Environmental Sustainability Measures for Airports

by

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The attached Occasional Papers have been prepared by a group of scholars associated with the Institute of Air and Space Law (IASL) at McGill University. They are the result of a collaborative effort between the IASL and the Centre for International Sustainable Development Law and are designed to be part of a book prepared by authors from both groups which will eventually be published by the Cambridge University Press under the title Sustainable International Civil Aviation.

As the title of the book suggests, bringing together these various scholars and papers is the central theme of the sustainable development of international aviation. In particular, the work of the International Civil Aviation Organization (ICAO), the primary United Nations body tasked with regulating the environmental aspects of international aviation, and the provisions of the Chicago Convention which lays down powers of the Organization and the fundamental rules of international air law, form the primary focus of this collection. At the next ICAO Assembly in September-October of 2016, ICAO has the ambitious mandate to finalise a global scheme to limit CO2 emissions from international aviation. As many of the articles contained in the book are of immediate relevance to the discussions due to take place at ICAO, publishing and disseminating these draft chapters will contribute to the growing interest and debates on the issue of the environmental impact of aviation. It is hoped that these papers will contribute to the work of the Assembly and that informed readers and delegates participating at the ICAO Assembly will have constructive comments to share with the authors.

Readers are invited to send their comments to the authors whose e-mail addresses are set out on the title page of each paper as well as a copy to the following address: edannals.law@mcgill.ca

The authors and the Editors of this collection of papers thank all readers for their attention and their comments.

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SUMMARY

Socio-economic benefits and environmental costs of airports: How can governments achieve a balance between the economic and environmental considerations involving airports?

The issue:
- What are the primary environmental issues associated with the operation of airports?
- What are the solutions available in addressing those environmental issues?
- How can the government balance airport growth and the environment?

Its importance:
- Airports play a vital role in local and national economies.
- Airports create significant environmental costs and impacts to the locality where they are built.
- Community opposition prompted by the environmental concerns brought about by airports may hinder the latter’s full development.

The treaty law:
- Annex 16 to the Chicago Convention addresses environmental concerns posed by aviation such as aircraft noise and greenhouse gas (GHG) emissions.

The analysis:
- Primary environmental issues associated with the operation of airports are GHG emissions, noise pollution, land utilization, waste, and congestion.
- Several solutions are available in addressing the environmental impact caused by airports. This ranges from adopting new procedures and technology to imposing caps. One of the effective measures is Air Traffic Management. It increases the efficiency in the use of fuel and use of airport, which ultimately reduces GHG emissions and can mitigate noise emissions.
- Growth of airports should be encouraged for the economic and social benefits they provide. However, such growth should be a green growth in which increase in capacity is not achieved at the cost of negative impacts on the environment.
- A balance between the growth of airports and its environmental concerns can be achieved through the implementation of careful studies, the active involvement of the local communities in all stages of development, and implementation of plans necessary for the effective management of airports.
- Effective regulation and policy-making regarding the environmental sustainability of airports requires action both at the international and national levels.

Options for decision-makers:
1. Adoption of national regulations that will promote the environmental sustainability of airports.
2. Involvement of the local communities in developing airports.
3. No action on the part of decision-makers, which may result in either the limitation of airport growth or escalation of the adverse environmental impact caused by airports.
I. INTRODUCTION

Airports, with the facilities and services they provide, are considered as one the most important parts of the infrastructure required for the regular operation of aircrafts.国际机场 considerably contribute to local economy and employment. However, together with the socioeconomic benefits they offer, environmental costs and impacts are the inseparable results of the operation of airports. Following the increasing demand for air travel of passengers and cargo, aviation industry is anticipated to grow further and this means more incentives and driving forces for building new airports or expanding the existing ones, and this will intensify the significance and complexity of environmental and sustainable development concerns.

Some of the main environmental and sustainable development concerns raised with respect to the operation of airports are emissions, noise issues, land use by airports and energy consumption. The challenge ahead of airport authorities is to find a balanced approach for maximizing the capacity of airports and the possibilities and potentials for future growth in one hand, and minimizing the accompanying negative impacts on the other hand.

