Pharma Special Interest Group Climate Change Context and Action Plan

Introduction - Overall problem statement	The Pharma Special Interest Group (Pharma SIG) notes IChemE's position on climate change. The action plan presented here follows on from this statement and forms part of IChemE's delivery against several of the commitments set out, namely to: ▪ develop detailed positions and action plans for economically sustainable and secure transitions to net zero carbon emissions in all areas of chemical engineering practice and regions where members are active. It will also help underpin work on several other commitments, including: ▪ provide policy advice to governments based on chemical engineering experience and expertise ▪ engage in public outreach activities with businesses and communities, to understand their concerns about the threats and uncertainties posed by climate change ▪ develop training courses and mandate CPD to provide the knowledge and skills to support members in the transition to a net zero carbon economy and in climate change adaptation ▪ encourage all regional member groups and special interest groups to hold webinars and seminars as part of the CPD programme to enhance skills and knowledge in pursuit of zero carbon futures and understanding of climate risks, and to engage with the wider membership.

Specific problem statement	The pharmaceuticals and medical technology industries (including veterinary medicines, vaccines, and medical devices) are significant emitters of greenhouse gases. For instance, CO_2 emissions are generated at manufacturing facilities that may employ energy intensive unit operations, high turnover HVAC systems for hygienic areas, and have regular cleaning and steam sterilisation cycles. Most, if not all, pharmaceuticals and medical technology manufacturing processes have multiple steps, consuming large quantities of raw materials and generating a commensurate amount of waste. The manner the industries' products are packaged and distributed – often in single-use plastics and transported across continents – gives rise to further environmental impact. For example, in 2012, the SDU's research suggests that 21% of NHS in England GHG emissions were attributed to pharmaceuticals and 11% to medical devices (1). Another study (2) in 2015 showed that the pharmaceutical sector accounted for approximately 3% of all greenhouse gas emissions in Canada, which is on par with that generated by air travel (also 3%). Medicinal and medical products tend to be high value and low volume, which coupled with the large set-up and operational costs leads to batch processing in multi-product facilities. his type of processing has inherent inefficiencies, necessitating wasteful changeover processes and additional cleaning. Pharmaceuticals, vaccines, and medical technologies are intended to bring health benefits to society and IChemE recognise that these benefits should be widely and increasingly available. Pharma SIG recognises the importance of a holistic systems approach in maximising the benefits and minimising the harms arising from the transition of the pharmaceutical industry to an environmentally sustainable state. Improving process and energy efficiencies to reduce climate impact has an important co-benefit in that it should lower the cost of goods, and hence improve access to medicines. The industry response to the global pandemic has shown how impressively the pharmaceutical industry's working with governments and academia, can respond to a global crisis. Climate change is just such a crisis.

What actions need to be taken to address the issue?	The climate emergency is affecting all industries in which IChemE members discharge their professional duties. As such, the Pharma SIG suggests that the Institution's approach might be to incorporate climate change awareness and mitigation into its core values, ie ▪ publicise the climate emergency, along with how the organisation can assist ▪ push for the chemical engineering profession to accelerate the adoption of science-based sustainability measures and targets ▪ provide reskilling and retraining opportunities and strengthen course accreditation requirements with regards to sustainability and climate change teaching as appropriate. Pharma SIG can support this through the provision of appropriate webinars and/or by working with Ed SIG to develop teaching materials relevant to the pharmaceutical industry ▪ promote research and innovation (academic and industrial) specific to the Climate Crisis. Pharma SIG will contribute to this through its technical activities. **The Pharma SIG's Responsibilities with respect to Climate Change** IChemE provides the leadership and a framework for the organisation as a whole, under which the Pharma SIG can participate by engaging with chemical and biochemical engineers working within the pharmaceutical and medical technologies sectors. These engineers have opportunities to influence the development and production of medicines and devices reducing the environmental impact of the whole supply chain, not just activities in the territories where IChemE is the main chemical engineering institution. **Publicise the climate emergency** The industry specific publicity that the Pharma SIG can get involved with includes: ▪ increase pharma sector awareness of the climate emergency, highlighting any particular areas that the sector can focus on ▪ hold Pharma SIG technical events and training sessions on the climate emergency ▪ work with other pharmaceutical and medical technology groups to develop and disseminate cross-discipline good practice. **Develop a Net Zero Carbon Emissions action plan** The Pharma SIG will play its part in developing technical contributions towards net zero. Examples of technical contributions include: ▪ promote the use of green chemistry to reduce the use of organic solvents and their recovery during the manufacture of pharmaceutical products ▪ evaluate the use of wash in place (WIP) systems against single use technology (SUT) for unit operations ▪ promote the use of renewable energy and the recovery of waste energy ▪ promote the use of sustainable and environmentally friendly packaging ▪ reduce transport costs by promoting 'pack where produced' philosophies so that the transport and shipment of pharmaceutical intermediates is reduced. ▪ work with automation engineers, building services engineers and process architects to reduce the energy consumption of HVAC in ATEX and hygienic facilities ▪ promote the use of lifecycle assessment techniques to the design of

