OUTER SPACE ENVIRONMENT PROTECTION: AN IMPERATIVE FOR A SUSTAINABLE FUTURE

*Pankaj Mehta**

ABSTRACT

Air and Space Law is an emerging and niche area of study. With the passage of time, there has been a shift from air law to space law. The Outer Space Treaty, 1967 was formulated in order to regulate the human exploration of outer space. The Outer Space Treaty, 1967, provides for various obligations and is generic. Owing to this generality, various specific international and national legislations have been passed in order to fulfill these obligations in a better manner. Environment protection is one such specific obligation for which there are no specific laws. Therefore, through the present article, the author attempts to highlight the need and urgency to protect the outer space environment. Furthermore, the present article analyses the current legal position with regard to outer space environment protection and provides for the possible ways of outer space environment protection.

Keywords: *Outer Space environment, Environment pollution, Outer space pollution, Environmental Impact Assessment (EIA), Space debris.*

I. Introduction

MANKIND HAS a history which goes back millions of years. Throughout their journey, humans have progressed in every aspect, be it science, arts, literature etc. Humans are curious beings. This curiosity combined with the existence of various possibilities is one of the reasons for the progression of mankind. In furtherance of this progression, 'What lies beyond this planet?' is yet another question which is still being researched upon. The genesis of the idea of exploration of outer space dates back to the beginning of the 20th century. In 1903, space pioneer Tsiolkovsky discussed the possibility of human exploration in the outer space.[1] Since then, humans have come a long way in terms of outer space exploration.

* Final year law student at Dharmashastra National Law University, Jabalpur. The author is currently a research intern at UNIDROIT, Rome, Italy.

[1] Fabio Tronchetti, *Fundamentals of Space Law and Policy* 4 (Springer, New York Heidelberg Dordrecht London, 1st edn., 2013).

Outer space, in broad terms, refers to space which lies beyond the earth and consists of celestial bodies, radiations, cosmic waves etc. The term 'Outer Space' is often confused with 'Air Space' but they are not synonymous. Air Space refers to the atmosphere which surrounds the earth. The terms 'outer space' and 'air space' have no universal definition *i.e.,* there are no universal criteria through which you can locate the boundaries which separate outer space and air space surrounding the Earth.[2] As a result, there are multiple standards to delimit 'air space' and 'outer space'.

The *Fédération Aéronautique Internationale*, the world governing body for air sports, uses the concept of the *Kármán* line to determine the boundary between air space and outer space. The *Kármán* line refers to an altitude of 100 km which is considered to be the boundary between air space and outer space.[3] According to the Chicago Convention, 1944, the outer space zone lies beyond an altitude of 120 km, below which are near-space zone and air space zone at an altitude of 50-120 km and 50 km respectively.[4]

Later, the launch of the first artificial satellite in the year 1957 marked the beginning of the space era. At that point in time, outer space was a new territory for mankind. With the passage of time, states realized that space activities will increase. Therefore, there was a need for some robust law which has been emphasised in the past as well. In the year 1910, Emile Laude stated that there is a need to have a separate body of law to regulate outer space affairs.[5] One of the significant reasons for the development of space law as a separate field was the incapability of air law to regulate outer space affairs. In a nutshell, air law refers to that wing of law which aims to regulate activities in the atmosphere which surrounds the earth.

Furthermore, in 1926 the Air Ministry of the Soviet Union argued that the sovereignty of a State is limited to its airspace column.[6] As the sovereignty of a State is limited to air space, no sovereign shall be capable of formulating laws for outer space column above its territory. Therefore, there was a need for a separate body of law relating to outer space. Today, Air Law and Space Law have emerged as two distinct fields of law.

