**Forum:** Environment Commission

**Issue:** Mitigating the environmental and health impacts from incidents in “dirty industries”

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Introduction

 Ever since the industrial revolution and even more so in the past few decades, industrialization has picked up a rather fast and destructive pace all over the world, CO2 emissions going from 2 billion metric tonnes in 1900 to 37 billion tonnes in 2019. The staggeringly high, yet *still* increasing demand of goods and services greatly contributes to the increase of all sorts of industrial activities around the world.

 In this realm of debate, the term “Dirty Industries” refers to the category of industries that are highly pollution intensive, i.e. *dirty.* Examples of these industries are energy, transportation, raw materials, and agricultural industries, which all produce a massive amount of greenhouse gases, thus being labelled dirty.

 Despite the economic and technological success of these dirty industries in supplying the current world with electricity, fuel, and transportation, these industries bring along with them a huge downside that the world has had to suffer from numerous times in the past. That is - major accidents in the form of deadly toxic gas releases, factory fires, and oil spills that have been of constant occurrence. Mismanagements and miscommunications amid the coordination of industrial activities cause such disasters to happen, which can cause severe and even irreparable damage to people, communities, and infrastructure.

 Major industrial accidents involving dangerous chemicals - such as arsenic, lead, and benzene - pose a significant threat to humans and the environment. However, the use of large amounts of dangerous chemicals is inevitable in certain industry sectors which are vital for a modern society, therefore prevention measures must be implemented.

 Some of the deadliest incidents and accidents that have happened in the past few decades are, for instance *The Bhopal Gas Leak* in India, which occurred on 1984 December where 45 tons of dangerous methyl isocyanate gas escaped the plant, killing over 15,000 people and causing bodily damage to over half a million people. Furthermore, is the *Chernobyl disaster,* in 1986, where a nuclear reactor malfunctioned to release huge amounts of radioactive material in the atmosphere, where it was carried even larger distances by air currents. It went on to cause over 5000 cancer deaths. These disasters have the potential to make cities inhabitable. In fact, Chernobyl was only made open to tourists after 2011, a whole 25 years of recovery later. From investigations and inspections, it is believed that *industrial disaster recovery* is something that has been, in the past, a very disjointed, conflict-ridden, and prolonged process with high chances of failure, thus more measures need to be taken to mitigate the environmental and health impacts of it.

 Historically, these disasters have taken place mostly in MEDCs (More Economically Developed Countries), as only the economically developed countries were able to afford manufacturing plants and industrial equipment in the first place. However, there is an arising phenomenon that is creating a shift towards the other end of the spectrum, which is known as *The Pollution Haven Hypothesis.* The Pollution Haven Hypothesis argues that Dirty Industries are now slowly migrating from developed countries to developing countries instead. It is believed that increasing economic awareness in developed countries has caused them to enact more stringent environmental regulations, and that has resulted in the increased cost of production for Dirty Industries in those countries. Therefore, companies have been migrating to developing countries where more lenient environmental regulation standards have made it easier to set up their businesses and create profits. Therefore, experts now formulate that developing countries are becoming the new *Pollution Haven* for Dirty Industries, and no longer the developed countries.

 Whereas this is economically beneficial for developing countries as their economic output and activity increases, it is also worth noting that as this hypothesis becomes a reality and as more countries start to nurture Dirty Industries, a bigger domain of probability for industrial disasters is being created. It is this increasing potential for major industrial accidents that has brought to attention the need for a clearly defined and systematic approach to the control of such occurrences in order to protect workers, the public, and the environment.

Definition of Key Terms

Dirty Industries - An officially recognized industrial category consisting of firms that are highly pollution intensive. By this criterion, five sectors emerge as leading candidates for 'dirty industry' status: Iron and Steel, Non-Ferrous Metals, Industrial Chemicals, Pulp and Paper, and Non-Metallic Mineral Products.

Clean industries - Based on official criterion, Clean industries are those which does not emit smoke, noise, offensive odors or harmful industrial wastes.