Airports’ authorities, in response to communities’ concerns, public awareness of environmental issues of aviation activities and regulatory measures of local authorities and governments, have been trying to apply strategies and procedures to diminish the adverse effects of their activities on the environment. By having appropriate and effective

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1 Milan Janić, Greening Airports: Advance Technology and Operations (Delft, Netherland: Springer, 2011) at 6, 12 [Janic, Greening Airports]. Another important component of this infrastructure is Air Traffic Control Services.
3 Energy consumption, wastage and water contamination are among other problems. See Janić, Greening Airports, supra note 1 at 20-21, 35.
environmental management which develops and implements approaches and mechanism to integrate airports and their activities in sustainable development issues, airport authorities may accomplish the optimum balance between airport’s growth, and communities and regulator’s satisfaction.

In this writing, the main concerns of environmental sustainability raised by operation of airports are highlighted and the importance of engagement of communities as well as effective interference of government as part of the policy planning process for airports sustainability will be discussed.

II. AIRPORTS ENVIRONMENTAL BURDENS

A. EMISSIONS AND ENVIRONMENTAL CAPACITY

The anthropogenic negative effects on the Earth’s climate are one of the most important environmental issues the aviation industry has faced. Emissions from aircraft, both at ground level and at altitude, can give rise to numerous negative effects on air quality, climate and the ozone layer. The gases and particles emitted from aircraft engines can cause harmful effects in different stages of the flight, from the ground to higher altitudes. At ground level, where airports are involved, one of the adverse effects of aircraft emissions is degradation of the air quality, which may directly impact human health. According to the environmental reports and assessments, particulate matters, NOx, HC, SOx, and CO from aircraft engine emissions can affect air quality, health and welfare. Aviation-related emissions in the ground level and airport vicinities do not limit to aircraft emissions; ground support equipment are other contributors. This means that air pollution from the airport ground-service vehicles, as well as the airport surface access systems should be considered as part of the environmental burden of the airports.

Assessing Climate Change, Noise and Air Quality Aviation Impacts, supra note 5 at 7.
8 This includes Motor vehicles (e.g., cars and buses for airport operations, and passenger, employee, and rental agency vehicles), Ground service equipment (GSE) (e.g., aircraft tugs, baggage and belt loaders, generators, lawn mowers, snow plows, loaders, tractors, air-conditioning units, and cargo moving equipment), Stationary sources (e.g., boilers, space heaters, emergency generators, incinerators, fire training facilities, aircraft engine testing facilities, painting operations, and solvent degreasers). See
Today, there are environmental limits and constraints which are implemented with respect to the airports in order to lessen the environmental costs of aviation activities. To this aim, environmental capacities have been defined by regulators and authorities, which limit the number of air traffic movements for people and cargo, and foster other measurements to keep the environmental burdens below the defined limits. Such environmental capacity limits and targets are manifested in the form of caps and quotas in each airport. To address the pollution and air quality concerns raised by airports operation, different solutions and mechanism are suggested and being employed by the airport authorities. Such solutions may range from using procedures and technologies to reduce aircraft emissions at landing and take-off, and sustainable management of airport fleets to aircraft engine efficiency, as well as the use of alternative fuel sources for ground support equipment and power heating. With respect to the emissions from airport operations, it is important to mention that the strategies for minimizing emissions from sources owned or controlled by airport operator and emissions from off-site generation of electricity purchased for airports are different from those developed to prevent acceleration of environmental impacts created by emissions from sources which are not owned or controlled by the airport operator, including aircrafts and ground access vehicles and public transport.

B. NOISE ISSUES

Noise, which can be defined as any unwanted sound, can cause profound negative effects on humans’ health and their physical, psychological and social well-being and quality of life. Since the emergence of the aviation industry, aircraft noise has been one of the most important sources of excessive noise generated by human activities. Two sources of aircraft noise are the engines, which include two major types of jet and
piston engines, and the aircraft frame. In the view of the fact that aircraft produces more noise during take-off and landing, airports are considered to be important contributors to the problem of excessive noise, and from a community’s perspective, one of the most obvious environmental problems of airport activities is noise pollution. In addition, noise generated by ground access systems in the airport landside area adds to the already existing problem of excessive noise in airports.

