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ALGEMENE KENNISGEWING

NOTICE 3015 OF 1998

DEPARTMENT OF TRANSPORT

NATIONAL POLICY ON AIRCRAFT NOISE AND ENGINE EMISSIONS

Draft published for comment

December 1998

"Everyone has the right –

(a) to an environment that is not harmful to their health or well-being; and

(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other matters that –

(i) prevent pollution and ecological degradation;
(ii) promote conservation; and
(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development".

Section 24 of The Constitution of the Republic of South Africa, 1996 (Act 108 of 1996).

FOREWORD

Internationally and in South Africa there is a growing interest in and concern for the environmental impact of airports, and specifically the noise and engine emission impacts. Last year when the White Paper on National Policy on Airports and Airspace Management was developed, it became clear that there is a definite need for a national policy on aircraft noise and engine emissions in South Africa. Consequently, the Department of Transport invited tenders and early this year appointed a consortium of consultants for the necessary investigations and proposals regarding the formulation of a policy.

The appointment specifically stated that the policy formulation must be done in consultation and cooperation with all stakeholders. The plenary, workshop, meetings, invitation for submissions and the questionnaire were all actions in the process to consult. The publication of the draft proposals is probably the widest consultation for the policy development.

You are thus invited to study the proposals carefully and let us have your comments. It is important that we get the viewpoints and opinions of all the different stakeholders in our country, before Government takes a final decision. We would like all stakeholders to feel that the final policy proposal is also their proposal and that it has the widest support possible. The Department of Transport and the South African Civil Aviation Agency believes in consultation and transparency.

I would like to give recognition to and thank everyone who has participated in this policy formulation process thus far.

Please send your comments, before 25 January 1999, to:

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1. INTRODUCTION

The White Paper on National Transport Policy, published in September 1996, committed the Government to "an integrated environmental management approach in the provision of transport". The ensuing White Paper on National Policy on Airports and Airspace management, published in March 1998, committed the National Department of Transport to "encourage all airport developments to be planned with an appropriate Environmental Impact Assessment and management programme, reflecting the principles of Integrated Environmental Management as recommended by the Department of Environmental Affairs and Tourism, ...". It also stated that "The Department of Transport, in consultation and cooperation with the provinces and other stakeholders, will formulate a detailed policy on aircraft noise control and engine emissions".

Internationally and in South Africa, there is growing interest in and concern for the environmental impact of aircraft and airports, specifically noise impact. A policy on aircraft noise and engine emissions therefore needs to be formulated and accepted.

1.1 BACKGROUND

1.1.1 Historical development

Aircraft noise at airports really became an issue only 40 years ago when the first Boeing 707 purely commercial jet became operational in 1958. This first commercial jet aircraft was very noisy, much noisier than any aircraft in operation today, sparking off many concerns and escalating public complaint worldwide, and in South Africa. In 1966, South Africa was one of 23 international countries to take part in one of the first of many international conferences on aircraft noise, namely the International Conference on the Reduction of Noise and Disturbance caused by Civil Aircraft, or the so-called London Noise Conference. At that time the Aviation Research Unit of the Council of Scientific and Industrial Research (CSIR), the South African Bureau of Standards (SABS), and the South African Airways (SAA) started working together to develop a method for the measurement of aircraft noise and the calculation of noise contours. This work was completed in 1969 and published in a "Report on the prevention and combat of noise in the vicinity of airports, cities and roads".

In 1974, the SABS Code of Practice for "The determination and limitation of disturbance around an aerodrome due to the noise from aeroplanes" (SABS 0117-1974) was published. In 1978, the South African Cabinet accepted a proposal pertaining to the implementation of noise zones at airports and linking each zone with specific land-uses. The original objective of the noise zones was to protect the public against noise associated

with airports. In May 1981, the Cabinet approved guidelines for development proposals to change land-use or subdivide large areas of land zoned for industrial use within the 70 Noise Index (NI) contour. These guidelines, *inter alia*, applied to all airports and basically meant that all development proposals within the 70 NI contour, with the exception of certain public recreation facilities, should be rejected and that no densification of residential areas within the 70 NI contour would be allowed. The intention was, among others, to ensure that people who lived and worked within the noise zones were not negatively affected by the noise. From 1981 onwards, this Cabinet decision played an important role with regard to noise control at airports.

Another important legal milestone affecting noise at airports was the Environmental Conservation Act (Act 73 of 1989) and, more specifically, the Noise Control Regulations as promulgated in 1992, which enacted the recommendations set out in the SABS Code of Practice 0117-1974. These regulations, if implemented within a specific area, place restrictions with respect to aircraft noise on land-use and development in the vicinity of airports. It determines, for example, that schools, universities, churches, and hospitals should not be placed in areas where the total Noise Index exceeds 60, and residential areas where the total Noise Index exceeds 65.