Accident - An uncontrolled event occurring during the process of manufacturing, transport or storage, in which there is a release of certain quantities of hazardous chemical substances in air, water or soil, and to different territorial levels, which could result in a threat to life and health, material goods, or the environment.

Haven - A place of safety or refuge.

Pollution Haven - An economic or geopolitical zone or area with suitable conditions to shelter and let thrive a firm which is a part of the Dirty Industry.

Pollution Haven Hypothesis - The pollution haven hypothesis (or pollution haven effect) posits that jurisdictions with weak environmental regulations – ‘pollution havens’ – will attract polluting industries relocating from more stringent locales, as intuitively a lack of environmental regulations will decrease the overall cost of production.

Dirty Industry Migration (DIM) - An almost equivalent phenomenon to that of *Pollution Haven Hypothesis,* stating that polluting industries in the rich developed world will migrate to pollution havens in poorer and less regulated developing countries.

History & Developments

The Industrial Revolution

 To understand the origins of Dirty Industries, we must trace all the way back to the Industrial Revolution which occurred in the 18th Century. Originally beginning in Great Britain, the Revolution was, in fundamentality, the process of change from a handicraft and agricultural economy to a new type of economy led by industry and machine manufacturing.

There were 3 basic strands involved in the entire Industrial Revolution - technological, socioeconomic, and cultural, out of which the technological strand is the one necessary for this topic. The technological changes in the Industrial Revolution brought about the usage of new materials such as iron and steel; new energy sources such as coal and steam, new machines, and a new system of work known as the Factory System~~,~~ that the world commonly knows of and sees today.

Before 1800, industrial disasters were tremendously few and far between, but with the advent of machines, technology, and the Factory System, many countries, economies, and private firms began to invest in, and adopt these systems for their operations. Consequently, industrial disasters have had an exponentially increasing graph since the Industrial Revolution, with currently well over at least 120 recorded industrial disasters each year. This shows the brutal increase in the frequency of these industrial accidents and allows us to conclude that it is during these historic times where the domain of industrial accidents was born, as with the preliminary creation of those machines came the possibility of their failure themselves.

Past accidents

 Rana Plaza

Rana Plaza was an accident that occurred in Dhaka, Bangladesh recently, in 2013, where a building containing several factories collapsed, causing more than 1,100 fatalities. This is by far the deadliest industrial catastrophe to happen within the clothing manufacturing industry. Upon investigation, it was found that the factory had in fact been built with below-standard materials under weak conditions, such as partially-frozen concrete, cracked glass, and subpar iron. It was also disclosed that the mayor of the city had wrongly approved for the construction of the building despite its architectural plans not meeting the minimal construction codes.

Furthermore, just a day before the collapse, the sudden formation of large cracks on the building forced Sohel Rana, owner of the plaza, to call an engineer for inspection. Upon the inspection, the engineer reportedly told Rana the building was unsafe for use; however, Rana ordered the workers to return for work the next morning, subsequently causing one of the worst industrial accidents ever. This not just falls into this specific topic, however cascades into the arena of human rights violations as well, as workers are not being provided a safe working environment.

This occurrence brings to light the lack of tightly enforced measures for construction and maintenance, and the lack of regular inspection on the quality of leadership.

 Benxihu Colliery Mining Disaster

Another very major accident occurred in 1942 in China, at the Benxihu Colliery, when an unexpected gas and coal-dust explosion in the mine created massive flames bursting across the mine, causing a death toll of 1,549 through either heat suffocation, burning, or carbon monoxide poisoning.

Unfortunately, in a faulty attempt to trap the fire underground, some on-site soldiers and workers deliberately shut off the ventilation and sealed the pit head that led to the underground space. Investigations confirmed that they did this before checking whether all workers had evacuated from underground or not, and accidentally caused over 100 workers to suffocate in the smoke, needlessly increasing the death toll. This clearly happened due to uncoordinated, unpracticed, and disjointed prevention measures of the on-site staff. This shows the lack of attention towards disaster drills in the industry.