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[2] Dr. Gbenga Oduntan, "The Never-Ending Dispute: Legal Theories on the Spatial Demarcation Boundary Plane between Airspace and Outer Space" 1 *Hertfordshire Law journal* 64-84 (2003).
[3] Statement About the Kármán Line, *available at: https://www.fai.org/news/statement-about-karman-line* (last visited on Jan. 12, 2021).
[4] Convention on International Civil Aviation, 1944, art. 12.
[5] Vikrant Pachnanda, *Space Law* 11 (Bloomsbury, India, 1st edn., 2019).
[6] *Ibid.*

With the emergence of space law as a separate field of law, the international community came up with the Outer Space Treaty of 1967. One of the objectives of this treaty was to provide every state with the benefits of space exploration. The Outer Space Treaty, 1967, is an international treaty containing numerous provisions (relating to the use of outer space, demilitarisation, liabilities etc.) to regulate outer space activities and exploration. This international treaty is generic because when you read the treaty carefully, the reader will realise that it contains numerous principles to regulate human behaviour in outer space. But the treaty does not extensively provide any literature about these principles. As a result, in order to meet specific requirements, various other international treaties were formulated, such as Liability Convention, 1972, Registration Convention, 1974 etc. to meet the specific requirements.

Protection of the environment is one of many obligations laid down in the Outer Space Treaty, 1967.[7] Currently, there are no specific international treaties dealing with the protection of the environment in outer space. Many States have shown their commitment and compliance towards various international obligations through the enactment of various municipal legislations regulating outer space activities. For example, U.K.'s Outer Space Act, 1986.[8] But there are no detailed national legislations which deal with outer space environment protection. As a result, the following questions arise:

1. Is there a need to protect the outer space environment?
2. What is the position of law concerning the protection of the outer space environment?

To find the answers to the above-mentioned questions the main body of this article has been divided into three parts. Firstly, this article establishes the significance of the protection of the outer space environment by discussing the possible threats to the outer space environment and its effects on human beings. Secondly, this article analyses the position of public international law and various municipal laws with regard to outer space environment protection. The last portion of this article focuses on providing recommendations and solutions as to how the outer space environment can be protected. At this point, it shall be made clear that protection of the outer space environment may include (a) protection around the universe and (b) protection of the outer space surrounding the earth. For the purpose of this article, the focus is on protection around the earth.

[7] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 1967, art. 9.
[8] Outer Space Act, 1986 *available at: https://www.legislation.gov.uk/ukpga/1986/38/contents* (last visited on July 19, 2021).

II. The Need to Protect Outer Space Environment

When talking about the need to protect the outer space environment, it is obvious to expect questions such as, how does the problem of outer space pollution concern us? It is an obvious question because unlike environmental pollution on the earth, outer space pollution is rather 'invisible'.[9] It is invisible because the impact of outer space pollution is not visible to the naked eyes. For instance, when we look at the sky, we cannot see the accumulation of space debris as it is not visible to our naked eyes. To understand this proposition better, let us compare how these two kinds of pollutions have been dealt with.

Environmental protection of the earth has become a major concern because of two reasons, first, it endangers life on earth and second, the effects of environmental pollution on earth are visible. A prominent example of the effects of environmental pollution is the depletion of the ozone layer. The existence of ozone holes in the polar region was confirmed in 1987.[10] It was further discovered that radiation penetrating through such an ozone hole increases the risk of genetic mutation and cancer in human beings.[11] The Montreal Protocol, 1987 was adopted by numerous States.[12] The Montreal Protocol, 1987 was adopted with the aim to protect both environment and human health against the adverse effects of ozone layer depletion. Both national and international media covered the situation extensively. As a result, the case of depletion of the ozone layer was handled with due care.

As far as extra-terrestrial or outer space environmental protection is concerned, the matter fails to attract the required attention. Space debris is one such threat which requires attention. According to the International Academy of Astronautics (IAA) Space debris refers to "any man-made Earth-orbiting object which is non-functional without any expectation of resuming functionality, or any other function (includes fragments and parts of such objects)".[13] The invisibility of space debris was pointed out by artists Nick Ryan and Cath Le Couteur. Nick Ryan and Engineer Dave Cranmer came up with 'Machine-9' which transforms movements of

[9] Space 'Junk' Music Project Points to Invisible Environmental Problem, *available at:* https://eandt.theiet.org/content/articles/2016/11/space-junk-music-project-points-to-invisible-environmental-problem/ (last visited on Sep. 02, 2020).
[10] Joseph N. Pelton (ed.), *Space Debris and Other Threats from Outer Space* 52 (Springer, New York Heidelberg Dordrecht London, 1st edn., 2013).
[11] *Ibid.*
[12] Montreal Protocol on Substances that Deplete the Ozone Layer, 1987, *available at:* https://treaties.un.org/doc/publication/unts/volume%201522/volume-1522-i-26369-english.pdf (last visited on July 19, 2021).
[13] Lotta Viikari, *The Environmental Element in Space Law* 49 (Martinus Nijhoff Publishers, The Netherlands, Vol. 3 of Studies in Space Series, 2008).

space debris into sound when it passes overhead.[14] It was stated that "*Space debris as such is silent. It's silent because it's out of the earshot but also because it is in a vacuum*".[15] To further understand the threat of outer space pollution let us consider a hypothetical situation.