Another highly significant outcome of the Environmental Conservation Act, is that, in terms of Section 21, the Minister of Environmental Affairs, has under Government Notice R1182 of 5 September 1997, identified activities which may have a substantially detrimental effect on the environment and which will, under certain circumstances, be subject to an appropriate environmental impact assessment. These activities include the construction or upgrading of airfields and associated structures outside the borders of town-planning schemes, as well as changes in land-use from, for example, agriculture to any other land-use, including that of airports.

It is clear that many environmental impact assessments (EIAs) may be done at airports in South Africa in future and the issue of noise will be addressed in such EIAs. A clear and unambiguous noise policy, with appropriate criteria and standards, which can be used to evaluate the noise impact of an airport and its usage on the surrounding area is, therefore, necessary.

1.1.2 White Papers on National Transport Policy and a National Policy on Airports and Airspace Management

A further relevant development in South Africa was the compilation and adoption of a "White Paper on National Transport Policy", published in September 1996. In the White Paper, the vision for transport in South Africa provides for "*safe, reliable, effective, efficient and fully integrated transport operations and infrastructure which ... are environmentally*

and economically sustainable". The White Paper further states that *"The provision of transportation infrastructure and the operation of the transportation system have the potential for causing damage to the physical and social environment, inter alia, through atmospheric and noise pollution ... Government is cognisant of these dangers ... The Department of Transport is committed to an integrated environmental management approach in the provision of transport".* In the chapter dealing with Civil Aviation, Government also committed itself to the formulation of a national policy on airports and airspace management. The "White Paper on National Policy on Airports and Airspace Management" was published in March 1998. This White Paper on Airports was the forerunner to the investigations for a noise policy and, therefore, determines important departure points for the determination of such a policy. In the chapter on Airports, a vision for airports and airport operations provides for environmental sustainability. The related policy, *inter alia*, states that an *EIA should be performed as part of the process of determining the viability of a new airport or major developments at an existing airport. Where possible, financial and environmental management systems should be introduced. Provincial governments are responsible for the enactment of adequate environmental legislation within the framework of national environmental legislation and national norms and standards".*

The chapter on "The Integration of the Airport into its Environment" deals more directly with the subject under discussion. The vision provides for an airport to perform its function in the economy and transportation system, and to serve and benefit its affected community with minimised negative impacts on both the built and natural environments. It promotes a balance between the airport interests and those of stakeholders in the vicinity of the airport. In this regard the following broad policy statements have been accepted by Government:

"All role players (authorities and airport owners) must ensure that, as far as possible, airports are in harmony with their environment (particularly with regard to airport development and operations). The airport owner will have to comply with all local, provincial and national requirements, including the local structure plans, land development objectives (LDOs), integrated development plans (IDPs) and integrated transport plans (ITPs), similar to any other land use development. The airport owner will be obliged to give input into local planning, and public use airports should contribute towards provincial and local development according to the local and provincial development frameworks.

The provincial and local government should support the airports with regard to development and to their effective operation. Any legislation and regulations that govern the airport should benefit the community and the natural environment, and should take into account the aviation needs of the airport so as to provide for development".

In the same chapter, there is a specific section dealing with Environmental Impact and Noise Control. This section provides the basis for a new noise control policy. It recognises the growing concern and resistance to increasing noise pollution from airports located in residential and commercial areas. Furthermore, it identifies the need for all stakeholders and role players to take up their responsibility in addressing the problem, but admits that the responsibilities have not yet been delimited. It concludes that adequate measures are needed to ensure that the environmental impact and noise pollution from airports are properly managed and controlled. These measures should also address the issue of older noisier aircraft being used by local airlines and airlines flying to South Africa, specifically in the light of the ICAO policy on the phasing out of some of these aircraft.

The policy accepted by Government in this White Paper on National Policy on Airports and Airspace Management with regard to environmental impact and noise control, is:

"The DOT will ensure regulatory measures aimed at maintaining an acceptable and manageable level of environmental impact by airport developments and utilisation, inter alia, the level of noise pollution and engine emission control from the airport and the use of the airport by aircraft.

The DOT will encourage all airport developments to be planned with an appropriate EIA and management programme reflecting the principles of IEM as recommended by the Department of Environmental Affairs and Tourism, and will ensure that these meet the regulation within its powers. This will include the development of new airports, and the development of new buildings, runways and taxiways, hangars and all other physical infrastructure developments, as well as changes in their utilisation, of existing airports.

