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PFAS in the Environment and Packaging

Per- and Polyfluorinated alkyl substances (PFAS) are represented by over forty-one (41) individual compounds, around thirty (30) of which are under study by the US Environmental Agency (US EPA), various state EPA or Dept. of Environmental Protection (DEP) organizations, private industry, and universities (U Florida, Harvard[1] and others). This family of chemicals has been studied in the environment by EPA, industry, and academia since the later 1990s and early 2000s. PFAS compounds were labeled 'forever chemicals' due to their resistance to chemical or biological breakdown and bioaccumulation in animal and plant tissues. There is extensive environmental and medical literature publicly available detailing direct linkage of long-term exposure of PFAS compounds to various cancers, autoimmune diseases, and birth defects.

Contrary to some allied industry reports, specifically minimizing the extensive presence of PFAS compounds, its presence in the environment including many potable water supplies, foods, and up to 98% of the human tissues and sera sampled confirm its ubiquitousness. The presence these PFAS compounds in the environment is not a recent development; however, the presence of PFAS in pesticides as a direct result of the fluorination of HDPE packaging is very new having been reported in late 2020. Reference https://www.epa.gov/pesticides/pfasppackaging.

To be clear PFAS compounds are not an intentional additive at any step along the manufacturing chain for polyethylenes used in plastic packaging. The presence of PFAS compounds is either the result of post manufacturing fluorination treatment of high-density polyethylene (HDPE) bottles by a secondary fluorination treatment contractor or by what is known in the packaging industry as "in-mold" fluorination during the HDPE extrusion process. Fluorination of HDPE containers used for the transportation and storage of industrial chemicals including pesticides, automotive maintenance products, and volatile organic compounds (VOC's) reduce escape of potentially toxic or flammable materials from seeping through the walls of HDPE containers (aka 'permeation'). Additionally, many fluorinated HDPE containers and packaging are used for food, pharmaceuticals, and personal care products in which the presence of PFAS compounds have direct human exposure at a high level.

The post manufacturing fluorination of HDPE containers is largely the domain of one US company but there are other companies that utilize the "in-mold" fluorination process. Fluorination of HDPE packaging is not a preferred technology in the EU due to the dangers of the process involving fluorine gas (highly toxic). Technology has been developed to remove or minimize PFAS compounds on fluorinated HDPE (fHDPE) but it is expensive and does not account for the safe disposal of the resultant rinse water which contains the PFAS compounds.

It should be noted that this most recent discussion of fluorinated HDPE packaging is based on activities surrounding the work of the US EPA and, in one case, the Massachusetts Department of Environmental Protection (MA DEP) regarding the presence and accumulation of PFAS compounds in the environment and consequent human lifetime exposure. MA DEP confirmed

[1] Uncovering hidden forever chemicals (harvard.edu)

the presence of PFAS compounds in a mosquito control pesticide after being alerted by the MA Public Employees for Environmental Responsibility (PEER) in November 2020. Subsequently, MA DEP requested that the US EPA step in and investigate further to confirm presence and determine source of these PFAS compounds.

Initial tests conducted of fluorinated polyethylene (fHDPE) pesticide bottles extracted levels of PFAS compounds in the 20 – 50 parts per billion (ppb) range in the samples analyzed and virtually none in the non-fluorinated control samples. This result from the fluorinated samples is over 700 times the Human Contaminant Level of 0.07 ppb *lifetime* the EPA proposed in a recent Federal Register proposal for water supply regulations. In that some industry reports take these levels as being "small" it should be noted those 20-50 ppb levels still could be 25 times the EPA long term adult exposure (environmental—not direct contact) of 20 nanograms (ng) per kilogram body weight per day.

Further EPA studies (https://www.epa.gov/sites/production/files/2021-03/documents/results-of-rinsates-samples_03042021.pdf) confirmed the 20—50 parts per billion range levels on the outside of the fHDPE pesticide bottles impacting everyone in the supply chain touching those bottles including consumers purchasing these fHDPE containers in retail settings. This direct human contact will have high level of exposure, not secondary ingestion of diluted exposure via water supplies.

Although this one pesticide was the "sample zero" for the recent discovery, it has come to light that other HDPE packaging samples from other chemical manufacturers have shown levels of PFAS compounds both in their products as well as the inner and outer surfaces of the containers. It has been commented that this observation may be overbroad, but we believe the contrary. Federal and State governmental agencies, academia, and private industry are looking in a rather targeted manner at the contribution of fHDPE in the form of packaging to the PFAS environmental burden while the FDA and related State agencies examine food and drug packaging regarding more direct human exposure. To this end, several States have begun banning the presence of PFAS compounds both on plastic and food packaging. Even the EPA recently stated that it recommends users of fHDPE packaging exercise due diligence in finding alternative packaging.

A secondary issue involving fHPDE packaging that has not yet been investigated is the presence of these PFAS compounds in the recycled plastic. It seems to reason that since PFAS compounds have been discovered in fHPDE pesticide containers, these 'forever chemicals' would travel with the supply chain wherever fluorination has been used. It is estimated that approximately 40% of agricultural chemical containers, e.g., pesticides, are fluorinated. These agchem containers according to Federal Law must be triple rinsed after use and before disposal with the rinsed container now serving as a source for recycled HDPE. https://www.acrecycle.org/ One of the products made with this recycled plastic is ground water irrigation pipe. Consequently, neither the rinsate from the triple rinse process nor the actual agchem container nor the finished product made of the recycled product have been tested for the presence of PFAS compounds. This leaves a wide-open question of how fHDPE maybe contaminating the environment risking human exposure not only in the initial usage but also thru the whole life of the fHDPE.

There are alternative barrier products for HDPE packaging that offer the equivalent or superior permeation protection while adding prevention from ingress of oxygen and water vapor that can also damage a sensitive product are widely available and cost competitive. They are not made with the intentional addition of fluorine compounds or any of the PFAS family of 41 + compounds.

Claims that fHDPE is the only 100% recyclable closed loop does not consider these other barriers, most of which are equally recyclable.

Finally, Hollywood's 2019 legal thriller titled ***Dark Waters***, regarding PFAS contamination of a West Virginia town's water supply by DuPont, has increased the public's awareness of the severity of these 'forever chemicals'. PFAS producers have been hit with over $4 billion dollars in suits[2]. PFAS compounds that are used in firefighting foams are the object of several lawsuits, the last of which was a single $17.5 million award. While the utility of these compounds over the past decades is not being denied, the recent publicity of fHDPE pesticide containers and the potential for ill effects in human exposure makes it easy to agree with the EPA that alternatives need to be investigated with due diligence and due speed. Neither the EPA nor private industry nor public and private agencies have fully investigated fluorinated HDPE packaging, utilized for over forty years, as a source of environmental contamination and human exposure. As the recent petition filed by Earth Justice (https://earthjustice.org/sites/default/files/files/pfas_pmn_exemptions_petition_04-27-2021.pdf) argues, no amount of small exposure to PFAS compounds are acceptable and that it is high time that these toxic 'forever chemicals' are no longer tolerated to exist either directly or as a byproduct. For these PFAS compounds not only pose a threat to the present, they also pose a threat 'forever.'

PFAS References

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