 Bhopal Gas Tragedy

By far the worst industrial accident in many aspects, the Bhopal Gas Tragedy occurred in Bhopal, India in December1984, where a pipe defect caused a substance known as methyl isocyanate gas (MIC) to escape into the environment and make its way around the town near the plant. This disaster caused more than 16,000 fatalities and 574,366 non-fatal yet permanent physical injuries, such as facial deformities, skin diseases, respiratory issues, and memory impairment. Psychological issues such as PTSD (Post Traumatic Stress Disorder) were also a common occurrence across the victims.

Although the reason for the gas escape remains under debate, government officials and local activists have stated that it was caused due to constant delay in the maintenance of the pipes, which caused a situation where a large amount of water traveling in a pipe unexpectedly started to flow backward and collided into the gas tank that held the toxic gas MIC, triggering its escape.

The “Pollution Haven Hypothesis” in action

 As stated previously, the Pollution Haven Hypothesis is bringing to light the active phenomenon of industrial firms migrating and relocating to poorer or less developed countries due to more lenient and lax environmental laws.

This has only started to take place in the last decade as the recent surge in environmental awareness has forced many developed countries to adopt strict rules on the environment. Nations with stricter environmental policies increase the company’s expenditures that are associated with meeting the required environmental standards imposed by the nation. This would increase their cost of production and lower their profits, and therefore many companies have instead settled into less developed economies, as cheap resources and labor tend to have a lower stringency on environmental friendliness.

This phenomenon can be proven by some pressing statistics which readily show the surge in chemical production in several less developed areas throughout the past decade. From 2012 to 2020, chemicals production has grown by 46% in Asia Pacific, 40% in Africa and the Middle East, and 33% in Latin America and the Caribbean.

Moreover, developing countries seeing an influx of these Dirty Companies are at particular risk of accidents as their prior inexperience with these industries means they have limited regulation and incomplete enforcement of rules, awareness, preventive measures, and response resources.

Geopolitics

 There are several dozens of organizations that are working under the category of Prevention and Preparedness against Industrial and Chemical Accidents; however, these are the top three organizations that have actually made significant progress towards creating solid mitigation measures against the environmental and health impacts of Industrial Accidents in the past few years.

United Nations Environment Program (UNEP)

 Created in 1972, The United Nations Environment Program is a major branch of the UN, responsible for coordinating the UN’s environmental activities and closet working with developing countries establish environmentally-friendly mindsets in their countries. The UNEP is significantly involved in the Prevention of Industrial and Chemical Accidents. It has been supporting activities to raise awareness primarily through the creation of two frameworks for the prevention of chemical accidents - APELL and Flexible Framework Programs.

 Both of these programs implement awareness measures at local and international levels. APELL focuses more towards increasing the awareness of civilians and local community members about the hazards of numerous types of sources and teaches the preparation one needs to take to protect themselves.

 On the other hand, the Flexible Framework for Addressing Chemical Accident Prevention and Preparedness takes an approach of working more with governments to discuss, develop, and formulate sets of laws, regulations, policies, and guidance to address different types of disaster scenarios.

United Nations Office for Disaster Risk Reduction (UNDRR)

 Founded in December 1999, the UNDRR (United Nation Office for Disaster Risk Reduction) is a sub-section of the UN that brings together many governments, entities, and communities to tackle the issues of disaster risk reduction and formulate common solutions for a safer industrial environment worldwide. The UNDRR has created a well-known framework called the Sendai framework that focuses on increasing resilience and awareness against risks, more so than the disaster itself.

Organization for Economic Cooperation and Development (OECD)

 OECD (Organization for Economic Cooperation and Development) was founded in 1961 to stimulate economic progress and trade worldwide.

 The OECD’s program on Chemical Accidents has an objective to share experiences among governments and other individual people or entities. The program also recommends policy options for enhancing the prevention of, preparedness for, and response to chemical accidents.

This program creates a platform where a wide range of stakeholders from OECD member countries, non-member countries, NGOs, and more, meet at a ministerial level and have discussions to share experiences on accidents and lessons that they all can learn from each other. As stated on their official website - “The program is about inclusiveness, cooperation and broad-based participation, and cover policy issues on prevention, preparedness and response to accidents.”