The DOT, in consultation and in cooperation with the provinces and other stakeholders, will formulate a detailed policy on aircraft noise control and engine emissions. Early indication will be given on the actual policy and the programme for the phasing in of ICAO guidelines. The following aspects will be given more detailed attention in this policy:

- *The introduction by the DOT of general noise abatement procedures for aviation, and by airport owners for introducing and maintaining adequate and acceptable airport-specific noise abatement procedures, in accordance with their responsibilities and in terms of the DOT guidelines and requirements.*
- *The introduction of aircraft-specific noise abatement procedures and controls by the DOT.*
- *The preparation of guidelines and requirements by the DOT for noise abatement and control, and the establishment of mechanisms to enable the control of such noise abatement procedures.*

- *The allocation of responsibility to airport owners for determining and monitoring the existing noise contours, and for projecting future noise contours and providing the information to the municipalities concerned. The development of specific criteria under which conditions this would be required from an airport owner.*
- *The introduction of noise charges, if feasible.*
- *The demarcation of noise contours in the municipal spatial planning frameworks, and to ensure that no inappropriate development takes place in the demarcated noise zone and noise controlled area. Attention will be given to mechanisms for local government to consult the CDCAA and the airport owners regarding any proposed developments in the noise zones or noise-controlled areas.*
- *The promotion and means of ensuring acceptable overnight noise control in residential areas.*

The DOT will give due consideration to the guidelines of ICAO in the drafting of regulations and legislation in implementing this detailed policy".

All the policy statements in the White Paper on National Policy on Airports and Airspace Management also apply here. This includes the strategic objectives and basic principles in Chapter 2 of the aforementioned White Paper. This policy document should therefore be read and interpreted in conjunction with that specific White Paper.

1.1.3 International Civil Aviation Organisation (ICAO)

South Africa is a signatory and, therefore, a Contracting State of the Convention on International Civil Aviation, Chicago 1944, which is set out in the First Schedule to the Aviation Act no. 74 of 1962. Section 2(1) of the Act states that *"The provisions of this Act and of the Convention and of the Transit Agreement shall, except where expressly excluded under this Act or by regulation, apply to all aircraft whilst in or over any part of the Republic or the territorial waters thereof and to all South African aircraft and personnel wheresoever they may be". Section 3(1) further states that "The State President may*

a) issue such proclamations as appear to him necessary for carrying off the Convention of the Transit Agreement and for giving effect thereto or to any provisions thereof'.

Section 22A of the Aviation Act provides that the Commissioner for Civil Aviation may issue technical standards for civil aviation which have legal status and, if not complied with, would constitute an offence. Furthermore, the Commissioner may also incorporate into a technical standard any standard or recommended practice or procedure of ICAO by mere reference to the title, number and year of issue. Such a "South African Civil Aviation

Technical Standard SA-CATS-ENVIRO Environment Protection" has been issued and states that both Volume I (Aircraft Noise) and Volume II (Aircraft Engine Emissions) to Annexure 16 (Environmental protection) to the Convention on International Civil Aviation, Third Edition – July 1993, are incorporated in this document. The Convention also imposes an obligation on Contracting States to notify ICAO of any differences between their national regulations and practices, and those contained in Annexure 16. South Africa has not notified ICAO of any differences.

It should be recognized that policies, guidelines, standards and procedures with regard to aircraft noise and engine emissions are still in a development phase and there is no, or limited, uniformity internationally with regard to many of these aspects. On the one hand, there are many different techniques, procedures and even standards which South Africa has applied. On the other hand, there is a tendency to move towards uniformity. This trend is recognised, as is the importance of South Africa being globally in line with the latest aviation developments.

Policy

- South Africa, where possible and applicable, will stay in line with international aviation developments. This includes a movement towards uniformity in standards and procedures.
- ICAO standards and practices will apply unless there are unique local circumstances which make it necessary to introduce specific local standards and practices.

1.1.4 Further existing legislation and regulations

There are a number of Civil Aviation Regulations in terms of the Aviation Act (No. 74 of 1962) which refer to certain noise and engine emission issues. Part 34 deals with Engine Emission Certification and Part 36 with Noise Certification, both of which relate to SA-CATS-ENVIRO referred to previously. Part 91, dealing with General Operating and Flight Rules, states in section 91.07.16 that no person shall operate an aircraft contrary to noise abatement procedures established for an aerodrome in terms of the provisions of Part 139. In section 139.01.27, it is stated that no person shall test-run an aircraft engine on a licensed aerodrome or heliport except at a place designated for the purpose by the aerodrome or heliport operator. Section 139.02.19 deals with the general duties of an aerodrome licence-holder, and states in 3(c) that, from 1 January 2003, the holder of the licence shall be responsible for monitoring aircraft noise on and in the vicinity of an aerodrome and reporting violations to the Commissioner in accordance with certain still-to-be determined prescribed requirements and standards.

