eu

HEXAVALENT CHROMIUM COMPOUNDS

- **Classification:** Acute toxicity, corrosive to skin and toxic in aquatic environments.
- **Hazard characteristics:** Explosive, flammable, strongly oxidizing and toxic to aquatic environments.
- **Use**: Anti-corrosion agents in coatings, biocide in wood preservatives, pigments in plastics, paints, inks and dyes, tanning agent in leather, mordant in textile dyes, oxidising agent in reagents and catalysts.
- **Alternatives:** Dye mordents such as potassium aluminium sulphate, stannous chloride, copper sulphate, iron (II) sulphate, sulphated castor oil; Lanasol 4G CAS 70247-70-0, Remazol Black CAS 17095-24-8.
- **Technical feasibility:** potassium aluminium sulphate and iron (II) sulphate are not listed hazardous by sources investigated and sulphated castor oil has low toxicity.
- **Economical feasibility:** All alternatives are available, prices are not prohibitive and may even cut costs.

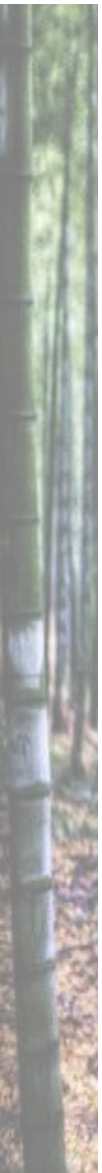
Reference: www.subsport.eu

FORMALDEHYDE

- **Classification:** Carcinogenic.
- **Hazard characteristics:** Toxic if swallowed or inhaled, corrosive to skin, carcinogenic, aquatic toxicity and potential GHG.
- **Use:** Intermediate in production of formaldehyde based resins, industrial chemicals and plastics. Bactericide or fungicide, treating textiles for wrinkle-resistance.
- **Alternatives:** Chitosan, dimethyl urea glyoxal, polyvinylpyrrolidone and polymaleic acid in textile finishing for wrinkle-resistance. Synthetic resins (isocyanate - based adhesives) and PureBond® as one of the bio-based resins. Cement and clay as alternatives for wood composite binders.
- **Technical feasibility:** Bio resins are non hazardous (tannins, lignins). PureBond; performance aspects similar to formaldehyde-based plywood. Clay boards; natural product, not suspected to contain dangerous substances, show good results of indoor air and moisture.
- **Economical feasibility:** Bio resins (PureBond) currently available at similar cost to formaldehyde-based plywood. Clay boards currently more expensive than traditional formaldehyde-based structural panels.

Reference: www.subsport.eu

HEXABROMOCYCLODODECANE (HBCDD)



- **Classification:** Very toxic to aquatic life.
- **Hazard characteristics**: Causes skin and serious eye irritation, suspected to damage fertility of the unborn child, may cause harm to breast-fed children. May cause an allergic skin irritation and is very toxic to aquatic life.
- **Use:** Additive in flame retardants, for EPS and XPS foam insulation and black textile coatings.
- **Alternatives for Expanded Polystyrene (EPS) and Extruded Polystyrene (XPS):** Emerald 3000, TBBPA bis (allyl ether). Dibromoethyldibromo-cyclohexane, non-flame retarded EPS and XPS with thermal barriers (TB) and Rock wool.
- **Technical feasibility:** Dibromoethyldibromo-cyclohexane and Rock wool are technically feasible.
- **Economical feasibility:** Dibromoethyldibromo-cyclohexane, TB and Rock wool are commercially available.

