

# The Feasibility of Applying the Polluter Pays Principle to Space Debris

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## Abstract

Space debris is one of the most challenging issues of space activities, which not only threatens the sustainability of the Earth's orbit but can also have a devastating impact on the Earth's environment. On this ground, and by considering Article IX of the Outer Space Treaty as a gateway to environmental domains, it could be reasonable to investigate the applicability of environmental law principles to tackle the challenges of outer space activities. In this regard, the Polluter Pays Principle (PPP) could be one of the most relevant environmental principles for space debris issues, suggesting a practical mechanism and compliance with it could be a condition for sustainable access to outer space. By examining its pros and cons, this paper makes an effort to bring to light the feasibility of applying the PPP to space debris.

**Keywords:** Space Debris, Sustainability, Polluter Pays Principle, Space Law, Environmental Law, Outer Space Treaty.

## 1. Introduction

The global community's perception of outer space activities has undergone significant changes in recent years. At the outset, governments carried out space activities mainly for military purposes, but with the beginning of the third millennium, the privatization of governmental organizations caused tremendous transformations in the space activities ecosystem. Furthermore, the cheapening of the cost of space launches and technological advances led to the entry of more actors, such as emerging space nations, various types of private companies, and academic institutions into the field. Despite the positive impacts of the boom in space activities, some consequences that follow with it should not be neglected. The exponential increase in space debris is one of the direct implications of this paradigm shift, making it a significant challenge in the space industry, undermining the sustainability of

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outer space activities. Moreover, the current geopolitical context, which has already extended the battleground into outer space, has worsened the situation. Conducting anti-satellite weapons tests is a direct outcome of this approach, leading to an unexpected increase in space debris in orbits.

Examining the existing norms governing space activities, one can find explicit or implicit provisions that apply to space debris in hard and soft law forms. Nevertheless, none of them have provided the space community with an effective legal solution to overcome the current and future challenges associated with the generation of space debris. The very reason why space debris has not been directly addressed is that international space law was negotiated and established before debris was recognized as a problem.<sup>1</sup> Accordingly, it is worth investigating the analogous domains of international law to move beyond the current situation and reconsider the issue from a new perspective. Although international environmental law deals with different domains than outer space, it has faced somewhat similar challenges in some aspects. In 1972 and 1992, at the initiative of the United Nations, the participants of two historic environmental conferences in Stockholm and Rio de Janeiro formulated a set of principles to respond to the serious environmental concerns of the international community, *inter alia*, such as common but differentiated responsibility, responsibility for transboundary harm, inter-generational and intra-generational equity, precaution, prevention, and polluter-pays principle.<sup>2</sup> In general, since the principle is primarily expressed in vague terms and its status and content are always open to debate, there should be no problem considering some environmental principles as a basic structure,<sup>3</sup> to construct on which more detailed rules aimed at tackling other fields of international law challenges.<sup>4</sup> However, this paper attempts to investigate the feasibility of applying the 16<sup>th</sup> principle of the Rio Declaration,<sup>5</sup> namely the polluter-pays principle, to space debris, leaving the other principles to further studies. This principle was first formally adopted in 1972 by the Organization for Economic Cooperation and Development (OECD) and is often applied as a liability and compensation mechanism.<sup>6</sup>

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1 Larsen, Paul B. "Solving the Space Debris Crisis." J. Air L. & Com. 83, 2018. p. 482.

2 Kurukulasuriya, Lal, and Nicholas A. Robinson, eds. Training Manual on International Environmental Law. UNEP/Earthprint, 2006. p. 24.

3 Hurova, A. (2021). Dr. Anna Hurova on Space Debris. The Knowledge Constellation. Available at: <https://constellation.iislweb.space/anna-hurova-space-debris/>.

4 Viikari, Lotta. The Environmental Element in Space Law: Assessing the Present and Charting the Future. BRILL, 2008. p. 204.

5 Rio Declaration on Environment and Development, in the United Nations Conference on Environment and Development Report, UN Doc. A/CONF.151/26 (Vol. I), 12 August 1992, Annex I.

6 Undseth, Marit, Claire Jolly, and Mattia Olivari, Space Sustainability: The Economics of Space Debris in Perspective, 2020. p. 41.