Imagine a beautiful landscape. The landscape has a variety of plants and it is full of life. A factory is established near the landscape. As soon as the factory starts to function it also starts to dump all the waste generated into this beautiful landscape. Five years down the line, the landscape which was once filled with life and beauty turned into a wasteland. Assume for a moment that the landscape is outer space and the waste dumped in the landscape is space debris generated due to human exploration of outer space. As a result of outer space pollution, the earth has been surrounded by a massive amount of space debris.

In 1963, the United States of America came up with the project West Ford. It was an "attempt to create a short-lived band of millions of hundreds of tiny wires about the Earth to test passive communications techniques".[16] ESA's Annual Space Environment Report, 2019 states that "As of the end of 2017, it was determined that 19,894 pieces of space junk were identified in one of the orbital divisions of the earth with a combined mass of 8135 tonnes- that is more than the entire metal structure of the Eiffel Tower."[17] "As of February 2020, the number of debris objects estimated in all the orbit divisions combined is approximately 128 million."[18] Based on the above-mentioned facts, it is safe to conclude that outer space is a landscape which is losing its beauty with each passing day.

Nuclear contamination is another major source of outer space pollution. Interestingly, space debris could be a source of nuclear contamination in certain circumstances. With the advent of the space age, nuclear power-based or nuclear power-sourced satellites were launched in space for various operations. To date, nuclear power-based objects have not been removed from outer space because the world's first space debris removal mission *i.e.*, Clean Space-1 will be launched in 2025.[19] In case of an accident of space objects, one of which is a nuclear power-based object, there is a possibility of nuclear contamination. The crash of Cosmos 954 in

[14] *Supra* note 9.
[15] *Ibid*
[16] "West Ford Needles: where are they now?" 17 *NASA Orbital Debris Quarterly News* 3 (Oct. 2013).
[17] ESA Space Debris Office, "ESA's Annual Space Environment Report" (2017). *Available at: https://www.esa.int/Safety_Security/Space_Debris/Latest_report_on_space_junk* (last visited on July 20, 2021).
[18] ESA Space Debris Office at ESOC, Darmstadt, Germany, "Space Debris by Number" (Feb.2020).
[19] ESA commissions world's first space debris removal. *Available at: https://www.esa.int/Safety_Security/Clean_Space/ESA_commissions_world_s_first_space_debris_removal* (last visited on July 20, 2021).

Canada is a prime example of nuclear contamination. The same will be discussed later in this article.

It was only after the advent of solar cell technology, the focus shifted from nuclear power sources to some extent.[20] However, the fact remains that nuclear power continues to be considered a viable option.[21] At this point, you may ask why contamination in outer space may be a cause of concern/alarm. What is the harm in using nuclear power sources?

Imagine a situation where you have a vessel containing concentrated acid. Now you drop a plastic ball into this vessel. The ball will not survive. Assume for a moment that the vessel is outer space, concentrated acid is nuclear contamination of outer space environment and earth is the plastic ball. Accidental satellite collisions and explosions can cause nuclear contamination from nuclear power-sourced objects.[22] With no atmosphere to contain nuclear contamination in case of an explosion, the threat becomes extreme.[23] In such a case, the radiation generated can spread thousands of kilometres and can even reach the Earth.[24]

The crash of Cosmos 954 in Canada is a well-known incident. The Soviet Union launched Cosmos 954, a nuclear power-sourced satellite in September 1977.[25] In November 1977, it was reported that the orbit has become erratic and it would fall in Canada in January 1978.[26] Fortunately, the satellite landed in an uninhabited territory of Canada and no human lives were lost. Had it landed in a populated area; the consequence would have been hazardous. Such an incidence is enough to make outer space nuclear contamination a matter of concern

