

The Juridical Management of the Noise Produced by Aircrafts

Florin FAINISI^{1,*}

*Corresponding author

Faculty of Law and Public Administration, "Spiru Haret" University,
Soseaua Berceni, nr. 24, sector 4, Bucharest, Romania
florin.fainisi@yahoo.com

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Abstract: *Noise is a public health problem and, more than that, a source of discomfort perceived strongly by population. World Health Organization (WHO) has undertaken studies that have underlined the harmful aspects of noise on the human body, and EU regulations have aligned their requirements to both WHO standards and the standards set by International Civil Aviation Organization (ICAO). At national level, Romania has adopted rules on controlling noise, which transposed the European directives in the field. This study presents the legal measures taken by France to mitigate noise pollution around airports, of which the act establishing compensations for residents for soundproofing homes would be a good example for Romania.*

Key Words: *noise, airport noise pollution, aircraft, comparative legislation*

1. GENERAL REMARKS

Petit Larousse defines noise as all the sounds produced by vibration that can be perceived by the ear or as a set of sounds without harmony. Noise is often considered pollution or sound distress, depending on its intensity or frequency.

Noise has a paradoxical role in people's concerns. It is rarely placed at the rank of pollution in terms of environment, most often identified as a main source of distress, especially in urban areas. The latest medical and psychological studies have highlighted the harmful and often insidious aspects of noise on human body, so that 16% of EU citizens suffer from hearing loss and amount to, according to World Health Organization (WHO), 1,818,000 years of healthy life lost each year in Western Europe due to diseases that are related to noise.

In addition, in "Guidelines for Community Noise" [1] WHO confirms that the effects of ambient noise, including distress, are serious health problems. In "Night Noise for Europe" [2] the indicative value for noise levels at night must not amount to more than 40 decibels (dB, Lnight).

Also, the latest publication [3] of WHO and European Commission indicates that ambient noise is one of the serious environmental risks for public health and that exposure to noise in Europe has the tendency to increase compared with other stress factors. Urbanization, growing demand for motorized transport and inefficient urban planning are the main forces responsible for exposure to ambient noise. Moreover, noise is often associated with urban areas in which air quality may also be a problem. For the quantification provided, general methodology is used, based on the evaluation method DALY (Disability-adjusted

¹ Associate Professor PhD.

life years - "correction for the life years taking into account the disability") [4]. WHO makes estimates on the number of life years lost per year due to a premature death or years lost due to disability or illness caused by noise in Western Europe (61,000 years for cardiovascular disease; 45,000 years for children with cognitive deficiencies; 903,000 years for sleep disturbances; 22,000 years for acute noise trauma, 654,000 years for discomfort).

Noise pollution can disrupt, disturb sleep, affect cognitive function in children of school age, cause physiological stress reactions and also lead to cardiovascular disease in subjects chronically exposed to noise. Stress can trigger the production of certain hormones that can have various intermediate effects, including high blood pressure. If exposure takes a long time, these effects may lead to increased risk of cardiovascular disease and mental disorders.

The economic costs of noise pollution include: decrease of house value, loss of productivity due to health effects and distributional effects. Social costs related to premature death or morbidity (reduced concentration, fatigue, hearing problems).

Moreover, the study conducted by Bridget Schield "Evaluating socio-economic costs of hearing deficiency" whose results were compiled in a report published in October 2006, concludes that the shortcomings in the treatment of hearing loss cost Europe 213 billion euros per year, equivalent to 473 euros per adult/per year [5].

According to the report, a slight loss of hearing acuity costs 2,200 euros/person per year; a moderate loss of hearing acuity costs 6,600 euros/person per year, while a severe loss of hearing acuity costs 11,000 euros/person per year. These figures do not take into account losses in terms of income and income taxes due to unemployment or early retirement due to a weakening of hearing. Calculations in the report are in agreement with European Commission standards, establishing a statistical value of "a year of quality of life" at 44,000 euros and having the health index that classifies different types and levels of disease and suffering compared to a healthy person. Sound discomfort can be classified into three categories: the one from the transportation, the one related to work conditions, and the one felt in urban and suburban areas. WHO's and the European Commission's report of 2011 concludes that traffic noise can be responsible for the annual loss of over one million healthy life years across EU Member States and other countries in Western Europe [6]. Of these, air traffic is responsible for the special problems of noise at airports located in the center or near large urban areas and the sustainable development of air transport requires measures to reduce aircraft noise at airports with particular noise problems.