There have been numerous studies on the applicability of international environmental law principles to space law issues. One of the outstanding efforts has been made by Lotta Viikari.<sup>7</sup> In her investigation, the author initially outlines the environmental problems related to space activities, such as space debris, nuclear contamination, solar power satellites, manned space stations, and exobiological contamination. Then, both existing international and domestic space law instruments are examined to bring their environmental considerations to light. In the following, the application of international environmental law treaties and principles in the space sector is being studied. Considering the year in which the book was published and the technological advances of the last decade in the space field, it chiefly focuses on applying the polluter-pays principle as an economic tool to compensate for collision damage rather than as a mechanism to remediate the existing space debris in the orbits. Besides that, Paul B. Larsen, in his article, believes that space debris may be viewed as pollution of outer space and regards the polluter-pays principle as a principle of customary international law and points out that this principle may be applied not only to prevent the polluter from engaging in pollution of outer space but also to cause the polluter to compensate for the damage.<sup>8</sup> However, the author does not mention how this principle addresses the space debris issue. Moreover, in their article,<sup>9</sup> Fawaz Haroun and his colleagues emphasize the need to extend the polluter-pays principle to outer space to create a deterrent structure and an objective way to develop funds to deal with space debris. However, like the previous one, these authors do not discuss the details of implementing this principle in outer space.

This paper will attempt to clarify the exact meaning of the polluter-pays principle and evaluate the opportunities and challenges that the principle if implemented, can present to space actors. After a brief overview of the legal status of space debris in space law, the polluter-pays principle and its position in international law will be discussed. The fourth part deals with the applicability of this principle to space debris and the benefits it can bring to the sustainability of space activities. Finally, the last part investigates the likely challenges of applying the principle, which could prevent space actors from considering it a viable solution.

## **2. What Is the Legal Status of Space Debris?**

Intending to solve the space debris concerns, the international community has come up with several normative and regulatory initiatives to ameliorate the

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7 Ibid. [4].

8 Ibid. [1]. p. 491.

9 Haroun, Fawaz, et al. "Toward the Sustainability of Outer Space: Addressing the Issue of Space Debris." *New Space 9.1* (2021): 63-71.

situation. However, the fact that should be noted is that space law has not explicitly defined space debris.<sup>10</sup>

The first and foremost source that could be referred to when it comes to space-related issues is the Outer Space Treaty,<sup>11</sup> which serves as the basic legal framework governing the utilization of outer space. Article IX of the Outer Space Treaty's first and second sentences implicitly address space debris. The first sentence is as follows:

In the exploration and use of outer space, including the moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of cooperation and mutual assistance and shall conduct all their activities in outer space, including the moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty.

This sentence requires States Parties to consider cooperation and mutual assistance in their space activities and obliges them to consider other States' interests, referring to the "due regard" principle. The second sentence provides:

States Parties to the Treaty shall pursue studies of outer space, including the moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose.

According to the second sentence, States Parties are obliged to refrain from polluting outer space in a harmful manner. Although there is no complete agreement on the applicability of Article IX to space debris, it could be argued that the second sentence specifies the due regard principle in the first sentence for the environmental protection of outer space.<sup>12</sup> Moreover, the introduction and generation of debris represent a form of space contamination.

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10 Ibid. [1]. p. 483.

11 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies. Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205.

12 Stubbe, Peter. *State Accountability for Space Debris: A Legal Study of Responsibility for Polluting the Space Environment and Liability for Damage Caused by Space Debris*. Brill, 2017, p. 147.

The prohibition of transboundary pollution, among customary international law, could be an international norm applied to space debris. This norm was formulated in principle 21 of the Stockholm Declaration as follows:

States have, in accordance with the Charter of the United Nations and the principle of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility that activities within their jurisdiction or control do not cause damage to the environment of other states or of areas beyond the limits of national jurisdiction.<sup>13</sup>

The International Court of Justice recognized the customary international law character of this Principle in its advisory opinion on the legality of the use of nuclear weapons.<sup>14</sup> However, regarding the applicability of the principle to outer space, it should be noted that it explicitly refers to the areas beyond national jurisdiction, including the high seas, Antarctica, and outer space.<sup>15</sup> Moreover, due to the lack of reference to outer space as a part of the environment in international space law instruments, attention should be paid to two other international treaties: Article 1 of Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water and Article 2 of Convention on the Prohibition of Military or any Other Hostile Use of Environmental Modification Techniques. Both instruments constitute outer space as a part of the environment.<sup>16</sup>

Based on the above discussion, it was pointed out that outer space pollution violates both conventional and customary international law. Given the lack of appropriate measures to prevent the formation of space debris and also to reduce existing one, several efforts have been made by some relevant international bodies, such as the Inter-Agency Space Debris Coordination Committee (IADC), the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), European Space Agency,<sup>17</sup> the International Organization for Standardization (ISO),<sup>18</sup> and the International

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13 Stockholm Declaration on the Human Environment, in Report of the United Nations Conference on the Human Environment, UN Doc. A/CONF. 48/14, at 2 and Corr. 1, 1972.