Humans claim that the establishment of space colonies and space tourism is the future of humankind. But, at the same time, humans themselves continue to pollute outer space and threaten their future. Based on the above-mentioned facts, it can be concluded that outer space pollution is a serious issue which concerns us all, yet it is not afforded due importance. The main reason why the issue of outer space pollution is not provided due importance is that it affects us indirectly. But it should not matter whether it is a direct or an indirect effect. What

[20] *Supra* note 13 at 46-51.
[21] *Id.* at 46.
[22] *Id.* at 45.
[23] *Id.* at 47.
[24] *Ibid.*
[25] W Michael Reisman and Andrew R. Willard (eds.), *International Incidents* 68-84 (Princeton University Press, New Jersey, 1st edn., 1988).
[26] *Ibid.*

is significant is that outer space pollution threatens the future of mankind. Therefore, there is a need to protect the outer space environment.

III. Legal Position with Respect to Outer Space Environment Protection

Now that it has been established that there is a need to protect the outer space environment, the question arises as to how to protect the outer space environment. Regulation of human conduct in outer space seems to be the only option. Therefore, the status of law, both at the municipal and international level comes into the picture.

Status of Public International Law and The Outer-Space Environment Protection

As far as international law with regards to outer space is concerned, the Outer Space Treaty, 1967 was the first international treaty to be formulated to regulate human activities in outer space. It can be said that the Outer Space Treaty, 1967[27] is generic, addressing all the issues related to space exploration. Protection of the outer space environment happens to be one of the issues which this treaty addresses.[28] It states that "the State party shall conduct studies of outer space, including the Moon and other celestial bodies in such a manner to avoid harmful contamination". The treaty also suggests that "the State party must avoid causing unfavourable changes to the environment of the earth with the introduction of extra-terrestrial material". But this legislation does not answer the question of what is meant by "harmful contamination" and "adverse changes to the environment". As a result, this treaty appears to be vague when it comes to addressing the issue of outer space environment protection.

Another international treaty which provides for outer space environment protection is the Moon Treaty, 1979. This treaty was formulated to regulate State conduct with regard to the exploration of the moon and other celestial objects. The Moon Treaty, 1979 states that "In the exploration of moon State, parties shall not disrupt this existing environment by bringing any change in the environment or by any form of harmful contamination".[29] The same provision further states that "the States shall not harm the environment on earth by introducing any extra-terrestrial material".[30]

[27] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 1967.
[28] *Supra* note 7.
[29] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, 1979, art. 7.
[30] *Ibid.*

When the above-mentioned clause is read carefully, you realise that this clause aims to protect the environment of the moon only. The second part of the same clause intends to protect the environment of earth from extra-terrestrial matter. But, similar to Outer Space Treaty, 1967, it fails to define what is meant by "harmful contamination" and "adverse changes to the environment" and is rather vague.

The next convention that provides a perspective on outer space environment protection is the Liability Convention, 1972. As a result of space exploration, one question that arose was how do you establish liability and responsibility in case of damage to or by space objects? The Outer Space Treaty, 1967 does answer the above-mentioned question but the answer it provides is very general. Therefore, The Liability Convention, 1972 was formulated to specifically deal with the issue of liability and responsibility in outer space. This convention holds a party accountable under two separate doctrines *i.e.,* absolute liability and fault liability. The former deals with the damage caused by a space object on earth whereas, the latter deals with any damage caused in outer space by one space object to another.[31] It is a fact that any damage caused by a space object to another space object or any property on earth will cause damage to the environment as well. But, at the same time, under this convention, you can claim compensation only when a human agency's interest is involved. Unlike the protection of the environment on earth, the convention does not protect the outer space environment as a separate entity. Pollution of the outer space environment becomes an auxiliary issue in case of damage claimed under this convention.

Another source which shall be analysed at this point is the IADC Space Debris Mitigation Guidelines, 2007.[32] As stated earlier, space debris imposes a severe threat to the outer space environment and the smooth exploration of outer space. To minimise the increase in the amount of space debris, the IADC Space Debris Mitigation Guidelines, 2007 were signed by various States. Although these guidelines intend to mitigate space debris at the same time, these guidelines do not mention anything about outer space environment protection.