Furthermore, provision has been made for certain noise abatement procedures in the AIPs of specific airports, and in an Aeronautical Information Circular (AIC 20-3 94-06-15). AIC 20-3 proposes, *inter alia*, the following procedures:

"4.1 All aeroplanes must, as far as possible, use the full length of runways for take-off to ensure that sufficient altitude is gained in order to cross built-up areas with the minimum noise. No jet aeroplanes are to use RWY or TWY intersections for take-off between 2000-0400Z.

4.2 Turnouts immediately after take-off must as far as possible be avoided and runway heading must be maintained to a reasonable altitude.

4.3 Where possible, aeroplanes must climb at the best angle of climb after take-off and this must be maintained until all built-up areas are overflown.

4.4 Testing and run-ups of aeroplane engines must, as far as possible be avoided during the period 1800 UTC and 0400 UTC.

4.5 After landing minimum reverse thrust must, as far as possible, be utilized for purposes of braking.

5. An appeal is made to all pilots to be considerate towards inhabitants of areas adjacent to aerodromes by combating aeroplane noise at all times".

1.2 STUDY PROCEDURE

1.2.1 Phased Approach

The study is being conducted in four distinct phases

Phase 1: Status quo determination
Phase 2: Policy framework formulation
Phase 3: Draft policy development
Phase 4: Finalisation of policy proposals.

The status quo determination (phase 1) contained, *inter alia*, the following aspects:

- Role-players were identified.
- The status quo on noise and engine emissions in South Africa was determined, especially with regard to legislation, procedures, complaints, and measures to reduce noise and emissions.

- A comprehensive questionnaire was sent to 12 airports expected to have the greatest noise and emission impact.
- The aircraft types operating in South Africa and Africa were determined and the situation evaluated.
- An international literature survey was done with regard to relevant organisations, such as ICAO, AFCAC and JAA; the policies which other countries have developed; and general literature on aircraft noise and engine emissions.
- Issues were identified.

The second phase dealt with the creation of a policy framework within which a policy could be developed. This included evaluating the problem areas and developing a better understanding of the issues, as well as determining the scope of possible alternatives to be considered.

The draft policy development phase, or third phase, followed a national plenary workshop with role-players and stakeholders to discuss the policy, framework, alternatives and solutions. After initial draft policy proposals had been developed, they were tested at a regional workshop in the Western Cape.

These draft policy proposals have now been published for comments, which will then be considered in the fourth phase, when the policy proposals have been finalised.

1.2.2. Consultation

The White Paper on National Policy on Airports and Airspace Management identified communication and consultation as an important issue in the development and operation of airports. The proposed policy places an obligation on Government to ensure that all stakeholders are consulted on a regular basis. It also provides for consultation forums to be established for each of the larger airports.

Consultation in this study comprised:

- questionnaires sent to the 12 most relevant airports in the country
- interviews and meetings with a number of organisations and authorities
- a national plenary held in Kempton Park/Tembisa on 20 August 1998 and attended by representatives from a variety of stakeholders
- a regional workshop held in Tygerberg in the Western Cape on 18 September 1998
- an open invitation for input and comments, which drew a significant response
- publication of these draft proposals for comment.

The majority of roleplayers are located in Gauteng and the Western Cape, where the two largest airports in the country are also located. Most of the complaints on aircraft noise are received at these two airports. Therefore, the national plenary, regional workshop and other meetings were held in these two provinces. The questionnaires and invitations to the national plenary were sent to provincial and local authorities, airport operators, and other roleplayers throughout the country. This document has been made available for comment throughout the country.

1.3 STUDY ORGANISATION

After inviting tenders late in 1997, the Department of Transport appointed a professional team of consultants in 1998 to conduct the study, consult with all roleplayers, and assist with the policy formulation. The professional team comprised:

Mr OAW van Zyl (Khuthele Projects for BKS) Project Leader
Mr GJ de Swardt (Khuthele Projects for BKS)
Ms M le Roux (BKS)
Ms V Mahlati (Reaching Out)
Mr PL Goldschagg (Anlum)
Mr F le R Malherbe (SABS)
Mr SJ Dunsmore (PD Naidoo and Associates.)
Ms V Jansen (PD Naidoo and Associates.)

The professional team, together with Mr LL van den Heever and Mr CM Purnell, originally of the Department of Transport and now of the SA Civil Aviation Authority, formed the Steering Committee for the project and held regular meetings throughout the study. A number of working documents and draft reports were discussed at Steering Committee meetings.

