# Preventing the Spread of SARS-CoV-2 on Single-Use Plastics through Enhanced Ecobricking

A Proposal for Civic Action

to Flatten the Spread of CoVid-19

Developed by the Global Ecobrick Alliance

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### Summary

A novel human coronavirus (SARS-CoV-2) emerged in Wuhan, China, in late 2019 and is now causing a global pandemic<sup>1</sup> of the CoVid-19 disease. The spread of the disease has resulted in a sharp rise in the production and consumption of single-use plastics, such as food packaging<sup>2</sup> and medical products<sup>3</sup>. Following historical patterns of waste accumulation and lowering of sanitary conditions during pandemics<sup>4.5.6</sup>, Wuhan province local waste management systems were unable to keep up with a 600% increase in waste in February and March 2020-- in particular single-use medical and consumer plastic<sup>7</sup> One of the primary constituants of single-use plastics is polypropylene<sup>8</sup>. In March 2020, research was published by US researchers that showed that SARS-CoV-2's viability a polypropylene surface had an estimated half life of 6.8 hours and viruses still detectable after 72 hours<sup>9</sup>. These results were similar to a 2015 study of corona virus 229E, which showed that it remained infectious in a human lung cell culture after five days of persistence on PVC plastic<sup>10</sup>. Field research into the virus's initial spread in China infers that surface spread was a likely transmission factor.<sup>11</sup> Given these findings, it is clear to the Global Ecobrick Alliance (GEA) that the intensity of human/plastic interaction during the consumption of single-use-plastics, makes such plastics a potential route for SARS-CoV-2 transmission. Also based on these findings, the GEA is promoting an enhanced ecobricking technique during the Covid-19 pandemic of immediately washing plastic after consumption using the World Health Organization Hand Washing Guidelines<sup>12</sup>. Enhanced ecobricking ensures that single-use plastic does not linger to become source of viral transmission, and that it is permanently contained -- in particular until the virus's period of vitality expires<sup>13</sup>. By mobilizing civic action in ecobricking single-use-plastics, the stress on centralized waste management systems can be reduced as well as the potential contamination caused by pileups of unprocessed waste, and by later dumping and/or incineration. The low-tech accessibility of ecobricking means that enhanced ecobricking can be rapidly promoted by the GEA, governments and the media as a means for meaningful citizen participation in curbing the spread and impact of CoVid-19 pandemic. Ecobricks can then provide a post-pandemic building block for community resiliency projects.



## SARS-Cov-2 and single-use Plastic

During the Covid-19 pandemic millions of citizens are practicing social distancing and remaining at home. Millions of others are now compelled to stay indoors, out of work and in quarantine. During this time, the consumption of plastic packed food and medical products is increasing. We conjecture that single-use plastic poses a notable risk for transmission due to the intense period of human/plastic physical interaction during its consumption period.

#### An Increase in Single-Use Plastic Consumption

Historically pandemics are associated with a rise in the production of human wastes of all kinds, and a decrease in social capacity to deal with it<sup>4</sup>. Human and medical waste plays a large role in spread of ebola<sup>6</sup>, while history shows a high correlation between pandemics, low sanitary conditions and solid waste management failures<sup>5</sup>. This has lead the UN to declare waste management an essential public service during the CoVid-19 period.<sup>14</sup>

Currently, social trends indicate a significant increase of the use single-use plastic for both medical and food packaging purposes. In February 2020, hospitals in Wuhan, produced more than 240 tonnes of medical waste daily during the peak of the outbreak, compared with 40 tonnes before the epidemic.<sup>15</sup> Meanwhile, in the UK and England, companies are returning to single-use plastic products<sup>16</sup> while companies producing plastic packed manufactured foods<sup>17</sup> are seeing an increase in sales<sup>18</sup>

#### The Risk of Transmission through Single-Use Plastic

According to the Secretariat for the Basel Convention, "The safe management of household waste is... likely to be critical during the COVID-19 emergency"<sup>19</sup>. In a letter published March 15th in the New England Journal of Medicine (NEJM) concludes that "SARS-CoV-2 was more stable on plastic and



stainless steel than on copper and cardboard, and viable virus was detected up to 72 hours after application to these surfaces. The longest viability of both viruses was on stainless steel and plastic; the estimated median half-life of SARS-CoV-2 was approximately 5.6 hours on stainless steel and 6.8 hours on plastic."



