Simon Corbey MSc MRICS Director at the Alliance for Sustainable Building Products

**Delivering Healthy Buildings** 

**Plastics and Construction** 

24th January 2019 - Wood Window Alliance



oducts

## Over 60 members and partners

Including architects, product manufacturers, specifiers, suppliers, contractors, research institutions and more...







The Alliance for Sustainable Building Products

Mission driven

To accelerate the transformation to a sustainable built environment and society, by championing the understanding and use of demonstrably sustainable building products



#### APPG for healthy homes and buildings White Paper: Building our Future; Laying the Foundations for Healthy Homes and Buildings; October 2018



#### APPG – some 46 recommendations

# ZONE 3 RETROFIT

# Recommendation:

Make renovation of current housing stock and infrastructure a Government priority and develop plans for retrofitting that takes and develop plans for retrofitting health a holistic approach to maximising health and wellbeing.

**A**≤**SBP ■** 

#### RCPCH/RCP call for evidence

- The Royal College of Paediatrics and Child Health (RCPCH), in collaboration with the Royal College of Physicians (RCP), has established an Indoor Air Quality Working Group.
- Led by Professor Stephen Holgate speaking again at our Expo 28/2/19 at LSBU. Discount code just for you at 50% off
- The Working Group's aim is to produce an evidence-based report on the issues affecting the health of infants, children and young people exposed to poor indoor air quality in homes and schools, considering both indoor and outdoor sources of pollution.



Plastics in construction – key learning 2017/18

Complex

- We need support on this journey
- Expo 28/2/19: we have15 leading experts confirmed
- Each product is different
- ► 55,000 products half of which are synthetic
- Emotive subject knee jerk reactions
- Extremely likely to have unintended consequences







European Regional Development Fund

#### Sustainable Bio&Waste Resources for Construction (SB&WRC)

- The Alliance for Sustainable Building Products (ASBP) and its French and English partners are undertaking this project as part of the Interreg France (Channel) England programme.
- The aim is to develop prototypes of construction materials from bio-resources and recycled waste.
- University of Brighton and University of Bath
- ASBP is pleased to be co-leader for communication for the project

Find out more at www.asbp.org.uk/sbwrc



This project is supported by the INTERREG VA France (Channel) England programme and receives financial support from the European Regional Development Fund (ERDF)







European Regional Development Fund

#### **Project Partners**



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My journey with plastics in construction 2017 - What's in my uPVC window frame

- Ineos fracking for plastic. One of the world's largest manufacturers of chemicals and oil products, with sales of \$54 billion, employing 15,000 people.
- In 2016, it produced 10 million tonnes of plastic worldwide roughly twice the weight of the population of the UK
- Weston, Cheshire HBCD a brominated flame retardant; Feb 2000
- Manufacturing chlorine is highly energy intensive.. Such (energy) costs are particularly important for Ineos. Its Runcorn plant, which provides the chlorine for 95% of Britain's water, "consumes as much energy as Liverpool", says Ratcliffe.





Jim Ratcliffe CEO



No one loves the messenger that brings bad news – Sophocles

TV: Blue Planet 2, Secret Life of Landfill, Drowning in Plastic, Dr Who

Metro Headline 23/10/18.

Plastics in our water and in the air

The tragedy at Grenfell – plastic cladding

2 billion people have no access to municipal waste collection

2/3 of UK waste is exported

London recycling found in Malaysian landfill

Plastic pollution is the gateway issue for us all to take more radical action on climate change, habitat depletion, resource consumption and the rampant clear cutting of our natural world and ocean. It doesn't end at plastic:

Hugo Taghelm SAS.





#### Plastics in the budget 29/10/18

- The largest response to a call for evidence on single-use plastics in the Treasury's history was received this summer, with 162,000 responses.
- The Chancellor announced plans for a new tax on plastic packaging which contains less than 30% recycled plastic, subject to consultation.
- This forms part of a cross-government package of measures to address single-use plastic waste, including reform of the Packaging Producer Responsibility system and new funding for innovation as part of the government's wider strategy to address plastics waste
- Further detail is to be set out in the Resources and Waste Strategy later this year.



# The UK throws away an estimated 295 billion pieces of plastic every year



UK Annual Plastic Waste 1,074m diameter

The London Eye UK Annual Plastic Waste 123m diameter 92.4 million m

#### EVERYDAY PLASTIC

∕ **A** SBP ⊨

#### **Plastics and construction**

Plastic invented in East London 150 years ago 8.3bn tonnes of plastic produced to date 30% still in use 70% reached end of life

It is estimated only 14% of plastics are collected to be recycled, with just **2% recycled in a close loop**, 8% down-cycled and 4% lost. Of the rest, 14% incinerated, 40% goes to landfill and 32% leaks into the environment.