2. COMMUNITY RULES

European Commission has found that although 75% planes became less noisy in the past 30 years, however, by increasing air traffic, many EU citizens are still exposed to high noise levels. To ensure sustainable development of aviation, the measures on noise impact remain necessary for a significant number of airports [7].

In European Union countries, European regulation establishes restrictions on the registration and operation of aircraft depending on acoustic characteristics. To facilitate the joint definition of noise measurement and reflection, European regulation aligns its requirements to the internationally established rules: the standards of International Civil Aviation Organization (ICAO).

Currently, aircrafts are divided into three classes, according to their level of noise:

- "uncertified" aircrafts, that do not comply with noise limits agreed by international aviation authorities and, thus they are prohibited from operating at European airports;

- "chapter 2" aircrafts prohibited at European airports from April 1, 2002 (apart from certain exceptions for some countries which need extra time to renew their fleet);
- "chapter 3" aircrafts, less noisy planes in operation (among these, there are "chapter 2" aircrafts which underwent some changes and could accede to the "chapter 3" status).

In October 2001, a new stage in the prevention of aircraft noise emissions occurred following the adoption of a "Chapter 4" (10 dB less than "chapter 3"). Since 2006 any new aircraft must comply with this new category.

In 1992, to reduce noise of air transport, the European Community adopted Directive 92/14/EEC [8], based on International Civil Aviation Organization regulations (ICAO), in order to prohibit the noisiest aircraft at European airports. The operation of such aircraft - defined in Chapter 2 of Annex 16 of the Convention on International Civil Aviation ("Chicago Convention") - has not been authorized in the European Union since April 2002.

In March 1998, the Commission proposed a new directive to limit the operation of "chapter 2" aircrafts in the European Union, which had been equipped with soundproofing devices. These devices are installed on the engines to make them less noisy, but although they become consistent with the stricter rules of "chapter 3", the noise margin was so reduced that the overall effect of the noise was low, finally the aircraft being noisier than aircraft manufactured for "chapter 3" aircraft. Subsequent regulation was repealed on March 28, 2002 after the adoption of a new directive [9] that integrates ICAO Resolution A33-7 on using a "balanced approach" to management of the noise around airports. This approach involves four main elements: reducing aircraft noise at source, management and urban planning measures, operational procedures to combat the noise and operation restrictions.

But reducing aircraft noise at source, i.e. by the manufacturer, is difficult. Before the 1990s, with few exceptions, designing an engine disregarded the requirement of noise. Since then, the need to reduce costs, to increase weight and performance has led to research on resistance and a new turbine design that is less noisy [10]. The design of modern aircraft engines is different from those of 1990 and the effect was to lower the noise of components of the total noise of engine. In addition, implementing the acoustic treatment to modern turbine has proved to be rather challenging than efficient, as exhaust temperatures have increased significantly, and the acoustic treatment of materials to meet the requirements of high temperature is not yet widely available [11].

In addition, the ICAO Council adopted in September 2001 a new standard for noise certification, "chapter 4" of Annex 16, Volume 1 of the Chicago Convention, in force since 2006 for newly designed aircraft. Or, as the progressive elimination of "chapter 2" aircrafts ended and as most of the airplanes built today already meet standard "chapter 4", the entry into force of the rule was not sufficient to improve noise problems around airports.

In order to protect the environment, in 2002 the European Parliament and the European Council adopted Directive 2002/30/EC, which sets rules to limit or reduce the number of people significantly affected by the harmful effects of noise, to promote development of airport capacity in harmony with the environment, to facilitate the achievement of specific objectives to reduce noise at each airport.

A common framework of rules and procedures for introducing operating restrictions at Community airports, as part of a balanced approach to noise management, contributes to internal market requirements by introducing similar operating restrictions at airports with comparable noise problems. These regulations include the assessment of noise impact at an airport and the evaluation of measures that can be taken to mitigate this impact, and the selection of appropriate measures to reduce noise to obtain, at minimum cost, the largest environmental benefit.