	pharmaceutical products, supply chains and facilities to reduce waste and minimise environmental impact ▪ promote the use of systems approaches to ensure the best overall benefits are achieved for pharmaceutical products and processes with the impact on the environment being an explicit part of these. **Chemical Engineering Profession to adopt Science-Based Sustainability Measurements and Targets** The Pharma SIG could undertake tasks such as: ▪ help benchmark the pharma sector's challenges and responsibilities by working within the sector to agree standardised, definable metrics for determining the total carbon footprint. Any measures and metrics used should be based on the output of each country/region and adopt a broad life cycle approach and align to the United Nation's Sustainable Development Goals (SDGs) ▪ supporting members and their organisations in their journey towards science-based sustainability measurements and targets. Act as a convenor of stakeholders in the field of pharmaceutical industry 'decarbonisation' ▪ providing guidance on pharmaceutical sustainability, demand reduction, recollection/reuse of medical devices and waste to energy options ▪ actively promote the pharma climate crisis and develop Pharma SIG's outreach programmes to raise awareness of what net zero and science- based targets mean from a pharma Industry perspective and why these are imperative.
What skills, training gap or facilitation requirements need to be addressed?	With new ways of thinking and working comes the need to adapt existing skills and learn new ones. The Pharma SIG will assist this effort by providing training and support on: ▪ how to conduct a rigorous and structured sustainability audit at site or corporate levels. An example would be how to apply the HAZOP technique – routinely used by (bio)chemical engineers for safety risk analysis – to finding process inefficiencies and waste reduction opportunities ▪ data collection and analysis – define the important measurements and how they are collected and interpreted ▪ encourage organisations to report on environmental performance in a recognised and standardised format ▪ turn opportunities identified into viable improvement projects.

What actions should the SIG and its members take to support delivery of the above actions?	The climate emergency is predicted to disproportionately affect the poorest countries and members of society (3). Going forward on this premise, demand for affordable medicines/medical devices will increase as the climate emergency worsens. Pharma SIG has already set up a project to raise awareness of this potential issue, called *Access to Medicines in the 21st Century*, has published articles in *The Chemical Engineer* as part of this and will continue to make this a key objective for future initiatives. Also, the Pharma SIG has formed a joint working group with the Institution of Mechanical Engineers (IMechE) Pharmaceutical Committee and the UK affiliate of the International Society for Pharmaceutical Engineering (ISPE). We will continue to look to collaborate with all other willing professional engineering institution's (PEI's), organisations, companies, and governments with compatible stances on the Climate Emergency as well as pharmaceutical regulators to facilitate change.
What actions will you encourage others to take?	Increasingly, IChemE are seeing discourse and public communications from other professional organisations – for example, The Institution of Civil Engineers (ICE) climate declaration pledge (4), or the Alliance of World Scientists who published this statement endorsed by over 13,000 scientists across more than 150 countries (5). The Pharma SIG welcomes this cross-party approach. To this end, the Pharma SIG will encourage and assist the IChemE in promoting relevant research and innovation (academic and industrial). In the case of the Pharma sector, this should include supporting research into technologies that enhance sustainable supply at a reduced the cost of goods without compromising quality. Advances in continuous processing, biologics, robotics and process analytical technology are amongst the technologies currently being progressed (6). **Pharma SIG Collaborations** The Pharma SIG has close working relationships with other IChemE SIGs and external professional organisations, such as the Biochemical Engineering SIG, ISPE and the IMechE. Moreover, its members tend to work in the pharma sector for research, manufacturing, contracting or consultant companies. Therefore, Pharma SIG would seek to form co-operative partnerships to deliver webinars, articles, papers and events to improve awareness and understanding of the Climate Emergency. There are other organisations in the pharma sector with similar programmes, the ABPI's *Manufacturing Vision for UK Pharma* (6) for instance, and they too will be approached if there is a mutual benefit in doing so.
Next steps	**Short Term Horizon (12 Month)** ▪ create sustainability as one of three Pharma SIG work streams (**completed** Summer 2021, the other two being Digitalisation, and Pharmaceutical Engineering Education and Training) ▪ expand number of volunteers and set up task sub-groups

- establish a working group with ISPE UK and IMechE with regular meetings (**completed** Summer 2021)
- define the Terms of Reference for joint working group and get approval from IChemE, IMechE, ISPE UK
- set up a forum for pharmaceutical engineering design and construction companies
- organise a series of webinars. There may be subseries on specific areas, eg product design, process design, operational efficiency, supply chain
- contribute to the ISPE European Conference 2022
- deliver a sustainability related presentation at the next Making Pharma conference.

Medium Term Horizon (by 2024)

- link up with existing Pharma sustainability forums
- research the targets and activities of established Pharma companies in this area
- provide a weblink guide to existing resources
- collate published Pharma company footprints and commitments
- explore the possibility of setting up a Sustainable Pharma Conference (live or virtual)
- promote the use of lifecycle analysis
- integrate sustainability into the Digitalisation, and Pharmaceutical Engineering Education and Training workstreams

Long Term Horizon (beyond 2024)

- the Pharma SIG's intention is that by 2024 our short and medium term actions to combat Climate Change will become part of the fabric of chemical engineering in the Pharma sector.

References

(1) https://www.sduhealth.org.uk/areas-of-focus/carbon-hotspots/pharmaceuticals.aspx. [Online] [Cited: 30 April 2020.]

(2) Eckelman MJ, Sherman JD, MacNeill AJ (2018, *Life cycle environmental emissions and health damages from the Canadian healthcare system: An economic-environmental-epidemiological analysis*). [Online]

(3) World Health Organisation *Climate change and health*, 01-Feb-2018. [Online] [Cited: 26 Mar 2020.] https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health.

(4) https://www.civilengineersdeclare.com/. [Online] [Cited: 30 Mar 2020.]

(5) https://scientistswarning.forestry.oregonstate.edu. [Online] [Cited: 30 Mar 2020.]

(6) Association of British Pharmaceutical Manufacturers, *Manufacturing Vision for UK Pharma*, https://abpi.org.uk/media/1344/manufacturing_vision_for_uk_pharma.pdf. [Online] [Cited: 26 Mar 2020.]