300m+ tonnes of plastic made each year – 50% single use Projected to double in next 20 years 20% of global plastic waste is from the construction sector Construction is the second largest user of plastic behind packaging

Wilmott Dixon: In 2017 approximately one third of our overall waste profile was attributable to plastic and plastic packaging





#### The big picture; Dr Jon Cullen University of Cambridge



Global demand for materials is expected to more than double by 2050.

Halving absolute emissions by 2050 will require at least a 75% cut in emissions per tonne.



Plastic is not only a versatile material allowing it to be used for a range of uses but it is also has benefits in terms of sustainability.

The plastics industry is working on a range of initiatives to reduce energy, increase recycling and prevent litter. The BPF have a sustainability committee and you can find out more about the work it is doing here.

The environmental cost to replacing plastic with alternatives materials would be nearly 4 times greater [1]

Annual Review **Business Conditions** Survey **BPF Members Groups** Central Committees Affiliated Organisations **Business Support** Network Industry Topics Meeting Facilities Join the BPF Contact Us

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#### **Plastics and Sustainability:**

A Valuation of Environmental Benefits, Costs and Opportunities for Continuous Improvement





#### **Rick Lord: Author of Plastics and Sustainability; Trucost**

#### Telecom with me; 22/10/18

Accepted that this report was not an academic report and had not been independently peer reviewed.

Accepted lumping together worst and best alternatives was not really very helpful

Accepted that there was a mistake on the BPF website *It* only uses 4% of the world's oil production - the rest is used for transport, energy, heat or is burnt. He has 8 -12%

Accepted that it was not ideal that all the assumptions needed to understand the headline figure were not provided in an 87 page report. It's because it would then be 250 pages long

Accepted that methodology in the marine plastics costings was evolving





Costing the Earth on Radio 4 24<sup>th</sup> October 2018 **Richard Mattheson**, Trucost interviewed here



## **In Praise of Plastics**

- Incredible strength to weight ratio
- Lightweight
- Cost effective
- Durable
- Shatter proof
- Barrier to moisture
- Protects
- Maintenance free
- Keeps food fresh for longer
- Deals with extreme temperatures
- Reduces breakages
- Culturally enabling
- <u>https://lowcarbonbuildings.wordpress.com/20</u>
  <u>18/03/15/in-praise-of-plastic/</u>



## The Business of Plastics

- There are 6,200 plastic firms in the UK employing 170,000 people. It is the second biggest direct employer in the UK.
- The UK plastic industry has a turnover of £25.5 billion....one and half % of GDP
- 5m Tonnes manufactured in the UK
- \$180bn investment in plastic factories feeds global packaging binge
- The polyurethane foam industry is projected to reach a worldwide value of up to \$74bn by 2022



## Plastics are everywhere

- You can imagine a room with plastic paint on the walls and ceiling, plastic windows, plastic flooring, plastic wiring, plastic junction boxes and plug sockets, plastic coving, vinyl wallpaper, plastic worktops, plastic cupboards, plastic chairs
- Plastics are in timber: 10% of the weight of OSB board is plastic binders
- Plastics in natural insulation: 10% by weight is plastic binder
- Piping and conduit account for 35% of plastic in construction



## Whole life Plastics – the issues

**Extraction phase**: Based upon crude-oil/shale gas of unknown origin - a finite resource, major contributor to climate change

**Manufacturing phase**: Intermediate chemicals, health impacts of workers, waste from processing facilities

**Use Phase**: Plastics in our blood and gut. Phthalates, heavy metals, fire and toxicity, VOCs, chemicals, dust levels, moisture, marine plastic

End of life phase: Marine plastic, Re-use challenge often caused by the use of additives, likely to be downcycled, waste, landfill and toxicity



#### **Plastics**





#### **Figure 1: Plastics: Environmental Preference Spectrum**



Rossi, Mark & Tom Lent, "Creating Safe and Healthy Spaces: Selecting Materials that Support Healing" in *Designing the 21st Century Hospital*, Center for Health Design & Health Care Without Harm, 2006, page 66 (http://www.healthybuilding.net/healthcare/HCWH-CHD-Designing the 21st Century Hospital.pdf)



## Plastics – the issues; Highly energy intensive

#### PVC – oil/gas and salt water

Demand for PVC products in Europe is close to 5 million tonnes per annum, with window profiles accounting for 28% or 1.4 million tonnes.

PVC is produced by the polymerisation of vinyl chloride monomer, which is in turn derived from ethylene dichloride. Ethylene dichloride is obtained from the reaction of ethylene with chlorine, with the ethylene being obtained by steam cracking of hydrocarbons derived from **fossil oil** reserves.