In addition to the Directive 2002/30/EC, on June 25, 2002, the European Parliament and the European Council adopted the Directive 2002/49/EC on the assessment and management of environmental noise, which was an important step in developing EU policy on noise. It aims "to establish a common approach to avoid, prevent or reduce on a prioritized basis the harmful effects, including annoyance, due to environmental noise". The directive aims at monitoring environmental noise pollution in urban areas and around large transport infrastructures, including airports; informing the public on noise and its effects on the environment and the establishment by the competent authorities of the action plans to prevent and reduce noise in environment, where necessary, and preserve environmental noise quality where appropriate.

To achieve these goals, the Directive requires Member States to take a number of measures, including in particular:

- To determine the exposure to environmental noise through noise mapping;
- To adopt action plans based on noise mapping results and
- To ensure that information on environmental noise are made available.

At the same time, the directive provides the basis for further elaboration by the EU of other measures to reduce noise emitted by different sources.

To ensure a real improvement in noise pollution, the European Commission issued a Report to the European Parliament and the Council on the implementation of the Directive on environmental noise in accordance with Article 11 of Directive 2002/49/EC [12].

The report, which was delayed for several reasons, mainly due to the delayed implementation of the Directive, the lack of sufficient data and the complexity of evaluation, requests the Commission to assess in particular: the need for future EU action regarding the ambient noise and acoustic environmental quality analysis based on data reported by EU Member States.

For this report, the Commission was helped by the European Environment Agency [13] and conducted a series of supporting studies [14], with additional information.

The report underlines that in the European Union, ambient noise is treated with a wide range of instruments, from provisions on market access requirements for certain vehicles and equipment to railway interoperability specifications, including rules regarding operating restrictions at airports. In addition to the various measures and improvements in EU legislation in the field over the last decade, the Commission is considering the opportunity to deepen these measures in order to reduce noise exposure and noise pollution in the EU. The Commission's work program for 2011 included a number of initiatives in terms of noise, in particular:

- Transport: White Paper [15], which sets out a roadmap to 2050 and aims, among other objectives, to help reduce noise pollution generated by transport (eg steps towards the development of "standards on noise emissions/vehicles noise");

- Review of Directive 2002/30/EC on noise from airports which, as part of the package for airports, will improve the noise mapping based on methods and data internationally recognized and lead to cost-effective measures to reduce noise, taking into account internationally agreed standards to rationalize the relationship between airport noises and the Directive 2002/49/EC on environmental noise. Also, the definition of noisy aircraft ("marginally compliant aircraft") will be updated in accordance with the current composition of the fleet of aircraft.

The report identifies a number of achievements and challenges still to be addressed regarding the implementation of the Directive. First, the Directive introduced an ambient noise management system in all Member States. Some Member States had already developed

such systems and had experience, while others were addressing these issues systematically for the first time. While traditionally, the powers to manage noise were at the various authorities at different levels of government in the Member States, some Member States have benefited from the implementation of the directive to establish appropriate structures for cooperation and coordination.

The report highlights other achievements, especially:

- Progress in mapping and assessment of noise in the EU, which led, for the first time, to an overview of the extent of noise problems;
- Further steps towards improving the comparability of strategic noise mapping, including establishment of common indicators and the establishment of a comprehensive set of noise data at EU level, data that did not exist until then;
- development of EU action plans regarding noise, concerning critical points ("hot spots") noise, identified by Member States, etc.

3. FIGHTING NOISE POLLUTION IN THE AREAS AROUND FRENCH AIRPORTS

The example of France is relevant to the air transport system and airport infrastructure. It was presented in an Information Report on noise pollution [16], prepared by two members of the Commission for Sustainable Development and Planning of the Chamber of Deputies (Assemblée nationale). In France, it is estimated at 500,000 the number of residents living around airports and aerodrome, of which 300,000 live in Île-de-France (the area around Paris).

Reduction of aircraft noise, measure that benefited from the significant technical progress in the last two decades, can not compensate alone the strong growth in traffic. The guidelines outlined for a truly sustainable development of air transport include urban planning near airports according to the plans of exposure to noise, intensifying the aid for soundproofing houses according to "the plans for sound discomforts", optimization and control of airport rules, involving all the socio-economic actors concerned, etc.