With respect to the problem of excessive noise in the vicinity of airports, airport operator need to reduce aircraft noise emissions, reduce the number of people exposed to excessive noise levels, and finally help local community receive the airport’s plans and activities. Solutions such as urban planning, applying new technologies and designs, and restricting operation of particular aircraft types, frequency of flights and night-time flights, planning and managing land use, and redistributing noise by managing runways and routes use are some of the mitigative measures employed to meet noise quotas and prescribed limits. For the purpose of protecting local communities in the vicinity of airports, curfews and avoidance of immission of noise during night might seem to be some of the most practical solutions. However, restrictions on night flights and curfews lead to under-utilization of infrastructure, which is not favorable with respect to growth and economic viability of airports. ICAO, with its regulations and manuals, has been very active in noise management and control at airports.

C. LAND UTILIZATION, WASTE AND CONGESTION

The impacts of airports do not limit to emissions and noise issues. Land use by airport, waste and ground congestion are among the problems which need attention of regulators as well as airport authorities in order to diminish the impacts on environment and social life.

Land take refers to utilisation of land by airports for the purpose of building and operating airport related activities. Through effective operational procedures and increasing the capacity gains the need for additional land for building new runways and facilities will be avoided.

15 O’Brien, supra note 12 at 158.
16 Janić, Greening Airports, supra note 1 at 42.
17 Andre, supra note 6 at 36; Allegedly a third of complaints about airports concern acoustic issues. Thomas, supra note 10 at 105.
18 Janić, Greening Airports, supra note 1 at 56.
19 Oh, supra note 11 at 51.
20 CRS Report, supra note 8 at CRS 4; Janić, Greening Airports, supra note 1 at 44; Thomas, supra note 10 at 105.
21 Griefahn supra note 14 at 56.
22 Thomas, supra note 10 at 106.
23 Janić, Greening Airports, supra note 1 at 99.
Airport waste refers to the waste generated by an airport’s operation. Such waste can be generated by passengers, airfield operations and maintenance activities, and those caused by construction and demolition.\(^{24}\) The less the waste generated by airport over a specific time is, the better and more efficient waste management efforts of airports have been.\(^ {25}\) Needless to mention that some of the activities of airports such as aircraft and airfield deicing and anti-icing, fuel storage and refueling, aircraft and vehicle cleaning and maintenance, and construction may result in the discharge of pollutants to adjacent water bodies and consequently trigger aquatic life and human health.\(^ {26}\)

Airline and air passenger congestion and delays are another issue accompanied with operation of airports. Optimum utilization of airport and specially runways’ capacity is normally considered the key to minimize the aforementioned congestion.

III. THE ROLE OF ATM

Ensuring the sustainability of the airspace that aircrafts share has been a concern for environmental activists for the last few decades. One of the strategies to reduce the adverse effects of aviation on the environment is developing operational measures, one of which can be accomplished through improvement of air traffic management services. “The most important fuel saving opportunities come from ATM systems that permit more direct routings and the use of more efficient conditions such as optimum altitude and speed. Shortening routes can indeed significantly reduce CO2 emissions.”\(^ {27}\) ATM and other operational procedures, reportedly, can reduce aviation fuel burn between 8% and 18%.\(^ {28}\) However, fuel efficiency through ATM operational procedures requires that institutional and regulatory arrangements be applied at both the national and international levels. Operational measures are considered an effective and quantifiable means of minimizing aircraft emissions, with near-term results.\(^ {29}\) Therefore, the contribution of ATM systems to the protection of the environment, both in the implementation and operation of the global ATM system and the global air navigation plan, is encouraged.

In May 2007, aware of the importance of the air navigation service contribution to mitigating the impact of aviation on the environment, the Civil Air Navigation Services Organization (CANSO) adopted a voluntary code of conduct that establishes a

\(^{24}\) Oh, \textit{supra} note 11 at 50.
\(^{25}\) Janić, \textit{Greening Airports}, \textit{supra} note 1 at 56.
\(^{26}\) CRS Report, \textit{supra} note 8 at CRS 5.
\(^{29}\) \textit{ICAO Environmental Report 2007}, \textit{supra} note 27 at 139.
framework within which air navigation service providers can seek to offset the environmental impacts of growth through their own initiatives and collaboration with other industry stakeholders. These efforts, together with the initiatives of ICAO for improving the global ATM systems, are steps towards the environmentally sustainable use of airspace.