Chlorine is produced from brine (salt solution) by the chlor-alkali industry. Total chlorine production in Europe was nearly 9.7 million tonnes in 2016, with the largest single end use (33%) being for PVC production.



#### Plastics – the issues; Nurdles

FIDRA study 2018 – Nurdles (plastic pellets) found on 93% of UK beaches

I'm looking forward to Claire Wallerstein's talk - RAME Peninsula Beach Care







## Plastics – the issues: health and wellbeing

**Phthalates** are a group of chemicals that are often found in PVC sheet flooring, cables, extruded plastics, coatings and other flexible plastic products.

They are released during production and distribution but it is alleged 95% offgas during use and disposal.

Researchers have linked phthalates to asthma, attention-deficit hyperactivity disorder, breast cancer, obesity and type II diabetes, low IQ, neurodevelopmental issues, behavioural issues, autism spectrum disorders, altered reproductive development and male fertility issues.

The EU took action to restrict the use of four of the most damaging ones in July this year



### Plastics – the issues: health and wellbeing

**Heavy metals** are associated with a wide range of conditions, including kidney and bone damage, developmental and neurobehavioural disorders, elevated blood pressure and potentially even lung cancer,

Still often being used in petrochemical building products like plastics, finishes, coatings and acrylic varnishes and paints.

This is then justified with the very low concentration and hence minimal health risk ignoring that these are often bio accumulative and build up in the food chain and organs over time.



### Heavy Metals – the issues: health and wellbeing

Some examples of heavy metals used in construction materials as pigments, insecticides, fungicides, flame retardants or stabilisers are:

Antimony	Flame retardants
Arsenic	Timber treatment, PVC
Lead	Paints and lacquers, plastic stabilisers
Cadmium	PVC, pigments
Chrome	Timber treatment, paints and lacquers, plastics, textile treatments
Copper	Synthetic carpets, pigments, timber treatment
Nickel	PVC, pigments
Mercury	Timber treatment, paints and lacquers, leather, plastics, textile
treatments	
Tin	Timber treatment, flame retardants, preservatives, PVC, paints and
lacquers, plastics	



Products

### Plastics – Fire and toxcity

Richard Duffy, International Association of Fire-fighters, USA "*Exposure to a single PVC fire can cause permanent respiratory disease. Due to its intrinsic hazards, we support the efforts to identify and use alternative building materials that do not pose as much risk as PVC to fire-fighters, building occupants and communities*".

In conditions of uncontrolled burning, uPVC may release dioxins or phosgene, as will any organic material burning in the presence of chlorine.

The main hazard from uPVC in a fire is from the generation of large amounts of hydrogen chloride.

Professor Anna Stec In briefings to senior health agency staff, Stec said she had found "huge concentrations" of potential carcinogens in the dust and soil around Grenfell tower in west <u>London</u>, and in burned debris that had fallen from the tower.

High levels of hydrogen cyanide were also present in the soil she analysed.





## Plastics – Fire and Toxcity

Although the inhalation of toxic smoke is the biggest killer and the largest cause of injury in fires, it is very much the neglected area of fire science and fire safety engineering.

14:54, 5 February, 2017 Six crews dashed to Hanbury Plastics centre in Milton, Stoke-on-Trent, at 9.30am yesterday after the service received 78 calls in ten minutes about the blaze.

Graham Shaw, 63, said: "It questions whether the plastic factory should be built so close to residential properties. "It is the most smoke I have ever seen. The question is whether it is toxic."





# Research 1/8/18: Methane and ethylene produced from plastic in the environment

the most commonly used plastics produce two greenhouse gases, methane and ethylene, when exposed to ambient solar radiation. Polyethylene, which is the most produced and discarded synthetic polymer globally, is the most prolific emitter of both gases.



#### Plastics – 12 reasons it's all quite complicated

1) Health and Wellbeing; complexities



**Overview of known plastic packaging-associated chemicals and their hazards** lists 906 chemicals likely associated with plastic packaging and 3377 substances that are possibly associated.

Our work was challenged by a lack of transparency and incompleteness of publicly available information on both the use and toxicity of numerous substances

We don't really know the implications of human ingested plastics



Plastics - 12 reasons it's all quite complicated

2) Navigating the Data (bull) e.g. Lindab and BPF

## Lindab steel - a green effect on today's environment



(GRW) Global Warming Potential relative comparison

Galvanised steel

Cast iron

Zinc

PE

PVC

Copper

Aluminium

As our study shows, all metals in the comparison have advantages over plastic materials when it comes to recycling with steel performing the best of all.



e Alliance Sustainable Iding Products 3) BRE Green Guide

- There is just one domestic uPVC window listed on the BRE Green Guide, which scores A, which is detailed here; <u>https://www.bre.co.uk/greenguide/ggelement2.jsp?buildingType=H</u> <u>ousing&category=13&parent=0&elementType=10110&eid=15639</u>
- It scores badly on Climate Change D and Water Extraction E and Fossil Fuel Depletion E and Waste Disposal C...but still ends up with an A rating. It is not clear how this is possible?
- ASBP would intuitively challenge the A+ ratings for toxicity.