Noise exposure plan ("Le plan d'exposition au bruit – PEB") is a planning document that establishes the conditions of use for land exposed to pollution caused by aircraft noise. It aims to prohibit or limit construction to preserve the number of persons subject to noise pollution. It anticipates for the next 15-20 years a development of aviation industry, infrastructure expansion and air traffic procedures developments. The decision to establish a Plan of Exposure to Noise is taken by the prefect and the project is submitted to the local community consultation, the Advisory Committee for the Environment (CCE) and Airport Pollution Control Authority (ACNUSA) for the 10 airports in its area of activity. The document is then attached to the local urban plan. Of the 600 airports in France, 190 of them are equipped with Plan of Exposure to Noise.

A plan delimits four areas of noise (A – exposure to high intensity noise, B – exposure to loud noise, C – exposure to moderate noise, D – low noise exposure) for which prohibitions or restrictions on building are issued. For people already established in the area, allocation and the amount of the grant awarded for soundproofing homes are also based on the delimitation of noise.

Discomfort sound is calculated using a mathematical model taking into account:

- Noise emitted for each passage of a plane and the way it is perceived on the ground;
- Number of flights within 24 hours;

- Different perception of noise between day and night: a night flight generates discomfort 10 times greater than a day flight.

Noise annoying plan ("*Le plan de gêne sonore* – PGS") [17] is a document that delimits areas where the residents can receive help for soundproofing homes, but this aid can only be granted in certain conditions. Only 10 of the main airports are equipped with PGS. It is a report and a map indicating at a scale of 1/25,000 three types of zones: zone 1 of very high pollution, zone 2 of high pollution, and zone 3 of moderate pollution.

Noise annoying plan is determined based on estimated traffic, air traffic procedures applicable and facilities that will be used next year. The plan is designed under the authority of the prefect, who is the coordinator, submitted for approval to municipal councils concerned, the Residents Support Commission and Airport Pollution Control Authority (ACNUSA).

French legislation on noise dates back to early 1990s, from Law No. 92-1444 of 31 December 1992 on combating noise, codified in the Environment Code from the article L.571-1 to the article L.572-21 to provide a unifying legal framework, organizing prevention and protection against this type of pollution around four main axes: objects and activities producing noise, land transport infrastructure, airports and "sensitive" constructions. Articles L.571-1 to articles L.572-21 of the Environment Code were modified on several occasions, the latter being caused by Law No. 2009-967 of August 3, 2009 ("Grenelle I") and Law No. 2010-788 of July 10, 2010 ("Grenelle II").

To apply the law, the measures [18] taken for a truly sustainable development of the French air transport are based on three priorities:

1. Reducing the noise supported by overflown population by:

- Increasing the altitude of flight to 300 meters near Paris region since November 17, 2011. Implementation of this measure can reduce the noise suffered by the people in the overflown areas by 50% and a decrease of 60% of people exposed to noise above 65 decibels.

- Establishment of new paths to avoid the most urbanized areas. Directorate General of Civil Aviation (DGCA) requires, since March 2012, new routes for flights taking off at night from Charles-de-Gaulle airport to west. This way, more than 220,000 people living southwest from airport will be exempted from such overflight;

2. Protecting residents against aircraft noise by supporting 100% from expenses for soundproofing the homes located around airports;

3. Reducing noise at source by prohibiting the noisiest aircraft at night at Paris-Roissy.

Law No. 92-1444 of 31 December, 1992 concerning the fight against noise established a support device for soundproofing homes bordering the 10 largest domestic airports. From 1 January, 2004 the task of assigning financial aid is given to operators of these airports. Aid is funded from the tax on noise pollution, starting with January 1, 2005. The tax is collected by the General Directorate of Civil Aviation services and is paid to the operator of the airport from which each aircraft heavier than 20 tons takes off. The amount depends on acoustic grouping of the aircraft, the weight at takeoff and departure time. Methods of calculating the tax are set out in Decree No. 2004-1426 of 23 December, 2004 and in two other decisions taken on the same date.