It should be noticed, that although most of the officials initially involved in this project have gone over to the South African Civil Aviation Authority when it was officially established in 1998, the project, however, remains a project of the Department of Transport.

1.4 OUTLINE OF THIS DOCUMENT

Countermeasures with regard to aircraft noise and aircraft engine emissions broadly falls within the following four areas:

- aircraft design and modification
- aircraft operation and use

- airport planning and design
- land-use in the airport vicinity.

With respect to noise, the entire question of noise-measurement and noise-prediction is of special importance.

This document is divided into two distinct parts, the one dealing with aircraft noise and the other with aircraft engine emissions. The section dealing with aircraft noise is subdivided into four parts, the first dealing with the aircraft, the second with airport and aircraft operations, the third with noise measurement and prediction models, and the fourth with land-use around airports. The interrelationship between the two main sections on noise and engine emissions should be noted.

The following annexures are part of this document:

Annexure A: A list of organisations, institutions and individuals who participated in discussions at meetings, the national plenary, and regional workshop in compiling the draft policy proposals, or who have submitted written input.

Annexure B: A list of abbreviations and acronyms used in this document.

Annexure C: A list of definitions

2. AIRCRAFT NOISE

2.1 AIRCRAFT

2.1.1 Introduction

2.1.1.1 Background

Aircraft noise can be reduced either at the source or, by operational procedures, at or around the airport. This section deals with noise reduction at the source, namely the aircraft – as designed, manufactured and certified, or as later modified.

Aircraft noise at airports became an issue 40 years ago when the first Boeing 707 pure commercial jet became operational in 1958. The first of these aircraft were very noisy. In fact, commercial jet aircraft manufactured in the first 10 to 20 years were generally much noisier than those manufactured over the past 20 years. Some countries and organisations have therefore phased out and banned the use of such noisy aircraft from certain dates in the future. This decision was taken by most countries in North America and Europe, and also by countries such as Japan, Australia and New Zealand. As a result, many older, noisier aircraft are available at very reasonable prices and countries not restricting their use may become a dumping ground for such aircraft.

2.1.1.2 ICAO

In a general statement in respect of environmental protection and, more specifically noise, ICAO called upon all ICAO contracting states and international organizations to recognize the leading role of ICAO in dealing with problems of aircraft noise and invited them to keep ICAO informed of their policies and programmes to alleviate the problem of aircraft noise in international civil aviation. ICAO also requested contracting states to work closely together to ensure optimum harmonization of programmes, plans and policies.

ICAO Annex 16 Volume 1 contains the international standards and recommended practices with regard to aircraft noise. It classifies aircraft into different groups, specifically with regard to noise. The more detailed definitions are given in Annexure C to this document. Generally, noisier aircraft fall into two groups, namely the non-noise certified jet aircraft manufactured between 1949 and 1965, and the Chapter 2 subsonic jet aircraft certified before 6 October 1977. Subsonic jet aircraft certified after 6 October 1977 are classified as Chapter 3 aircraft, and supersonic aircraft as Chapter 4 aircraft. Propeller-driven aircraft, depending on certification date and maximum take-off weight fall under Chapters 3, 5, 6 and 10, while helicopters fall under Chapters 8 and 11. The USA Federal Aviation Agency (FAA) also has a

classification system, which refers to Stages instead of Chapters. However, only the ICAO classification system is proposed for use in South Africa.

Regarding possible operating restrictions on subsonic jet aircraft, which exceeded the noise levels laid down by ICAO, the following recommendations were made to concerned state authorities.

"The Assembly

1. *Urges States not to introduce any new operating restrictions on aircraft which exceed the noise levels in Volume I, Chapter 3 of Annex 16 before considering:*

   a) *whether the normal attrition of existing fleets of such aircraft will provide the necessary noise protection of noise climates around their airports;*
   b) *whether the necessary protection can be achieved by regulations preventing their operators from adding such aircraft to their fleets through either purchase, or lease/charter/interchange, or alternatively by incentives to accelerate fleet modernization;*
   c) *whether the necessary protection can be achieved through restrictions limited to airports and runways, the use of which has been identified and declared by them as generating noise problems, and limited to time periods when greater noise disturbance is caused; and*
   d) *the implications of any restrictions for other States concerned, consulting these States and giving them reasonable notice of intention;*