As far as the use of Nuclear Power Sources in outer space is concerned, the International Atomic Energy Agency came up with Safety Framework for Nuclear Power Source applications in outer space.[33] The purpose of these guidelines is to provide a safety framework

[31] Convention on International Liability for Damage Caused by Space Objects, 1972, art. 2 & art. 3.
[32] IADC Space Debris Mitigation Guidelines, 2007.*Available at: https://orbitaldebris.jsc.nasa.gov/library/iadc-space-debris-guidelines-revision-2.pdf* (last visited on July 20, 2021).
[33] COPUOS and IAEA, "Safety Framework for Nuclear Power Source Application in Outer Space" (2009).

for the use of Nuclear Power Sources in outer space.[34] Under its safety objective, the framework states that "it is to preserve and protect the people on earth and its environment from risks attached with the launch, operation and end-service phase of nuclear power sources".[35]

Similar to the other international documents which have been discussed so far, this framework also focuses on protecting humans on earth and the earth's environment from the hazards associated with nuclear power sources. The framework excludes protection to any human in outer space and does not mention anything about outer space environment protection.

In the year 1972 under the Stockholm Declaration, it was proclaimed that the environment provides the human race with all the resources and opportunities to grow and flourish.[36] Therefore, it becomes the duty of the human race to protect the environment, not only for the sake of preserving the human interest in the environment but also to ensure the sustenance and safety of our world and everything which forms part of the environment. After analysing the above treaties, conventions etc., it is safe to assume that international law addresses the issue of outer space environment protection in generic terms. All the international documents analysed so far recognise the protection of the outer space environment to the extent of serving human interest.

Unlike municipal law, international law is not binding in nature. To make these multilateral treaties binding, the signatories have to ratify the same. Numerous signatories have passed national space legislation to fulfil their international obligation. The question which must be answered at this point is "Do these national space legislations provide for outer space environment protection?".

National Space Legislations and Outer Space Environment Protection

India is a signatory to five UN treaties related to outer space but, to date, India does not have any robust space law.[37] With no robust law, India's obligation to protect the outer space environment flows from only one direction *i.e.*, Article 51 of the Indian Constitution and the question of India's willingness to show commitment to the Outer Space Treaty, 1967 concerning environment protection remained unanswered until 2017.

[34] *Ibid.*
[35] *Id.* at 2.
[36] *Report of the United Nations Conference on the Human Environment*, UN Doc.A/CONF.48/14, (5 to 16 June 1972) preamble.
[37] Why India Needs a Space Law *available at: https://www.thehindu.com/opinion/open-page/why-india-needs-a-space-law/article19094453.ece* (last visited on Sep. 11, 2020).

Space Activities Bill, 2017 was introduced with the object of fulfilling India's obligation under Article 253 of the Constitution, as a signatory to various treaties regulating the State's conduct in outer space. The aim of this legislation is to support space activities in India and to facilitate private-sector participation in outer space activities in India.[38] As far as the environmental obligation is concerned, the draft legislation provides that parties "shall not act in such a manner which leads to the contamination of outer space or pollute the environment on earth".[39] The draft legislation also provides for imprisonment and fine for activities which lead to pollution of outer space or pollutes the environment on earth.[40] The question is, are these provisions enough to protect the outer space environment?

The draft legislation has aimed at preventing contamination of outer space but has not defined what is "contamination of outer space". The draft legislation has also provided for imprisonment of a maximum of three years for "activities which pollute the outer space", but the same has not been defined. The use of the word "contamination" and "pollution of outer space" is ambiguous. Another problem with the provision related to punishment is the homogeneity of the punishment regardless of the magnitude of outer space pollution.

Let us consider a hypothetical situation where the Space Activities Bill, 2017 has become a law and a private industry launched a space object to successfully place it in orbit after procuring a license from the Central Government of India. Unfortunately, things did not go as planned and this space object became the source of contamination which affected not only the outer space environment but also the terrestrial ecosystem drastically. The law provides for imprisonment of a maximum of three years and a fine which has to be determined by the court. In this situation, you are left with the question, is the punishment provided by the law sufficient in the current case where a private actor has endangered the lives of millions? The Space Activities Bill, 2017 is a well-drafted piece of legislation from the viewpoint of commercialising outer space activities. As far as outer space environment protection is concerned, the draft legislation does not address this issue in an apt manner.