From December 28, 2011 new legislation [19] amounted to 100% the amount granted for soundproofing homes bordering the airport. Until then the amount of aid was 80% for individual files and 95% for files applying for collective operations. The measure is limited in time to stimulate the residents to take decision to soundproof the homes quickly. Thus, the 100% is guaranteed only until December 31, 2013 and the residents are invited to submit their files at the airport's manager in order to be fully repaid for soundproofing their homes.

Regarding the noise reduction at source, in the last 30 years new technologies progress have made possible the noise reduction of jets by an average of more than 20 decibels. Further progress is expected as a result of current efforts undertaken especially on motor noise and aerodynamic noise of the aircrafts. However, the Directorate General of Civil Aviation has revealed that there is a contradiction between the noise produced and the research on the design of engines that consume less fuel. Thus, "open rotor" allows appreciable fuel economy, but because of its "externalized" structure, it makes more noise than some of the existing turbines. Mostly during the approach phase (low engine, landing gear and flaps lowered), aerodynamic noise originates exclusively from the airflow around the aircraft.

But to reduce the noise produced by aircraft, the technological progress is not enough: given that the life of an aircraft is estimated at 20-30 years, the noisiest aircraft are phased out only gradually. Some studies [20] consider that environmental reasons would require replacement of aviation services by those of high-speed trains on short routes. The impact assessment on climate change, air and noise pollution, and comparing costs, it was concluded that the use of high-speed trains between London and Paris would be beneficial.

4. RULES ADOPTED BY ROMANIA FOR COMBATING NOISE

Ordinance no. 29/1997 on Civil Aviation Code [21] states the role of the Ministry of Transport to implement environmental programs at airports in Romania, that after the completion of specific activities have a significant impact on the environment. As the Code states, environmental protection covers all activities aimed at reducing the environmental impact of civil aviation, due to noise from civil aircraft, aviation engine emissions, substances used in civil aviation activities and residues resulting from the conduct of such activities (article 54).

According to Civil Aviation Code, in order to protect the environment, Ministry of Transport may restrict civil aircraft operations at airports in Romania or in the national airspace, but the measure does not apply to the following categories of civil aircraft: Romanian state aircraft, Romanian aircraft performing official missions, presidential or governmental, and in case of foreign aircraft, on a reciprocal basis; aircraft operating on behalf of the United Nations, Red Cross and Red Crescent; civil aircraft conducting search and rescue missions or transporting personnel or materials in these missions, aircraft on humanitarian and emergency aid missions, aircraft forced to land due to technical reasons, because of bad weather or force majeure, aircraft landing following the orders of the Ministry of Transport and/or the Ministry of Defence.

Regarding noise pollution, originally the article 58 of the Aviation Code stated that the Ministry of Transport must ensure, through specific regulations a single noise monitoring system at airports, to assess the noise from the operation of civil aircraft at the airport, to ensure a correlation between noise level and its effect on the population and environment, to comply with regulations, standards, practices, recommendations and procedures developed by the International Civil Aviation Organization, the European Civil Aviation Conference and other international civil aviation organizations to which Romania is part and also ensure the control of regulations. At the same time, Romania must carry out a system of noise mapping for the airports adjacent areas, allowing their ecological use. By the law no. 399 of 27 December, 2005 amending Government Ordinance no. 29/1997 on Aviation Code, this article has been repealed, but from the change made to the article 55, it appears that the Ministry of Transport together with the environmental authority establishes policies and

specific regulations on environmental protection, without the detailed measures that should be taken. These are contained in Resolution no. 321/2005 on the assessment and management of environmental noise, and especially in the Government Decision no. 1,074/2007 and Romanian Civil Aviation Regulation "Environment Protection" - RACR PM.

Directive 2002/49/EC was transposed into Romanian legislation by Decision no. 321/2005 on the assessment and management of environmental noise, which addresses nationally avoidance, prevention or reduction of harmful effects caused by human exposure to ambient noise, including annoyance, by progressive implementation of the following measures:

- a) determination of exposure to environmental noise through noise mapping using assessment methods listed in the annex to the Decision;
- b) ensuring public access to information on environmental noise and its effects;
- c) adoption, based on the results of noise mapping, of action plans for preventing and reducing environmental noise where necessary, particularly where exposure levels can cause harmful effects on human health and to maintain environmental noise levels where they do not exceed the limit.