14 The legality of the Threat or Use of Nuclear Weapons, Advisory Opinion of 8 July 1996, ICJ Reports 1996. Para. 29.

15 Brunnée, J. Common Areas, Common Heritage, and Common Concern. In *The Oxford Handbook of International Environmental Law*, 2007. p. 557.

16 *Ibid.* [12] p. 184.

17 European Code of Conduct for Space Debris Mitigation, 2004, Available at: <https://www.unoosa.org/documents/pdf/spacelaw/sd/2004-B5-10.pdf> (accessed 10.08.21).

18 International Standard Organization, International Standard 24113, 2019, Available at: <https://cdn.standards.iteh.ai/samples/72383/c7cbc22e4330461d8b691eab90af4f9e/ISO-24113-2019.pdf>.

Telecommunications Union (ITU).<sup>19</sup> Among them, the most prominent action was conducted by the Scientific and Technical Subcommittee of the UNCOPUOS under the title of Space Debris Mitigation Guidelines in 2007,<sup>20</sup> which was endorsed by the United Nations General Assembly.<sup>21</sup> This instrument, which has been built on the work of the IADC,<sup>22</sup> is of a soft law nature and attempts to specify and clarify the above-mentioned norms, namely Article IX of the Outer Space Treaty and the prohibition of transboundary pollution customary international norm.<sup>23</sup> Besides, this instrument is of a voluntary character. Since the UNCOPUOS Legal Subcommittee did not consider the IADC guidelines, this instrument provides only a practical definition of space debris,<sup>24</sup> as follows: “Space debris are all man-made objects, including fragments and elements thereof, in Earth orbit or re-entering the atmosphere that are non-functional.”

This instrument tries to mitigate the creation of space debris in that they, for example, recommend not to continue anti-satellite testing. Furthermore, before the end of the mission, those responsible for the mission should either propel the space object into a graveyard orbit or bring it down to earth so that it will be destroyed whilst re-entering the Earth’s atmosphere.<sup>25</sup>

Reviewing all the above norms, one could argue that all focus on mitigating space debris and remediation is either unanticipated or neglected. However, it is necessary to consider the legal status of these new techniques, such as harpooning or catching space debris. One of the obstacles regarding the remediation of space debris is related to the costs of these measures and the entity that should bear them. Moreover, establishing a causal link between space debris and its owners is another question that should be addressed.<sup>26</sup>

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19 International Telecommunications Union (ITU) Recommendation ITU-R S.1003.2 (12/2010) Environmental protection of the geostationary-satellite orbit, 2010, Available at: [https://www.itu.int/dms\\_pubrec/itu-r/rec/s/R-REC-S.1003-2-201012-I!!PDF-E.pdf](https://www.itu.int/dms_pubrec/itu-r/rec/s/R-REC-S.1003-2-201012-I!!PDF-E.pdf) (accessed 14.08.21).

20 Space Debris Mitigation Guidelines 2007, International Space Law: Documents of the United Nations. New York, 2017 / UN Document ST/SPACE/61/Rev.2, pp. 79-83.

21 UNGA Res. 62/217, International Cooperation in the Peaceful Uses of Outer Space, 1 February 2008, para. 26.

22 Inter-Agency Space Debris Coordination Comm., IADC Space Debris Mitigation Guidelines, IADC-02-01 1, 1 (Sept. 2007), [https://www.unoosa.org/documents/pdf/spacelaw/sd/IADC-2002-01-IADC-Space\\_Debris-Guidelines-Revision1.pdf](https://www.unoosa.org/documents/pdf/spacelaw/sd/IADC-2002-01-IADC-Space_Debris-Guidelines-Revision1.pdf).

23 Ibid. [12] p. 228.

24 Hobe, Stephan, et al. “Cologne Commentary on Space Law, Vol. III.” Carl Heymanns 2, 2015. p. 612.

25 Hobe, S. Stephan Hobe on Space Debris. The Knowledge Constellation. 2021. Available at: <https://constellation.iislweb.space/stephan-hobe-space-debris/> (accessed 12.08.21).