Today different advanced operational procedures are developed and implemented through Air Traffic Control and Air Traffic Management operations and more efficient and effective utilisation of the available airport airside capacity in order to mitigate noise around airports.31

Through Arrival and Departure Flow Management component of ATM, it is possible to optimize usage of existing airport’s runway capacity or the number of slots in the most feasible way by changing the time pattern of flights.32 In addition, advanced technologies can help in maximizing the runway’s landing capacity by reducing separation and increasing diversity of air traffic control separation rules.33 Through better management of the usage of the existing runways at the airports, it is possible to avoid the necessity of building new runways and ATM services considerably contribute to this aim.

IV. COMMUNITIES’ POSITION COUNTS!

Environmental concerns have always ignited local communities’ opposition to airports growth. Without having enough environmental capacity, which are defined through regulatory standards and dealt with through environmental management, airports’ potentials and infrastructures cannot be put into full and real use.34 Communities’ opposition to airports’ plans and schemes for expansion and growth can be so strong to abandon even very important and economically critical plans of expansion, the example of which is scrapping London Heathrow additional runway plans.35 Airports initiatives and performances, and their strategies in answering local communities’ environmental concerns are the key in prosperous and smooth growth of airports. Maintaining a relation based on mutual trust and partnership with communities can secure the society’s acceptance of growth plans of airports.36 The following steps may

30 Ibid at 138.
31 This includes procedures such as “ATC time-based instead of the distance-based separation, prioritising instead of currently used FCFS (First-Come-First-Served) priority rules for landing aircraft, and steeper approach procedures for landings on closely spaced parallel runways.” See Janić, Greening Airports, supra note 1 at 43-4, 100.
32 Janić, Greening Airports, supra note 1 at 45.
33 Applying ATC time-based instead of the distance-based separation rules are considered as an effective method for increasing runways capacity. See Janić, Greening Airports, supra note 1 at 100-103.
34 Upham supra note 4 at 149.
36 Oh, supra note 11 at 52.
be taken into account in order to ensure that local communities and environmental activists will receive airports plans for future growth:

A. CAREFUL STUDY OF THE ACTUAL ENVIRONMENTAL BURDENS ACCOMPANIED WITH AIRPORT’S ACTIVITIES AND PLANS FOR FURTHER GROWTH

This step can be seen as the first step in environmental management of airport activities and diminishing its negative effects to the greatest extent possible. It implies first identifying the environmental problems at a given airport and then measuring and quantifying negative effects in each area such as air quality, noise disturbance, waste, water contamination and traffic congestion. To this aim, advance modeling techniques and methodologies for precise quantification of such effects should be applied. Apparently the evaluation methods and techniques need to be updated regularly to have the most accurate results.37

B. DESIGNING PLANS AND SCHEMES FOR CONTROLLING AND DIMINISHING THE BURDENS, WITH COMMUNITIES’ ENGAGEMENT

Taking into account the results of the studies and measurements mentioned in step one, next step is carefully developing plans and schemes in which, environmental constraints in terms of noise and allowed emissions of pollutants are set in order to protect the local population, air quality and the environment from the adverse effects and minimizing the number of people affected. Therefore this stage means sketching out both preventive and mitigative measures and plans and then implementing such plans to meet the defined targets and goals. Communities’ involvement in preparing such environmental schemes and targets is a crucial element in success of such plans.38 Airport authorities must assure local communities that they listen to their issues of concern, and this can be best done through developing community engagement programmes in which the community is engaged in the process of preparation of environmental schemes.39 Effective communication and consultation strategies make communities’ involvement possible. Vienna International Airport, for example, in its mediation process on environmental concerns engaged different groups of stakeholders, including local communities, in order to prepare a mediation agreement, which took place in 2005.40

For the operational and strategic measure foreseen in such plans, milestones and short-to long-term goals can be defined for a better and more realistic and at the same

37 Griefahn supra note 14 at 52.
38 Upham supra note 4 at 149.
39 Thomas, supra note 10 at 107; Oh, supra note 11 at 52.
time trackable realization of the targets set forth in the scheme.