In the year 1986, the United Kingdom passed the Outer Space Act. The aim of this act was "to confer upon the secretary of the state, licencing and other power to secure compliance with The United Kingdom's international obligation of launching and operation of space objects".[41]

[38] Space Activities Bill, 2017.
[39] *Id.,* s.8 (g) (*i*).
[40] *Id*, s.16.
[41] The Outer Space Act, 1986.

Under this act, one of the conditions to obtain a license is that the licensee must operate in such a manner to "prevent the contamination of outer space or adverse changes in the environment of the earth".[42] Moreover, non-compliance with the condition of the license has been declared an offence under this act.[43] But, at the same time The Outer Space Act, of 1986 is commercial in nature and does not focus on outer space environment protection.

In the year 2018, the United Kingdom introduced the Space Industry Act intending to regulate space activities and sub-orbital activities. The 2018 legislation talks about various licenses. The two important ones from the perspective of the current discussion are spaceport and operating licenses. A spaceport license refers to a license authorising an individual to operate at a site from where space crafts are launched and a site of planned spacecraft landing.[44] Whereas, the operator's license refers to an authorisation to conduct space activities.[45]

One of the conditions on which the grant of spaceport and operator license to an individual depends is 'assessment of environmental effect'.[46] As compared to the Outer Space Act, 1986, the 2018 legislation grants more significance to environmental issues. Yet, the scope of environmental assessment under the Space Industry Act, 2018 is limited to protecting the environment of the earth. Space Industry Act, 2018 does not take into consideration the issue of outer space environment pollution.

The U.S.A. happens to be one of the veteran States with reference to the exploration of outer space. In 1958, the U.S.A. came up with its first national space legislation. The National Aeronautics and Space Act, 1958[47] was formulated with the purpose of regulating space activities in the United States. This act further established the National Aeronautics and Space Administration to institutionalise the mandate of this act. Although, the 1958 legislation happens to be an advance legislation. Yet, the National Aeronautics and Space Act, 1958, does not administer the issue of outer space environment protection.

In the year 1984, the U.S. introduced the Commercial Space Launch Act. The act marks the first instance of privatisation/commercial use of outer space in the U.S.[48] The act itself declared that privatisation of the space sector will offer a scope of growth, particularly for the U.S. Due

[42] *Id.,* s.5 (2) (e) (*i*).
[43] *Id*., s.12 (2) (e) (*i*).
[44] The Space Industry Act, 2018, s.3(2).
[45] *Ibid.*
[46] *Id*., s.11.
[47] Title 51, US Code (2010).
[48] Matthew Weinzierl, "Space, The Final Economic Frontier" *The Journal of Economic Perspectives* 173 (American Economic Association, 2018).

to the commercial nature of this legislation, it can be assumed that provisions related to the protection of the space environment were not suitable.

The only instruments which deal with an aspect of outer space environment protection in the U.S. are in the form of guidelines or standard practices. In the year 2001, the United States Government passed Orbital Debris Mitigation Standard Practices (ODMSP). These guidelines aim to regulate the increase in orbital debris in earth's space environment.[49] In the year 2019, these guidelines have been updated to control space debris more effectively. These updates include a limit on debris release, probability limit on accidental explosion etc. But at the same time, due to lack of enforcement, knowledge etc. these standards and guidelines prove to be ineffective.[50]

After analysing the above-mentioned national space legislations and initiatives it is safe to assume that national space legislations focus more on regulating commercial activities in outer space. Thus, it can be said that there are no detailed laws to deal with the issues related to outer space environment protection.

IV. Recommendations and Solutions

In order to resolve the issue of outer space environment protection, the following recommendations and solutions may be taken into consideration:

Strict Application of Environmental Impact Assessment

Environmental Impact Assessment (EIA) refers to a detailed study wherein a project's possible effects on the environment are determined.[51] EIA helps to predict and mitigate the impacts of an activity on the environment. Principle 17 of the Rio Declaration, 1992 notes that EIA is an effective tool against such activities which might have an adverse impact on the environment. EIA can prove to be an extremely useful tool to mitigate outer space environmental pollution, which is hard to mitigate once an activity takes place.