2. *Urges States which, despite the considerations in resolving Clause 1 above, decide to introduce restrictions on the operations of aircraft which comply with the noise certification standards in Volume I, Chapter 2 of Annex 16 but which exceed the noise levels in Volume 1, Chapter 3 of Annex 16:*

   a) *to frame any restrictions so that Chapter 2 compliant aircraft of an individual operator which are presently operating to their territories may be withdrawn from these operations gradually over a period of not less than 7 years;*
   b) *not to begin the above phase-in period for any restrictions before 1 April 1995;*
   c) *not to restrict before the end of the phase-in period the operations of any aircraft less than 25 years after the date of issue of its first individual certificate of airworthiness;*
   d) *not to restrict before the end of the phase-in period the operations of any presently existing wide-body aircraft or of any fitted with high bypass ratio engines;*
   e) *to apply any restrictions consistently within the non-discrimination principle in Article 15 of the Chicago Convention so as to give foreign operators at least as favourable treatment as their own operators at the same airports; and*

f) to inform ICAO, as well as the other States concerned, of all restrictions imposed.

3. Strongly encourages States to continue to co-operate bilaterally, regionally and inter-regionally with a view to:

a) alleviating the noise burden on communities around airports without imposing severe economic hardship on aircraft operators; and
b) taking into account the problems of operators of developing countries with regard to Chapter 2 aircraft presently on their register, where they cannot be replaced before the end of the phase-in period, provided that there is proof of a purchase order or leasing contract for a replacement Chapter 3 compliant aircraft and the first date of delivery for the aircraft has been accepted;

4. Urges States, if and when any new noise certification standards are introduced which are more stringent than those in Volume I, Chapter 3 of Annex 16 not to impose any operating restrictions on Chapter 3 compliant aircraft;

5. Urges the Council to promote and States to develop an integrated approach to the problem of aircraft noise, including land-use planning procedures around international airports, so that any residential, industrial or other land-use that might be adversely affected by aircraft noise is minimal; and

6. Further urges States to assist aircraft operators in their efforts to accelerate fleet modernization, and thereby prevent obstacles and permit all States to have access to lease or purchase aircraft compliant with Chapter 3, including the provision of multilateral technical assistance where appropriate."

Section 22A of the Aviation Act, 1962, (Act 73 of 1962 as amended) empowers the Commissioner for Civil Aviation to issue technical standards for civil aviation on matters prescribed by regulation. In the South African Civil Aviation Technical Standards, SA-CATS-ENVIRO Part 36, Noise Certifications, South African noise standards are specified as those contained in Annex 16 to the Convention on International Civil Aviation, Volume 1.

2.1.2 Acceptability of certain types of aircraft

2.1.2.1 Background

Many developed countries throughout the world have introduced measures to reduce the number of, and eventually prohibit, the older, noisier aircraft. As a result, the prices of such aircraft have become very reasonable and there has been an inflow of

these aircraft to countries that are not yet restricting them, such as most countries in Africa, including South Africa. Furthermore, passenger movements at some of the major airports in South Africa have increased dramatically over the past five years and the number of foreign operators to and from South Africa has increased from 21 in 1991 to over 80 in 1998. A large percentage of these flights originate in countries without any, or limited, legislation pertaining to aircraft noise and engine emissions and with no policy with regard to phasing out noisier aircraft. Increasing use of older aircraft to South Africa, plus increasing air traffic volumes could result in higher noise and engine emission pollution at South Africa's larger airports.

2.1.2.2 Issue

South Africa needs to clarify its policy with regard to restrictions on the noisier types of aircraft to be used in South Africa.