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## Plastics – 12 reasons it's all quite complicated

4) Some Life Cycle Analysis shows plastic is better

**Environment Agency study on plastic bags** To do better than a conventional 'single use' carrier bag, a paper bag would need to be reused 3 times, and the equivalent figures for LDPE bags for life and cotton bags were 4 times and 131 times respectively. And this is all assuming that the 'single use' bag was only used once; obviously if it's reused itself, it is environmentally even more advantageous compared to paper, cotton and LDPE.

5) The complexity of LCA

6) The shortcomings of LCA...no human health considerations

7) Comparing EPDs - Setting the functional unit



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## Plastics – 12 reasons it's all quite complicated

- 8) There are many types of plastics
- 9) Quality concerns with higher recycling rates performance
- 10) Each product has its own footprint; 15,000 products in building
- 11) What about bioplastics?
- 12) Should plastice be biodegradable?



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Material – ICE database	kgCO <sub>2</sub> /kg
Vitrified clay pipe	0.55
Lino	1.21
Galvanised steel sheet	1.45
PVC Pipe	2.56
Vinyl flooring	2.61
Polyurethane - rigid foam	3.48
Wool	5.53
Aluminium	9.16
Nylon carpet with pile weight	9.7
500g/m2	



#### Case Study - Skanska

An example is the decision in 2000 by our Nordic commercial development unit (CDN) to voluntarily phase-out PVC pipes and cables. This was done to avoid the risk of hydrochloric acid generation should a building catch fire since renovation costs are known to be higher where PVC is used.



#### Possible alternatives

	Pointless	Replaceable	Problem	Harder to Replace	Essential
DPM					
Underground					
pipework					
Rainwater					
pipe					
Guttering					
Windows					
Doors					
Cladding					
Insulation					
Coving		✓			
Skirting					
Electrical					
cables					
Conduit					
ME Plant					
Tile spacers			$\checkmark$		
Raw Plugs			1		



#### Comparing products

Product - Windows	Health	Carbon	Cost	Lifecycle
Aluminium	•	•	•	
uPVC	•	•	•	
Wood	•	•	•	
Product - Guttering				
ARP	No specific info	100% Renewable energy Section 0.9mm No EPD	>5%	30 plus years



# Biome Bioplastics; Paul Mines CEO on Costing the Earth on Radio 4 25/10/18

- Potatoes, Corn starch, Cellulose acetate from trees
- Mixed together under heat and pressure
- Pellets.....bags cups etc
- 70% bio-based
- All compostable fragment completely biodegraded within 3 months. Temp controlled, water controlled
- ▶ No heavy metals or plasticizers.....
- Will not contribute to marine pollution
- Plastics v food
- 13bn plastic bottles used in UK each year



#### Wooden Laptop







# Scottish National Performance Centre for Sport at Heriot-Watt University Edinburgh





#### BIOHM - Mycelium; grow your own insulation



superior insulation qualities, is naturally self-extinguishing, feeds off waste while it grows, and purifies the air once in place.



## **Plastics in products**

Bath University researchers say <u>up to 10% of sand in</u> <u>concrete can be replaced by plastic</u> without significantly affecting concrete's structural integrity.



#### In conclusion

- Precautionary Principle
- Collaboration between Fire and Rescue, demolition and building professionals
- Journey
- Next steps; ASBP Technical working group on plastics
- Expo 28/2 Discount Code 50% off ASBP1NOV
- Simon Corbey
- ▶ <u>simon@asbp.org.uk</u>
- www.asbp.org.uk



# What 1 specific product would you say would be best for me to focus on and why

24/10/18 NYTimes: New York Sues Exxon Mobil, Saying It Deceived Shareholders on Climate Change



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WOOD, AT THE HEART OF A GOOD WINDOW The Wood Window Alliance

#### Kindly sponsored by

# **Plastics in Construction**

Issues, Impacts and Alternatives

Thursday 28th February 2019 London South Bank University

We are delighted to announce our keynote speakers; environmentalist & yachtswoman Emily Penn, a leading advocate for reducing plastic pollution in our oceans; and Professor Sean Smith, Director of Sustainable Construction at Edinburgh Napier University.

Book tickets at <a href="https://www.asbp.org.uk/healthybuildings2019">www.asbp.org.uk/healthybuildings2019</a>