Decision no. 321/2005 is the framework for developing measures to reduce noise emitted by major sources, including aircrafts.

Local authorities prepare noise maps for areas they manage, strategic noise maps and related action plans, using noise indicators: *Lnight* (night noise indicator), *Levening* (evening noise indicator), *Lday* (day noise indicator), and *Lden* (noise indicator for day-evening-night).

In the annexes, the decision no. 321/2005 presents methods for assessing the noise indicators; methods for assessing harmful effects, the minimum requirements for developing strategic noise maps, the minimum requirements for developing action plans and lists the information transmitted to public authority for environment protection.

In 2007, Ministry of Transport and Infrastructure published the Romanian Civil Aviation Regulation "Environment Protection" - RACR PM [22], which was developed to harmonize the national legal framework in civil aviation with the existing legal acts adopted by community institutions for achieving the strategic objective, assumed by the European Community, to reduce the impact of aviation on the environment.

A chapter of the Regulation transposes into national law the Directive 2002/30/EC of the European Parliament and the Council of 25 June, 2002 laying down rules and procedures for the introduction of noise related operating restrictions at Community airports.

General rules on aircraft noise management refers to managing noise problems at airports in the national territory, which is achieved through a balanced approach, with actions to reduce aircraft noise at source; land planning and management, including those around the airports; implementation of noise abatement operational procedures, the introduction by the Ministry of Transport of operating restrictions, and providing economic benefits.

Another chapter of the Regulation, together with the Government Decision no. 1,074/2007 [23], transposing into national law the provisions of Directive 2006/93/EC of the European Parliament and the Council of 12 December, 2006 regulates the operation of airplanes covered by Part II, chapter 3, Volume 1 of Annex 16 to the Convention on International Civil Aviation. Regulation RACR PM sets the conditions for granting licenses at airports in Romania for temporary use of civil subsonic jet airplanes with a maximum takeoff weight of 34,000 kg or more, or with a maximum certified passenger configuration

for that type of aircraft over 19 seats, excluding any seats for crew and that have not been certified acoustically in accordance with specified standards.

Also, the provisions on registration restrictions to limit noise emission from civil subsonic jet airplanes, in Romania transpose Directive 89/629/EEC of the European Council of December 4, 1989.

From studying public documents, the legislation (such as Government Decision no. 455/2011, on airport charges [24] which apply Directive 2009/12/EC of the European Parliament and the Council of 11 March 2009 on airport charges), as well as the research on the Internet site of Romanian Civil Aeronautical Authority [25], we did not manage to find out if the Romanian airports apply noise pollution charges to any heavy aircraft, and if so, we do not know its destination. However, as far as we know, there is no compensation fund for soundproofing the civil buildings in the area affected by airport noise.

5. CONCLUSIONS

Noise does not trigger the same anxieties as other concerns regarding the environment: it does not lead to catastrophic irrepressible events, it does not compromise the basic elements of life such as air and water, it is difficult to be represented in the images and do not leave visible traces in the environment. So public opinion does not consider noise as a major environmental problem. However, it is listed among the factors of discomfort felt in the big cities mainly due to the traffic, especially on two-wheel motor vehicles and air traffic at airports.

Noise represents health and social pollution, whose costs are not yet fully evaluated at present. Only the World Health Organization has underlined its negative effects, estimating that each year nearly two million lives are lost in Western Europe due to physiological and psychological damage caused by excessive exposure, in intensity and duration, to noise.

Aircraft noise represents a real deterioration in the quality of live of people living near airports.

In the field of air transport, EU regulations have taken into account the standards of the International Civil Aviation Organization and have developed directives that have been transposed into national legislation, including Romania. In France, the noise exposure plans serve to determine urban plans, and the noise annoying plans provide soundproofing of affected buildings, by funding obtained from air noise pollution tax collected by airport operators.

We believe that the French measures adopted to mitigate noise pollution effects caused by air traffic can be a good example for the Romanian authorities as the largest airports in the country (Bucharest Otopeni and especially Bucharest Baneasa) are located in densely populated areas.

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