Concentration of viable SARS-Cov-2 virus in a sample, TCID<sub>50</sub>\* per litre of air, log scale

Illustration 1: Results of a New England Journal of Medicine published research letter on the persistence of SARS-CoV-2 on various surfaces –Image: The Economist, Daily Chart, March 19th, 2020

The March 2020 research concurs with a 2015 study of Corona 225-C, in which researchers observed:

"the virus retained infectivity for 5 days on all surfaces... Therefore, natural contamination of common surface material with very few coronavirus particles could represent a considerable risk of infection spread if touched **and transferred** to facial mucosa."<sup>20</sup> Researchers in the 2015 study, also concluded that "an infection may be contracted by touching contaminated surfaces" and that the "pathogenic human coronavirus 229E remained



*I*lustration 2: Persistence of infectious human coronavirus on common surface materials. - Human Coronavirus 229E Remains Infectious on Common Touch Surface Materials



infectious in a human lung cell culture model following at least 5 days of persistence on a range of common nonbiocidal surface materials, including plastic".

Field research into the virus's initial spread in China infers that surface spread, such as on elevator buttons in a mall, was also a likely transmission factor.<sup>21</sup> This reinforces the conclusions of the authors of the NEJM letter: "Our results indicate that aerosol and fomite transmission of [SARS-CoV-2}] is plausible, since the virus can remain viable and infectious in aerosols for hours and on surfaces up to days (depending on the inoculum shed),". This conclusion echoes that of corona virus 229E, in which these forms of transmission were associated with nosocomial spread and super-spreading events."

From this research, the Global Ecobrick Alliance conjectures that consumption of single-use-plastics (such as food packaging or face masks) involves intimate human interaction. The handling of the plastic brings it within the proximity of breath and droplet contact during the period of its usage. Unlike reusable glass or ceramic items, single-use plastic is not normally washed and cleaned. Often consumed plastic will remain on a table or public space for minutes or hours. The disposal and solid waste processing of plastic requires a second phase of human interaction, which puts recycling and waste collection workers at risk<sup>22</sup>.

#### **Eventual Virus Deactivation**

Both studies showed clearly that the viruses were most viable in the hours immediately following deposit on the surfaces. Illustrations 1 and 2 show the inverse exponential drop in virus quantity and infectiousness over time. For viruses on surfaces, the NEJM study indicated that the SARS-CoV-2 viability drops off to indetectability after 96 hours on plastic. 2015 research into the coronavirus 229E, likewise indicated that after 5 days that virus was no longer detectable on any surface type<sup>23</sup>.



#### Hand Washing as the Most Effective Technique for Viral Deactivation

Dylan H. Morris, (M.Phil. Princeton University, Princeton) one of the studies co-authors of the NEJM research, advised in a National Geographic interview "**to carefully wash items [everyday surfaces] and one's own hands.**"<sup>24</sup> The interview concluded that "the simple combination of soap and water remains one of the strongest weapons against infectious diseases, including the novel coronavirus"

According to the WHO, handwashing with soap is an effective means to kill the SARS-CoV-2 virus and prevent transmission. The WHO encourage detergent (plain soaps) handwashing with water to physically remove transient contaminants and has disseminated them to the general public during the Covid-19 epidemic: "Washing your hands with soap and water or using alcohol-based hand rub kills viruses that may be on your hands."<sup>25</sup>



## **Enhanced Ecobricking**

An ecobrick is a PET bottle packed with used plastic to a set density to create a reusable building block. Over the last decade ecobricks were produced primarily as a means of managing plastic waste by sequestering it and containing it safely. The GEA has promoted ecobricking as a means of plastic sequestration: by terminally reducing the net surface area of the packed plastic, it's degradation into toxins and microplastics can be prevented<sup>26</sup>. Ecobricks can then be used to produce modular items, including furniture, garden walls and other structures.<sup>27</sup>

#### COVID-19 Ecobricking relevance

We believe that the core ecobrick process of securing consumed plastic in a PET bottle, has pressing relevance for the Covid-19 outbreak.