Outer Space, High Seas and Antarctica are three recognized international spaces popularly known as ungoverned spaces.[52] Ungoverned spaces refer to those spaces which are not

[49] U.S. Government Orbital Debris Mitigation Standard Practices, November 2019 updates, preamble.
[50] Brendan R. Rogillio, "U.S. Drafted Guidelines on Orbital Debris and how to Convince Space Industries to use them" 109 *Journal of Aerospace* 1-9 (SAE International, 2000).
[51] Joseph Castrilli and Elizabeth Block, "Environmental Impact Assessment" 4 *Alternatives: Perspectives on Society, Technology and Environment* 28 (1975).
[52] Darrel C**.** Menthe "Jurisdiction in Cyberspace: A Theory of International Spaces" 4 *MICH***.** *TELECOMM. TECH. L. Rxv*. 69-70 (1998).

governed by any State. Like outer space exploration, the exploration of Antarctica has intrigued human beings. As a result, human exploration of Antarctica began. With the commencement of these exploration activities, a need for international cooperation was felt. Therefore, the international community came up with the famous Antarctica Treaty, 1959 which was signed by numerous States.[53] The Antarctica Treaty, 1959, declares that no territorial claims shall apply to Antarctica.[54] Furthermore, this treaty imposed a ban on any military activities in the Antarctic region.[55]

Soon, in the 1980s, the international community recognized the need to enhance Antarctica's environmental protection due to the application of new technologies which may harm the Antarctic environment.[56] Parties to the Antarctica Treaty decided to regulate mineral exploration through an instrument named the Convention on the Regulation of Antarctic Mineral Resource Activities, 1988. But the sinking of Argentine's vessel near U.S. Palmer Station leading to an oil spill of 2,50,000 gallons made the parties to the treaty take a different approach.[57] Rather than regulating mineral exploitation, it was now decided to ban such exploitation. This led to the Protocol on Environmental Protection to the Antarctic Treaty, 1991(PEPAT).

PEPAT is a comprehensive international treaty which provides for the protection of the Antarctic environment. The preamble of PEPAT recognizes the requirement to improve the protection of the Antarctic environment. PEPAT provides for the ban on activities relating to mineral resources unless an activity is related to scientific research.[58] PEPAT extensively provides for the application of EIA for activities which may take place in Antarctica.[59] Under PEPAT, activities have been categorised under three heads:

1. less than a minor or transitory impact;
2. a minor or transitory impact; or
3. more than a minor or transitory impact.[60]

[53] 12 UST 794, 402 UNTS 71.
[54] Evan T. Bloom "Introductory Note to Antarctic Treaty Environmental Protocol Liability Annex" 45 *ILM* 1 (2006).
[55] Antarctica Treaty, 1959, art. 1.
[56] *Supra* note 54.
[57] *Ibid.*
[58] Protocol on Environmental Protection to the Antarctic Treaty, 1991, art. 7.
[59] *Id.*, art. 8.
[60] *Id.*

Annex-I of PEPAT provides for the basic requirements of any EIA policy. PEPAT's EIA policy provides for three levels of environmental evaluation:

1. preliminary stage;
2. Initial Environmental Evaluation;
3. and Comprehensive Environmental Evaluation.[61]

In case where an activity is categorised as less than a minor or transitory impact then a preliminary assessment is required.[62] In case where an activity is categorised as a minor or transitory impact then an Initial Environmental Evaluation is required.[63] Lastly, where an activity is categorised as more than a minor or transitory impact then a Comprehensive Environmental Evaluation is required.[64]

National legislations do provide for a mandatory EIA requirement for any activity which might take place in outer space. But the issue with the current EIA implementation at the national level is that it does not consider the adverse impacts of an activity on the outer space environment. For instance, the Space Industry Act, 2018 of the United Kingdom provides for EIA which evaluates activity in order to protect the earth's environment.[65] As a result, the current EIA application in the space sector fails to protect the outer space environment. Therefore, it is suggested that a more comprehensive application of EIA in the space sector would prove to be a useful tool against outer space environmental pollution. Outer Space is also an international space or ungoverned territory. Therefore, a similar EIA policy inspired to form the PEPAT's EIA policy could be formulated to regulate the activities which take place in outer space.