Reference: www.subsport.eu

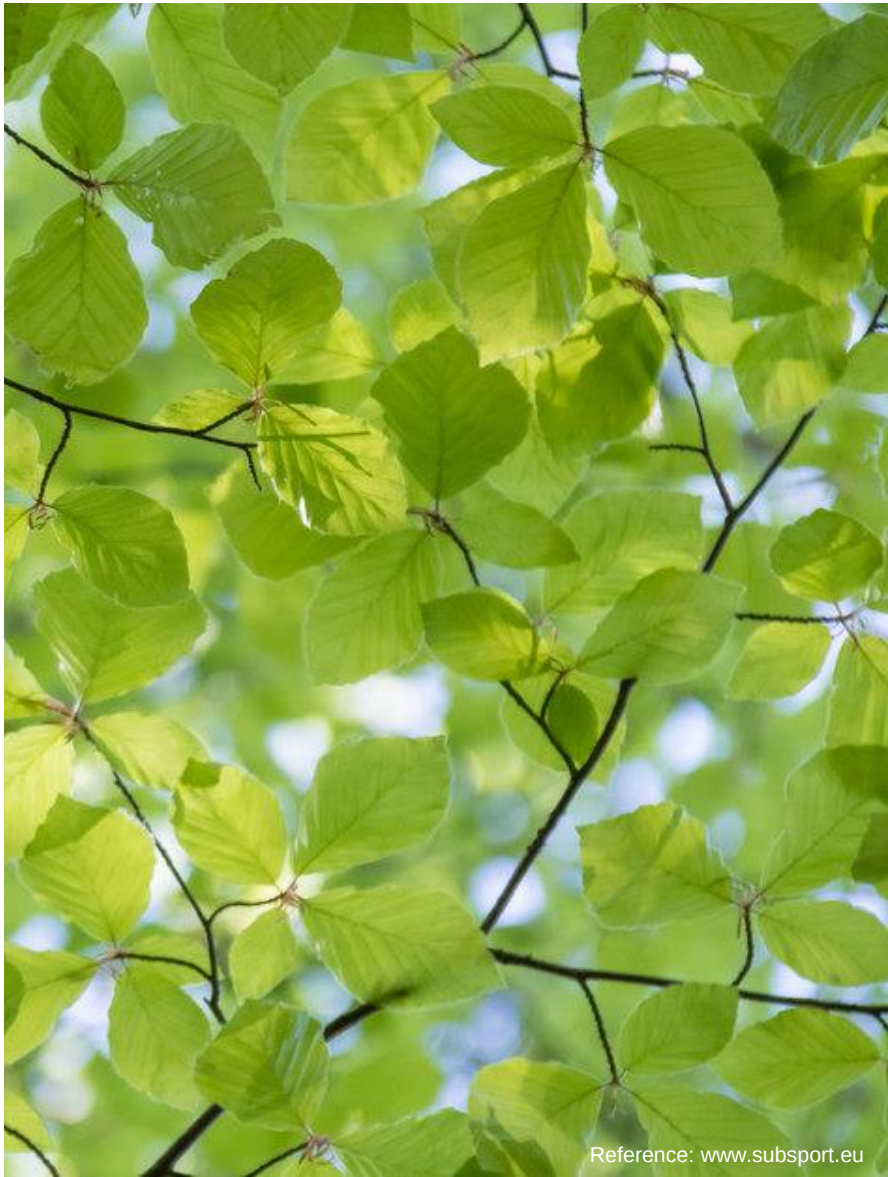
LEAD AND ITS INORGANIC COMPOUNDS

- **Classification:** Neurotoxic.
- **Hazard characteristics:** Neurotoxic, toxic by ingestion and inhalation of dust or fumes. Very toxic to aquatic life with long lasting effects. Harmful if inhaled or swallowed. Causes damage to organs and may damage fertility or the unborn child. Suspected of causing cancer.
- **Use:** Lead metal in lead oxide production and use of lead oxide in stabilizer production. Lead based pigments.
- **Alternatives:** For PVC stabilizers: calcium-zinc and Hydrotalcite compounds.
- **Technical feasibility:** Calcium-zinc and Hydrotalcite stabilisers have performance aspects similar to lead stabilisers.
- **Economical feasibility:** Calcium-zinc stabiliser: higher material costs and Hydrotalcite stabiliser comparable costs.

Reference: www.subsport.eu

NONYLPHENOLS AND NONYLPHENOL ETHOXYLATES

- **Classification:** Very toxic to aquatic life.
- **Hazard characteristics:** Harmful if swallowed, corrosive to skin and causes severe skin burns and eye damage. Suspected of damaging fertility or the unborn child. Estrogenic effects and very toxic to aquatic life. Not readily biodegradable, persistence increases with branching.
- **Use**: Detergent surfactants, paint, ink, paper dispersants. Textiles surfactants, emulsion polymerisation and leather degreasers.
- **Alternatives:** For leather degreasers, Lipase or water.
- **Technical feasibility:** Lipase have good leather quality, improves further processing but performance depends upon on alkaline conditions. Does not accumulate and is biodegradable. Water: similar quality to chemical degreasing but not suited for all leather types.
- **Economical feasibility:** Lipase costs may be reduced by improving further processing. Water is cheap.



Reference: www.subsport.eu

PERCHLOROETHYLENE (PERC)

- **Classification:** Carcinogenic, toxic to aquatic life.
- **Hazard characteristics:** Exposure may cause unconsciousness, proteinuria and hematuria. Irritates eyes, nose, throat and skin.
- **Use:** Solvent for dry-cleaning, chemical intermediate, processing and finishing in the textile industry.
- **Alternatives:** PERC free dry cleaning alternatives such as dibutoxymethane (Solvon K4) and glycol ether (Rynex), wet and CO_2 cleaning.
- **Technical feasibility:** All above are non hazardous to health. Solvon K4 a very good stain remover, Rynex best stain removal score of all alternative processes. Wet cleaning very good for stain removal. CO_2 cleaning best shrinkage score of all alternative processes.
- **Economical feasibility:** Rynex less spotting agent and paper work costs than PERC but more equipment and solvent cost. Wet cleaning less waste disposal, equipment and maintenance costs but more detergent, gas and electricity costs PERC.

Reference: www.subsport.eu

BISPHENOL A

- **Classification:** Causes serious eye damage.
- **Hazard characteristics:** Explosive, causes serious eye damage, irritation to respiratory system and an endocrine disruptor.
- **Use**: Antioxidant, plasticiser, intermediate, flame retardant, pesticide, process regulator, paints, adhesive, softener, construction material, stabiliser, lubricant, additive, surface treatment, filler, antistatic agent, viscosity adjustor, insulating material, hydraulic fluid, corrosion inhibitor, hardener, curing agent, casting material, brake grease, primer, stopping material, catalyst and, paper additive.
- **Alternatives:** polyethylene, polyethylene terephthalate (PET) and polypropylene (PP).
- **Technical feasibility:** Performance aspects similar to BPA products. PP and PET are declared to be environmentally-friendly.
- **Economical feasibility:** Available and relatively inexpensive

ACTIVITY

DISCUSSION

Take notes in your workbook, exercise (15-2).

Which chemicals from the 11 priority chemical groups have you substituted successfully?

Which chemicals from the 11 priority chemical groups are you working towards substituting?

Open To Questions

SUMMARY

Every participant to feedback one key learning from this session.

Take notes in your workbook, exercise (15-3).