- Ecobricking can secure clean plastic from being contaminated and become a vehicle for virus transmission
- Ecobricking by the general population can remove single-waste plastic from the waste stream thereby reducing the strain on centralized waste management systems.
- Increase the safety of waste management workers.
- Should contaminated plastic be packed into the bottle, the containment of the virus will lead to its safe deactivation after several days.<sup>28</sup>
- Ecobricking can provide meaningful active participation by the general public to curb the spread of the pandemic



- Ecobricking can prevent the dumping, incineration and eventual environmental contamination by single-use-plastics consumed during the pandemic.
- Ecobricks created can be used after the pandemic to build community resiliency projects such as gardens and green spaces

#### CoVid-19 Enhanced Ecobricking

In order to enable the additional service of containing potentially contaminated plastic, the GEA has updated its ecobricking guidelines and best practices. Prior to the epidemic the GEA Guidelines already included the cleaning and drying of plastic before packing (in order to prevent microbial growth and methane gas formation). The GEA is extending these recommendations to the immediate cleaning and drying of plastic right after consumption.

#### To Start...

- Have a small to medium sized PET bottle (>700ml / >25oz), a packing stick, and scissors ready to go.
- Prepare a soap and water cleaning station for both your hands, tools and your plastic. Familiarize yourself with WHO hand cleaning guidelines.
- Prepare a system for drying your cleaned plastic-- an outdoor clothesline is ideal. Placing inside a pillowcase in a warm room works also.

#### Immediately prepare the plastic...

• As you are consuming plastic (i.e. removing bread from a bag or noodles from a packet) be sure to open the plastic in such a way that remains one contiguous piece.



- When consuming food inside a package, store any items left over (i.e. transfer extra noodles to a glass or ceramic jar for storage)
- Cut the plastic open, to maximize its surface area-- but make sure it is still one contiguous piece.
- Clean the plastic with your hands, using soap and water.
- Dry your plastic.

#### Once Dry....

- Wash your hands, and packing tools and cut the plastic into small pieces that can be easily ecobricked. If you're sick, put on a face mask.
- Start packing the plastic into the bottle following the the GEA 10 Step Guide at\_ www.ecobricks.org/how. When your packing session is done, cap your ecobrick.
- Ecobricks must meet the density, labeling, color and all other best practice criteria.
- Once completed, seal the ecobrick with a screw top cap and log online.

#### Logging your Ecobrick

- Open the GoBrik.com app to log your ecobrick
- On GoBrik.com/#log, check off that you have followed the COvid-19 Enhanced Ecobricking Guidelines.

#### What not to Ecobrick

The conventional GEA guidelines of what not to ecobrick remain the same (no sharp metal, glass, biodegradables, etc.). For ecobricking within the Covid-19 Pandemic, we emphasize that medical waste should not be ecobricked. Designated medical waste requires special handling and is not within the scope of ecobricking. Any such waste, such as syringes, ventilators, bandages and clothing should be left for hospitals and centralized waste management systems to process.



#### A Special Note on Face Masks

Surgical masks are made from unrecyclable polypropylene fibers, are non-recyclable, and intended for disposal after use. During the Covid-19 outbreak, masks consumption and production has increased by 1200%, leading to a corresponding increase in disposal and 'a crisis in the making'<sup>29</sup>. It is important to note that face mask disposal will have ecological and health consequences. The incineration of masks will result in the release of CO2<sup>30 31</sup>. Masks disposed of in landfills will break down into microplastics.<sup>32</sup>

# It is important to note that clinical use of the masks in hospitals and by the sick requires medical waste designation and incineration. If facilities exist we strongly recommend that masks be disposed in this way.

However, when medical waste disposal is not possible (i.e. in remote areas) and/or where government guidelines permits household disposal of masks (as in Indonesia) we propose that ecobricking masks is a next-best-solution. Based on the research on the SARS-CoV-2 virus presented in this paper, cleaning by soap and water will deactivate the virus. After ecobricking, any potential remaining virus will be deactivated by the long-term containment in the ecobrick. The GEA recommends the ecobricking of masks according to the following guidelines:

- Immediately wash the mask with soap and water or alcohol as per WHO handwashing guidelines
- Dry the cleaned mask by hanging in the sun to dry, or in a pillowcase in a warm room.
- Once dry, wash your hands, and cut the mask into several pieces
- Pack into a bottle, mixing with other plastics, as per the Covid-19 Enhanced Ecobricking Guidelines above.