A Separate Legislation on Outer Space Environment Protection

As far as the current space policies, both on the national and international front are concerned, none of these policies provides a detailed account of tackling outer space environment pollution. Be it the Outer Space Treaty, 1967, the Liability Convention, 1972 or any other national legislation on space activities, they do not do justice to the issue of outer space

[61] Annex I to the Protocol on Environmental Protection to the Antarctic Treaty, 1991.
[62] *Id.* art 1 (2).
[63] *Id.* art 2 (2).
[64] *Id.* art 3 (1).
[65] Space Industry Act, 2018, s. 11.

environmental pollution. The basic problem with the above-mentioned international treaties is that they are incapable of addressing the current problem of outer space pollution.

For instance, the language of the Outer Space Treaty, 1967 regarding outer space environment protection is very vague.[66] Additionally, it could also be argued that the Outer Space treaty, 1967 does not aim to protect the outer space environment. It suggests that outer space exploration should be performed in such a manner that it does not lead to harmful contamination or adverse changes to the environment of earth.[67] Furthermore, the other treaties and national space legislations analysed in this article appear not to take into consideration the problem of outer space environment protection.

The above-mentioned space legislations were formulated at the inception of the space age. As space activities were minimal at that point in time, the issue of outer space pollution was nearly non-existent. But, with the passage of time, space activities have increased. As a result, outer space pollution has become a pressing concern. As a result, there is a need for detailed legislation addressing the issue of outer space pollution and environmental protection. Outer space and Antarctica share the same status of being an ungoverned territory or international space. In order to protect the Antarctic environment from issues including over-exploitation of minerals etc. PEPTA was formulated. A similar legislation shall be formulated which aims to protect the outer space environment.

V. Conclusion

The Environment has provided humans with resources which led to the advancement of human civilisation. Humans have exploited the environment recklessly which has caused serious damage to the environment. Since 1960s, the protection of the earth's environment has become a major concern both at the municipal and international level. Due to unregulated human exploration of the environment in the past, the quality of the environment in which you live today has declined.

Various forms of pollution, loss of vegetative covers, harmful contamination of the environment through chemical emission etc. pose a substantial threat to life on earth. Recognising the intensity of these various environmental issues, the United Nations Conference on the Human Environment was held in Stockholm in the year 1972. This conference aimed to urge the international community to take steps for the protection and

[66] *Supra* note 7.
[67] *Ibid.*

enhancement of environmental quality. As a result, today almost every State has its national legislation which specifically deals with the protection of the environment.

Similar is the case with space exploration. The year 1957 is said to be the beginning of the space age and exploration. Various international and municipal legislations have been introduced to ensure that every State and private parties get a fair and equal chance to explore outer space. But at the same time, these legislations ignore the importance of protection of the outer space environment in the process of regulating commercial activities in outer space.

As a result of this ignorance, outer space is being explored recklessly in some way or the other. The increasing accumulation of space debris is the best-suited example of this recklessness. At this point, it looks like the man-kind is waiting for the time when outer space environmental pollution starts to bear a direct effect on each living entity and then formulate specific legislation to resolve this issue.

Although there are provisions at both municipal and international level which deal with outer space environment protection. But these provisions happen to be very generic & vague. States are adopting space debris mitigation programs to resolve this issue. But outer space pollution is not limited to space debris. Nuclear contamination and solar power satellites are also a cause of concern.

The international community came up with the Liability Convention, 1972, to address the problem of monetary compensation in case of damage to or by any space object. The international community does not recognise the outer space environment as a separate entity and compensates this entity for any damage caused by human activity. There is no specific legislation probably because it has not yet become a pressing concern or because outer space environmental pollution does not lead to any economic loss. But it should be noted that a day will come when outer space environmental pollution will affect us directly and the effects will be drastic.

In order to avoid these drastic effects, one must start working towards mitigation of outer space pollution. One of the efficient solutions to tackle the problem of outer space pollution is the effective implementation of EIA. EIA is precisely suitable for outer space pollution. It is arduous to mitigate outer space pollution once an activity takes place. With an effective EIA implementation, it is possible to eliminate the elements which may cause damage to the space environment before an activity takes place.

With the passage of time, human exploration of outer space will increase. Therefore, specific laws are required, both at the municipal and international level, to address the various aspects of outer space environment protection. Outer space exploration, space tourism, and lunar colonies are the future of human civilisation and if you wish to save it from the clutches of environmental degradation, specific laws for outer space environment protection are a viable option.