2.1.2.3 Considerations

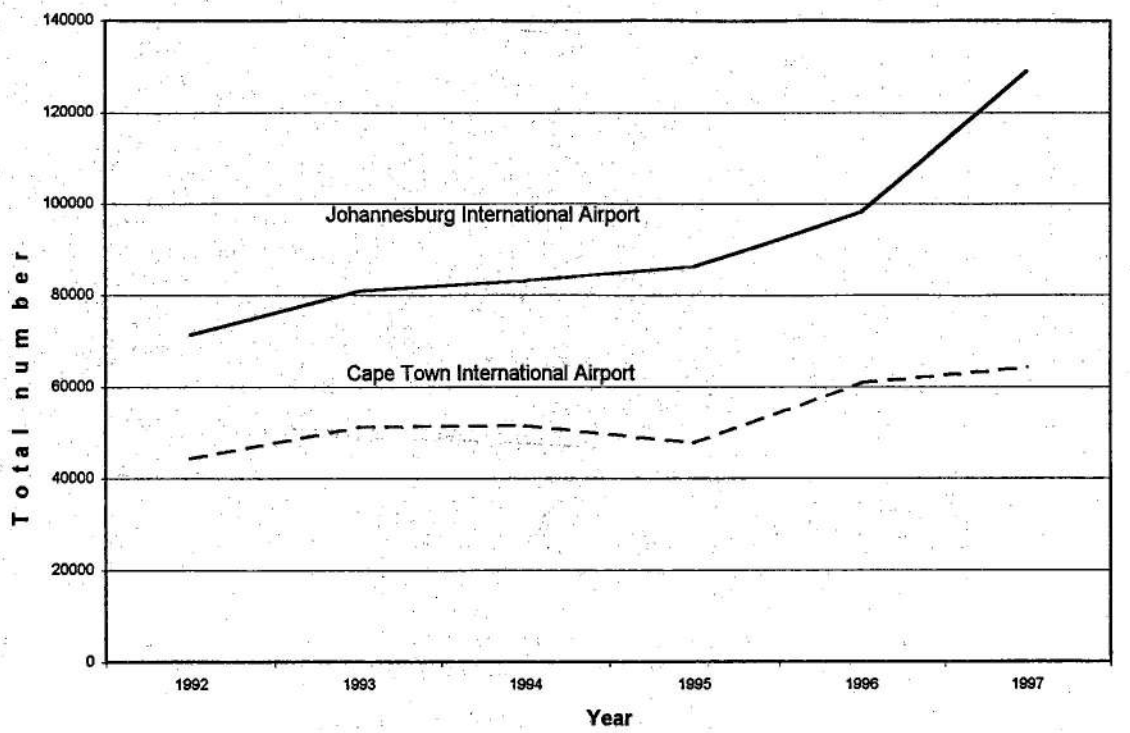
(i) The fastest growing two airports in South Africa are Johannesburg and Cape Town international airports as can be seen from the growth in aircraft movements over the past five years, as illustrated in table 2.1 and figure 2.1.

Table 2.1: Growth in aircraft movements (1992/93 to 1997/98)

Year*	Johannesburg International Airport	Cape Town International Airport
Domestic aircraft movements		
1997/8	97 594	62 710
1992/3	80 824	51 155
Growth	3,8% pa	4,8% pa
International aircraft movements		
1997/8	46 664	4 532
1992/3	29 382	2 088
Growth	9,7% pa	16,8% pa

*1 April to 31 March

Figure 2.1: Annual aircraft movements at Johannesburg and Cape Town airports
(Source: DOT and ACSA annual reports)



Daily distribution of aircraft movements at both these airports are indicated in figures 2.2 and 2.3. At both, 28% of all aircraft fall in the undesirable category of Chapter 2 aircraft, with 38% at Johannesburg and 31% at Cape Town falling in the category of Chapter 3 aircraft.

Table 2.2: Origin of flights to Johannesburg International Airport

Aircraft	Origin of flight to Johannesburg International Airport			
	South Africa (65% of flights)	Sub-Saharan African States* (19% of all lights)	Intercontinental (16% of all flights)	Total
Chapter 2 Jets	31%	45%	8%	28%
Chapter 3 Jets	28%	18%	92%	38%
Propeller driven aircraft	41%	37%	-	34%
Total	100%	100%	100%	100%

* Including Mauritius, Seychelles and Madagascar.