#### Containing and Deactivating Contaminated Plastic

It is important to consider the possibility of contaminated plastic being packed into an ecobrick. Whether capped or uncapped, corona virus surface research allows us to confident that after 5-6 days the virus will be completely deactivated inside an ecobrick. In their paper "*Virus Survival in the Environment*"<sup>13</sup>, E. Pirtle and G. Beran surveyed 61 studies on 14 viruses and their persistence out of body. Even in prolonged humid and warm conditions (such as a PET bottle) viral vitality only lasted for several hours on average. Virus could only be found on surfaces in these conditions after several days on average-- after which they were completely undetectable. Even in idealized conditions for viral survival (sausages, saliva, and special solutions) viruses could only last for 30-40 days before they were inactivated. These periods of vitality and persistence are much less than the years/decades an ecobrick is designed to last.

Regardless, tt is important to take into consideration the worst case scenarios of ecobricking during the CoVid-19 outbreak being done improperly, or using conventional ecobricking methods.

#### Ecobricking being done by a sick person, without immediate washing or drying

- In this case, the consumer contaminates plastic on touch while ecobricking. These plastics are
  packed into the bottle without washing or drying, leading to the bottle's contents being
  contaminated. *Likely*
- Re-opening the unfinished ecobrick bottle could release viruses. Unlikely as the virus would have settled.
- Packing the bottle later could contaminate the ecobrickers stick or bounce the viruses into the air Unlikely because of the small aperature of the bottle, but a potential risk on the stick's surface.
- Reopening the finished ecobrick later. Unlikely to happen as ecobricks are seldom opened after completed. After several days the virus is deactivated

Though, the outcomes in this scenario are not-optimal, we feel that the risks posed by not ecobricking potentially contaminated plastic are greater. Loose plastic that is contaminated shares all the same risks of passing the virus on as ecobricked plastic-- however because it is not contained, this risk of



transmission is higher. Consumers, animals, bystanders or waste management staff that come into contact with the uncontained and contaminated plastic are at risk.

To reduce the possibility of this scenario the GEA will immediately begin advocating and disseminating advanced ecobricking techniques.

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## Implementing, Socialization and Recommendations

By providing a simple, low tech, zero cost method in which consumed plastic may be immediately secured, plastic fomite transmission vector may be eliminated. In countries where medical and municipal waste management can no longer cope with the amount of plastic being consumed, enlisting the collaboration of citizens can prevent overloading centralized system and the piling up waste that has historically attended pandemics.

#### **GEA Next Steps**

The Global Ecobrick Alliance is moving forward to update all its resources and materials with CoVid-19 Enhanced Ecobrick Guidelines. We will be disseminating these guidelines through our networks immediately, and encourage ecobrickers to follow the guidelines as a proactive means of mitigating the spread of the virus. We will be making freely available the GEA Ecobrickable Designator Kit<sup>33</sup> for immediate use on single-use plastics.

#### Recommendations

The GEA recommends to companies, governments and institutions...

- The adoption and spread of these guidelines by local, regional and national governments.
- The dissemination of enhanced ecobricking by the press as a means for civic participation
- The labeling of single-use plastic as ecobrickable by the producers of single-use-plastics
- The labeling of single-use-plastics as ecobrickable by companies, governments and institutions distributing single-use-plastics (i.e. masks and food).



Illustration 3: The GEA Ecobrickable Designator Icon for single-use Plastics



### About The Global Ecobrick Alliance

The Global Ecobrick Alliance (GEA) is a not-for-profit Earth Enterprise with a mission to support the global plastic transition movement. We are comprised of 327 Ecobrick Trainers located in half a dozen countries around the world. As an independent and principled Earth Enterprise we are unaffiliated and unfunded by any government or corporation. Our focus is on developing, deploying and maintaining local and global solutions to the problems that are caused by plastic. We are guided by regenerative principles that ensure ecobricking methodologies can be adopted and implemented across classes and continents, without the need for capital or petroleum power.

- Read more about the GEA at: <u>www.ecobricks.org/about</u>
- Read more about the GEA's principles at: <u>www.ecobricks.org/principles</u>
- Contact us for further information at <u>vision@ecobricks.org</u>

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