26 Ibid.

### 3. What Is the Polluter-Pays Principle?

The polluter-pay principle can be defined as an economic policy for allocating the costs of pollution or environmental damage borne by public authorities with implications for developing international and national laws on liability for damage.<sup>27</sup> According to this principle, the polluter should bear the expense of carrying out measures decided by public authorities to ensure that the environment is in an ‘acceptable state’ and that the cost of these measures should be reflected in the cost of goods and services which cause pollution in production and or in consumption. Furthermore, such measures should not be accompanied by subsidies that would create significant distortions in international trade and investment.<sup>28</sup>

In general, the pollution problem arises because this factor of production is usually free to the producer of pollution and is not regarded as a factor of production used by him in his production process. Thus, the producer has no incentive to economize on its use in the same way as he does for other factors of production, such as labor, capital, or raw materials. Given that the adverse implications of producing pollution would ultimately affect not only the producer’s production process but also the consumer of the product through it (for example, corrosion or reduction of agricultural productivity, endangering public health, and water resources drying up), it seems reasonable that both sides should bear the cost of pollution; namely the producer of pollution and the consumer of the product that is produced as a result of this process.<sup>29</sup>

Various methods have been proposed to implement the polluter-pays principle, the most appropriate of which are as follows:

*Taxation:* Taxation is a method by which many issues can be controlled. This policy can be applied to both polluters and consumers of polluting goods. The tax amount can vary based on the difficulty of eliminating environmental pollution.

*Charges:* According to this method, the polluter would be charged proportionally to the amount of pollution discharged.<sup>30</sup> This approach can be considered an economic incentive to make polluters comply with the regulations and environmental standards and abate their deleterious effects on the environment; it stimulates the polluter to employ the best practices to reduce the harm caused by its activities and consequently reduce the cost.

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27 Patricia, W., et al. *International Law, and the Environment*. Oxford University Press, 2009. p. 322.

28 OECD, *The Recommendation on Guiding Principles Concerning International Economic Aspects of Environmental Policies*, 1972. A(a) 4.

29 Beckerman, Wilfred. “The Polluter Pays Principle.” *Interpretation and Principle of Application*, in OECD 38 (1975), p. 43.

30 OECD, *The Polluter Pays Principle: Definition, Analysis, Implementation*, OECD Publishing, Paris, 2008.

#### **4. How Could the Polluter-Pays Principle Be Applied to Space Debris?**

As discussed above, the polluter pays principle is rooted in environmental law. As a result, due to the customary international law nature of the prohibition of the transboundary pollution principle, there should be no problem applying environmental law principles, where applicable, to outer space. Accordingly, space debris can be considered the pollution that directly undermines outer space's sustainability. Therefore, if this principle applies to space debris, the producer should take responsibility for cleaning that debris, and this cost should not be imposed on other space actors.

The cleaning up process of outer space from space debris is divided into two principal measures: mitigation and remediation. Space debris mitigation means reducing the generation of space debris through measures associated with a space system's design, manufacture, operation, and disposal phases.<sup>31</sup> Space debris remediation means the restoration of a contaminated environment (outer space) by the removal of the contamination (space debris) through active space debris removal.<sup>32</sup>

As described in the explanation of the polluter-pays principle, this principle deals with pollution after discharging. Since the space debris mitigation measures are generally related to actions in relation to space objects before becoming space debris, it should be argued that the polluter-pays principle can come into play for the remediation of space debris; accordingly, attention should be paid to the applicability of above-mentioned methods of applying the polluter-pays principle to the remediation of the existing space debris.

Choosing a method to apply the polluter-pays principle to space debris should be done by taking into account outer space's unique characteristics. For example, applying a tax policy requires the assessment of the space activities of all space actors before launch to bring to light the possibility of their space objects becoming space debris. In fact, this approach brings about some difficulties; States are not willing to authorize an international body to access some information and data in the manufacturing phase. Taking into account the above considerations, it seems that a method should be applied that includes the process after turning the space object into space debris. Accordingly, the charging method could serve as an appropriate one that not only solves the above concern but collects the necessary financial resources to take action to eliminate the existing debris, especially the huge ones. The

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31 Ibid. [12] p. 459.

32 National Research Council, *Limiting Future Collision Risk to Spacecraft: An Assessment of NASA's Meteoroid and Orbital Debris Programs*. Washington, DC: The National Academies Press, 2011.



prerequisite for the implementation of such an approach is the existence of a supranational authority that performs, *inter alia*, the following actions:

- Identifying hazardous or troublesome space debris that requires action;
- Identifying the actual owners of space debris that requires immediate action and establishing points of contact with them;
- Founding an appropriate mechanism to determine costs related to space debris removal (such as creating a competitive platform for companies that want to provide space debris removal services);
- Proposing a legal mechanism to require polluting States to pay for debris removal costs;
- Monitoring compliance with the entire process (payment mechanism and the removal process).