Previous Attempts to Solve the Issue

 To combat the issue of accidents and disasters in dirty industries, numerous organizations including the ones mentioned above, as well as many others, have drafted dozens of frameworks, guidelines, and documents regarding the risk and disaster reduction of this issue, all of which have many similarities yet some key differences. These frameworks and documents have been able to achieve success to an extent, as international awareness and cooperation regarding this issue has definitely increased. However, some parts of the plan still only remain in theory, and have not seen execution due to lack of attention.

OECD’s Program on Chemical Accidents

 The OECD’s [[1]](#footnote-2) Program on Chemical Accidents is a program that addresses the issue that now is concerning more and more countries as time passes by, which is the handling and operating of any type of chemical machine, instrument, or site.

 In 1987, right after several major industrial accidents like the *Bhopal Gas Tragedy,* and the *Sandoz Chemical Spill*, member states of the OECD called upon the beginning of a program and a series of documents on hazardous chemicals. The member states were quick to respond and promptly began a high-level conference in which many entities participated.

 Going into more detail, this program assists in the providing and sharing of essential information and resources to public authorities, industry, labour and other interested parties for the prevention of chemical accidents, if one were to occur.

 Over the years, the discussions in this program have yielded many outcomes, which have effectively been compiled by OECD into several handbooks and documents consisting of laws and policies that the conference members settled on annually. One of the handbooks is called “*Guidance on Change of Ownership in Hazardous Facilities.”* This guidebook consists of 45 pages addressing the types of troubles, miscommunications, and mismanagements that are prone to occur within dangerous facilities when a new set of leaders, owners, or management staff are being transitioned in. It discusses the importance of a well-informed change of ownership, and how much oversight during the change of ownership can potentially have disastrous consequences that can result in social, economic, and individual detriment.

Another one of OECD’s Documents is called *“Guiding Principles for Chemical Accident Prevention, Preparedness and Response”,* in which it introduced a crucial 4-step process for Industrial Preparedness;

* Preventing the occurrence of incidents involving hazardous substances;
* Preparing for accidents, and mitigating adverse effects of accidents, through emergency planning, land-use planning, and communication with the public;
* Responding to accidents that do occur in order to minimize the adverse consequences to health, the environment and property;
* Follow-up to accidents, including initial clean-up activities, and accident reporting and investigation.

This 4-step process has been adopted by many other organizations ~~as well as the basis of their works.~~

UNECE’s Convention on Transboundary Effects of Industrial Accidents

The 1992 United Nations Economic Commission for Europe (UNECE) Convention on the Transboundary Effects of Industrial Accidents is an agreement designed to protect people and the environment from the catastrophic effects of Industrial Disasters and accidents. The convention was enforced 8 years later, in 2000, and to date has 41 parties abiding by it.

As the name of the convention shows, this document is not just towards preventing accidents on a local or national level, however, it calls upon transboundary cooperation; in other words, international collaboration and assistance across neighboring countries when an accident occurs. It encourages member states to not just help each other in the event of a catastrophe, but also share research developments, technology, and data upon investigations to better equip each other with resources to maintain a safe industrial environment.

Seveso Directive

Upon the Seveso Disaster which occurred in Seveso, Italy in 1976, prompted the adoption of the legislation called the Seveso Directive. Just to mention, the Seveso Disaster was a chemical gas release that occurred in a small chemical manufacturing plant north of Milan, Italy. It exposed a lethal gas to the residents and animals of the Seveso Community, where over 1000 people were harmed, 3000 animals died, and an additional *70,000 animals deliberately had to be killed,* to prevent the toxic chemicals from entering market food chains.

Likewise, many other frameworks, the Seveso Directive’s main objective is to also address major accident hazards and decrease the chances of industrial disasters. Upon the enforcement of the Seveso Directive, Europe is reported to have seen a fall in the frequency of accidents. The Directive is based on 4 pillars, that are nearly identical to the OECD’s 4 pillars as well. The pillars are - prevention, preparation, response and lesson learning.