C. CONTINUOUS MONITORING AND PUBLISHING REPORTS

Protection of communities against impacts of operation of airports and preventing degradation of quality of life in the vicinities of airports should be conducted through an ongoing and dynamic process. Continued, regular, and transparent monitoring and assessments on the airport performance with respect to environmental factors are a part of the process. This implies checking the generated disturbance, including emissions, noise, congestion, and wastage, in a given period of time to see first, whether the plans were implemented as foreseen and second whether the measures were effective and the results have been satisfactory. In this step, public access to the prepared reports should be ensured. The results of assessments and reports should be transparent and easily accessible in order to acquire and maintain the trust of communities. By demonstrating a commitment to green initiatives, airports will improve their relationships with local communities, and this may eventually lead to less opposition from local communities to future expansion. As an example, Sydney Airport in its Environment Strategy for 2010-2015, considers providing up-to-date environmental information to the community and making publicly available information on key environmental achievements as some of the targets of its action plan.

V. REGULATIONS

Regulatory intervention has always had a great impact on transportation industry, and the issues related to environment have been an important reason for such intervention. Policy makers and regulators have a key role in ensuring that in regulating the air transportation industry the interests of society as well as the local community are well taken into account. Governments as part of the policy planning process for transportation should consider protection of people against health hazards which may be accompanied by such activities as a top priority. With respect to aviation industry, this requires coordination between transport, environment, and health policy makers and

41 Griefahn supra note 14 at 52.
42 Upham supra note 4 at 149.
43 Oh, supra note 11 at 52.
44 Thomas, supra note 10 at 105.
46 Environmental issues are perceived to have a great impact on supply and demand. See Brian Graham, Claire Guyer, “Environmental sustainability, airport capacity and European air transport liberalization: irreconcilable goals?” (1999) 7 Journal of Transport Geography 165-180 at 172-3.
47 Charter on Transport, the Environment and Health of World Health Organization, 1999, in its preamble urges to ensure that community wellbeing be put first when preparing and making decisions regarding transport and infrastructure policies. See The World Health Organization 1999 Charter on Transport, the Environment and Health, EUR/ICP/EHCO 02, 02 05/9 Rev.4 09009 – 16 June 1999, at preamble.
developing policies accordingly in all the stages, from manufacturing of aircrafts and building infrastructures (regulations for standardization), to running and operation of airports. By creating environmental constraints, governments can help to control/limit the burdens of the air transport and the harmful impacts they might pose to people’s health and environment.\footnote{Janić, “Modelling Operational, Economic and Environmental Performance”, supra note 2 at 416.}

Without proper laws and regulations on stabilizing and/or diminishing negative effects of the aviation activities on people, airports and airlines might not have enough incentive to control the environmental hazards of their activities and therefore might want to use their full capacity for the volume of air traffic to maximize the profits.\footnote{Environmental issues are perceived to interfere in their primary goal of making money. See Graham and Guyer, supra note 46 at 165.} Regulations in place, permissions and licensing procedures which are needed to be complied with in order to operate or expand the airports, have the actual power to urge airport operators implement sustainability practices.\footnote{Kris Pauwels, “Road map to sustainability”, (February–March 2012) 17:1 Airport World, at 58.} Being aware of the fact that complying with regulations and licensing procedures is the prerequisite to executing the plans for growth and increase of capacity, airport authorities are motivated to develop and implement green strategies. At the same time it is very important that policies and regulations created by the government do not give rise to under-utilization of infrastructure and capacity. Because taking into consideration the social and economic benefits that airports operation, and aviation activities in general, offer to the local communities and the society, due attention to possibilities and potentials for future growth is as important as giving value to environmental concerns. “The dialogue around sustainability means considering not only the environmental issues around airport development and management, but the social and economic impacts of airports, and the benefits they bring to local communities.”\footnote{Thomas, supra note 10 at 104.} It is the policy maker’s art to balance between the inherently opposite interests associated with aviation activities.\footnote{Janić, Greening Airports, supra note 1 at 28.} Building new airports or expanding the existing ones is already a very long process, not just because of the construction process, but because heavy local and national regulations require a complex and time consuming process, which can affect smooth operation of airports.\footnote{Sean Paige, “Regulatory Reform and Airport Runways”, (June 2001) 17:22 Insight on the news, at 47.}