Such an authority can operate under the auspices of an international entity, such as the relevant bodies of the United Nations. A supranational body that would impartially and fairly supervise and manage space debris remediation will help clear up many uncertainties in solving this challenge and pave the way for the long-term sustainability of space activities. By establishing such a procedure, one can expect that the cost of clearing outer space will not be imposed on others, and only the polluter will bear the burden. This approach improves the status of space activities from two aspects:

- First, the emerging space actors (both public and private), which mostly have fewer financial resources than old actors, will not have to pay for the actions of the previous actors and will spend their resources to develop and flourish their space activities;
- Second, all space actors (both old and new) will be aware of the requirement to remove their space debris from the very beginning. As a result, they will not only pay attention to mitigation measures from the design stage of their space object, but in their cost calculations, they will allocate a budget for space debris removal.

## **5. What Are the Challenges of Applying the Polluter-Pays Principle to Space Debris?**

Despite the advantages of applying the polluter-pays principle to space debris, it must be acknowledged that implementing the proposed model can be associated with several obstacles. In this part, an attempt will be made to examine some of the challenges in implementing the proposed model.

### 5.1. The Definition of “Launching State” in International Space Law

The term “Launching State” is defined in Article 1(b) of the Liability Convention<sup>33</sup> and Article 1(b) of the Registration Convention<sup>34</sup> as follows: “(i) A State which launches or procures the launching of a space object; (ii) A State from whose territory or facility a space object is launched.”

The launching State is defined above broadly. This definition specifies four different forms to determine a State as the launching State of a space object. Such a broad definition caused some criticism by some States during the UNCOPUOS meetings, and they believed that it is unfair for a State that has opened its territory only for the purpose of launching a foreign rocket to be liable for the damage of this space object and its payload might conceivably cause.<sup>35</sup> The same is true for attributing the generation of space debris to a specific State or a group of States that are considered launching States according to the above definition. Given the fact that some space objects are launched into outer space with the participation of several States, the amount of their contribution to the generation of space debris might be different. Based on this, determining which State or States can be identified as polluters and obliging them to pay the remediation cost can be challenging in implementing this principle.

### 5.2. Increasing the Cost of Space Activities

It should be noted that the strict implementation of the polluter-pays principle can raise the costs of space activities and hinder the development of the space industry, particularly in developing countries. This increment can be expected in the following expenses:

- Insurance of space activities;
- Mitigation measures to prevent becoming space debris;
- Mandatory payment for the space debris remediation.

Given that conducting space activities is inherently expensive, compelling additional costs to the initial cost of the space activity can prevent the entry of new space actors and become only an area for the activities of developed countries. Nevertheless, given the urgent situation regarding space debris, this concern can be addressed through other measures, like applying the common but differentiated responsibility principle and starting the process from the largest producers of space debris in the first step.

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33 Convention on the International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187.

34 Convention on Registration of Objects Launched into Outer Space, Nov. 12, 1974, 28 U.S.T. 695, 1023 U.N.T.S. 15.

35 Hobe, Stephan, et al. “Cologne Commentary on Space Law, Vol. I.” Carl Heymanns 2, 2009. p. 137.

## 6. Conclusion

Space debris and related issues have been the subject of efforts and discussion by States, non-governmental institutions, and academia for many years. However, none has resulted in a binding and efficient solution. Moreover, technological advances, such as deploying satellite mega-constellations in Low-Earth Orbit, are worsening the situation, and failure to find a viable solution may make the situation irreversible. Despite the difficulty in reaching an agreement by States in the current geopolitical situation, particularly on space-related issues, space debris should be of particular concern to all stakeholders of space activities, and lack of compromise on other matters should not prevent cooperation in solving this problem. The successful implementation of the polluter-pays principle, as a customary international law norm, in the remediation of space debris can be considered one of the solutions to improve the situation of the Earth's orbits and promote responsibility among all States and private actors. However, its implementation is not feasible without considering possible challenges and might cause other problems, such as obliging States that had no role in creating space debris to pay for remediation and increasing the cost of space activities. As a final point, it should be acknowledged that cooperation in addressing global problems is the ultimate way. In this respect, international environmental law should be seen as a successful example of promoting cooperation in responding to global crises, which has been observed in some cases, such as ozone layer depletion and climate change.

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