Repeating this cycle over and over again would thus lead towards a continuous improvement cycle.

The Seveso Directive is in fact considered in several countries a benchmark for industrial disaster policy and has been a leading role model for related legislation.

UN Environment’s APELL Framework

APELL is a handbook and framework drafted by UN Environment, which was published in 1988. Since then, it has raised awareness about hazards and risks, and improving response measures. Falling back on nearly three decades of experience, the handbook provides the basic processes that aim towards helping countries minimize any health and environmental costs.

The methodology is structured into five phases and a 10-element process and has two parallel running objectives both of which operate at a local level. The first objective calls for conversations about hazards, risks, and prevention measures involving local community members and stakeholders to decide on the responsibilities and security measures that must be upheld by everybody. The second objective is to increase the community’s resilience along with first reducing its vulnerability by building more advanced facilities that mitigate health and economic dangers.

The 5 phases of the APELL framework are; (i) engaging stakeholders; (ii) understanding hazards and risks; (iii) preparedness planning; (iv) implementing, disseminating, and testing; and (v) maintaining APELL.

UNDDR’s Sendai Framework

 The Sendai Framework is one of the most recent documents to be created regarding this issue, being adopted by UN Member States in March 2015 at the UN World Conference on Disaster Risk Reduction that took place in Sendai, Japan.

The Sendai Framework has the advantage of having learned and analyzed the many prior documents that have been created for this purpose, and thus creating the most recent and time-tested set of solutions. The Sendai Framework adopts a relatively aggressive approach, focusing and emphasizing a lot more on managing risks than managing the disasters. By saying that, the Sendai Framework identified and ceases any type of risk before it has the opportunity to transmute into a disaster.

This would mean more emphasis on construction quality that includes intensive material and architectural qualifications before any machine or factory is deemed operational. This would also call for more difficult qualifications for employment, to ensure all workers are equipped with the necessary knowledge and plan to orchestrate a safe working process.

The Sendai Framework is also a bit more wide-scoped, covering more than just industrial disasters, but biological and natural disasters as well.

As stated officially, the goal of the Sendai Framework is to “prevent new and reduce existing disaster risk through the implementation of integrated and inclusive measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience”.

Possible Solutions

 In the past decade over 700,000 people lost their lives in disasters, more than 1.4 million were injured, 23 million displaced, and economic losses exceeded US$1.3 trillion. This is enough statistical evidence to put strenuous pressure upon the enactment of some serious mitigation measures to limit as much as possible the probability of industrial accidents in the dirty industry. Here are some of the possible solutions that are feasible for many countries.

Firstly, thorough inspections across a fixed regular interval of time from local authorities should take place for every industrial company or entity. These inspections shall include checking the quality and maintenance level of the factory, machines, employment standards, and management. Official criterion should be used as a base reference when inspecting the site, which ensures the imposition of equal standards across the country for all industrial activities. If any gap or leak in the qualifications shall be found, the industrial activity of that company should be temporarily suspended until the relevant issues are fixed and the factory is reinstated to safety.

Secondly, in the unfortunate case of an accident or disaster, it should be required that the subject company or industry submit to the government and other relevant multinational entities (OECD, UNEP), a post-disaster report that consists of all the necessary post-analysis details such as the reason for the disaster to happen, and exact details on *what and how* the company will do to ensure the same occurrence does not happen again. It is of tremendous importance that companies, and firms learn what’s necessary from the disaster to enact measures against similar future occurrences, and a post-analysis report should serve as an indicator for that.

Thirdly, to mitigate the health and environmental impacts, it is vital that the on-site staff is fully equipped with the skills to immediately suffocate any detectable risk, and in the case of a disaster, perform necessary procedures for evacuation and safety. Thus, through the help of associated organizations such as the OECD, UNDRR, and UNEP, training programs should be organized for industry-level employees to train them on how to identify potential hazards, and the sequence of procedure in the case of a disaster. These programs should also include real physical drills that ensure that staff can execute them if the time comes.

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