Therefore achieving such balance and designing adequate but not too much environmental constraints, which might halt successful performance of airports, requires considering different factors and conducting careful studies. “[T]rading-off between particular effects–benefits and related impacts–costs by using different policy instruments (tools) need to be carefully carried out respecting their rather strong inherent mutual interrelations.”\footnote{Janić, Greening Airports, supra note 1 at 61.} That being said, the importance of community’s perception of the environmental impacts of airport activities once again becomes evident. By securing the local community’s acceptance for operation or expansion of a given airport, overly
restrictive regulations can be avoided.\textsuperscript{55}

Adoption of international standards through international bodies such as ICAO is a very important part of the process. Possessing the authority to adopt and amend international Standards and Recommended Practices (SARPs) which deal with a wide range of matters affecting the international aviation industry, ICAO works to realize the goals of the Chicago Convention\textsuperscript{56} for achieving uniformity in regulations, standards, procedures and all other matters affecting international aviation. Having an environmental mission, ICAO has been trying to address environmental concerns of aviation, especially in the areas of aircraft noise and emission. Annex 16 to the Chicago Convention, entitled Environmental Protection, is the result of ICAO’s work in introducing international Standards and Recommended Practices for the environmental aspects of aviation.\textsuperscript{57} However, ICAO is reliant on its member states for implementation of its standards. In other words, States that are unable to abide by Annex 16, as required by article 38 of the Chicago Convention, should notify ICAO of any differences between their national regulations and practices and the international Standards and Recommended Practices introduced by the Annex.\textsuperscript{58} Although article 38 gives States the right to reject the application of the international Standards and Recommended Practices to their aviation industry, there is great pressure from the international aviation community to comply; and as a result, the standards and practices adopted though the ICAO system normally enjoy widespread compliance.\textsuperscript{59} Still, more international standards are needed to help making airports more sustainable. Nonetheless, because implementation of standards and operation of restrictions are done through local and national authorities, effective regulating and policy making for having environmental-friendly airports needs action in both international and national levels.

VI. CONCLUDING REMARKS

Airport operations are usually accompanied with economic and social benefits for airport operators as well as the local community and society. With airports’ growth this benefits increase. However, the increase of environmental burdens with the growth of airport remains an issue which needs to be dealt with. On the other hand, limiting airports growth through environmental caps and quotas may give rise to less benefit for communities and society. Where such conflicting interests arise, the decision about building or expansion of airports is obviously a trade-off between the positive and negative results of such decision for the local communities and the society as a whole. In this scenario, the role of government and its initiatives in appropriately addressing

\textsuperscript{55} Oh, \textit{supra} note 11 at 52.
\textsuperscript{58} Chicago Convention, \textit{supra} note 134 Article 38.
\textsuperscript{59} Miller, \textit{supra} note 176 at 729.
sustainability considerations becomes highlighted. When talking about the concept of sustainability, all the three factors namely financial sustainability, social sustainability, and environmental sustainability should be addressed. Aviation-related issues are not any exclusion. The critical role of a specific airport to a nation’s economy is highly significant and needs to be considered when deciding about airports operations and expansion plans. Together with the attempts to minimise the adverse effects that operation and growth of airports may have, it is also important that airports develop strategies which seek to maximise the social and economic benefits. Growth of airports is encouraged for its economic and social benefits, such growth should be a green growth in which increase of capacity does not happen in the cost of more environmental burdens. Making airports sustainable means looking at all the social, economic and environmental factors and accordingly developing an effective sustainable approach. Reaching to a desirable balance is achievable through careful studies that helps to decide how to define airports environmental capacities and constrains, and in this process all the environmental as well as social and economic parameters should be taken into consideration.

Active involvement of local communities should be part of the process of establishing and maintaining a sustainable air transport system, of which airport is an important part. This is achievable through involvement of communities in all the steps of developing and implementing plans needed for effective environmental management of airports. In other words, communities should be heard.

Finally, public policy initiatives of policy makers should be taken in a way to incentivise airport operators to more actively look for sustainable practices. But at the same time, it is important that the regulators and airport operators plan and choose operational procedures and supportive advanced technologies to achieve sustainability goals and objectives with an eye to the specific features of a given airport, to ensure their socio-economic feasibility and effectiveness of these procedures. ICAO, by proactively addressing issues concerning sustainability of airports, can provide national and local authorities with an effective and comprehensive guideline for producing proper regulations.

61 Charles, supra note 2 at 1011.
62 Upham supra note 4 at 149.
63 Thomas, supra note 10 at 102.
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