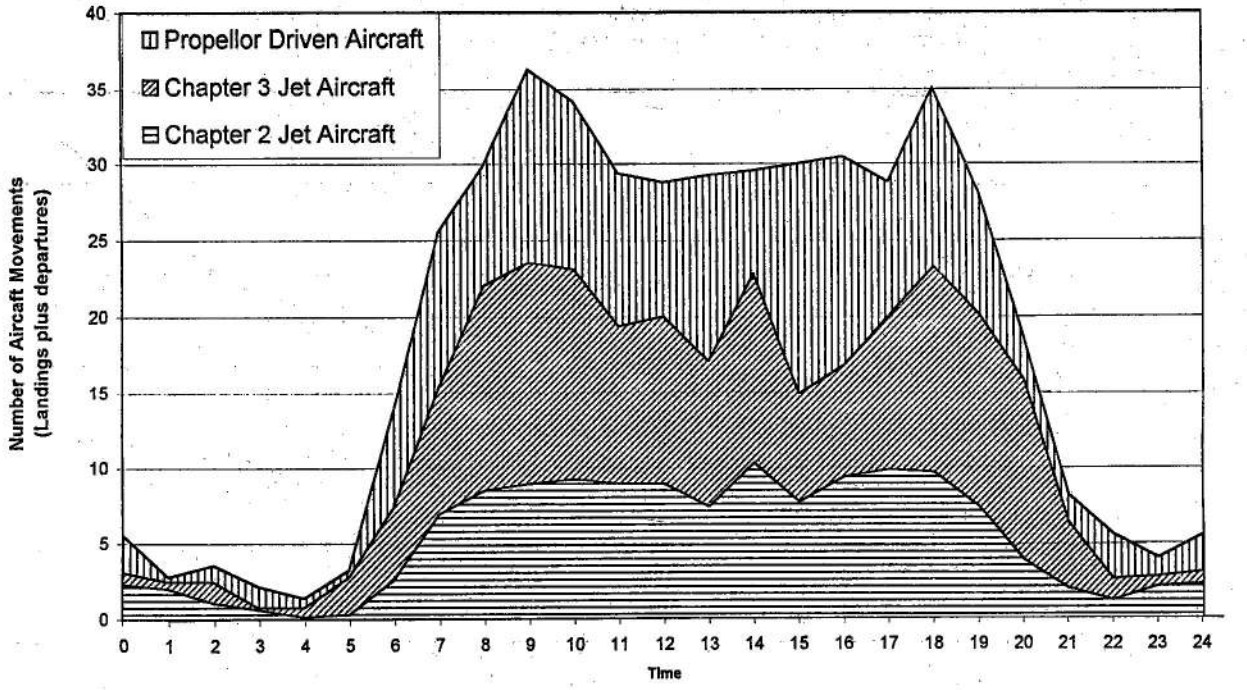


Figure 2.2: Number and type of Aircraft Movements over a typical day in June 1998 at Johannesburg International Airport

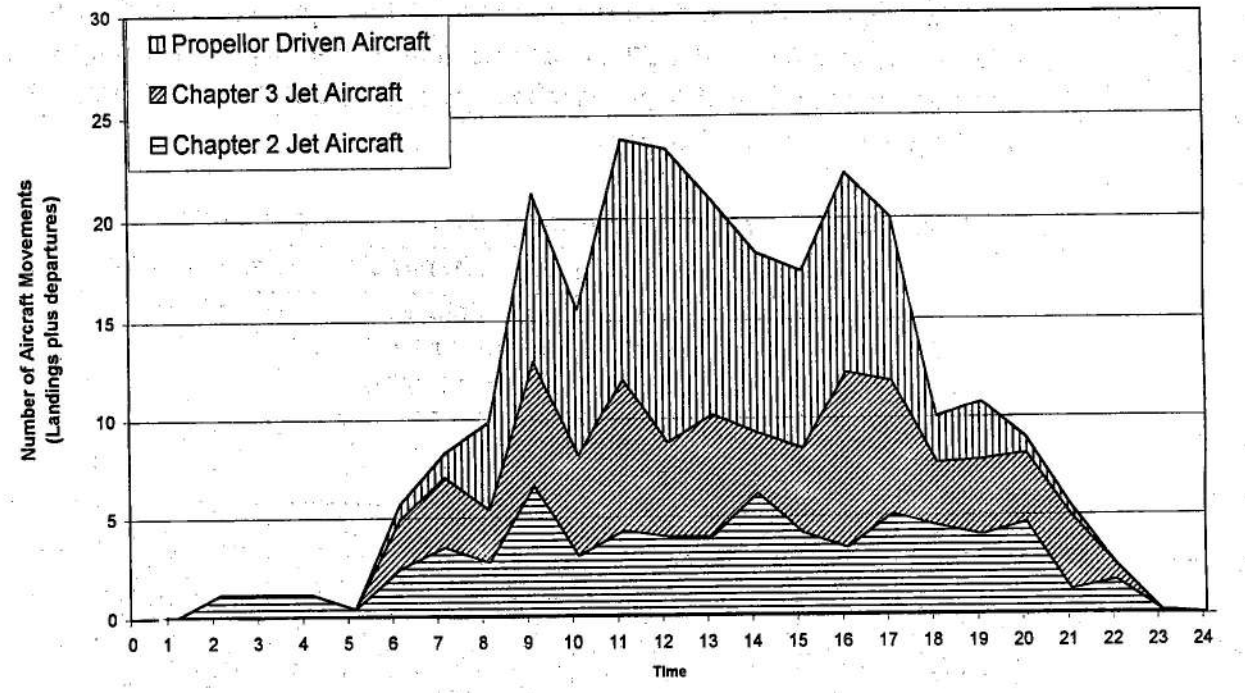


Figure 2.3: Number and type of Aircraft Movements over a typical day in June 1998 at Cape Town International Airport

From Table 2.2 it can be seen that 31% of all domestic flights in South Africa and 45% of those between Johannesburg and other Sub-Saharan countries are still with older generation noisier aircraft. The majority (92%) of intercontinental flights uses the acceptable Chapter 3 aircraft. In 1994 in Europe, one year prior to commencing with phasing out Chapter 2 aircraft, one-third of their fleet comprised Chapter 2 aircraft.

(ii) The first consideration regarding restrictions on noisier aircraft for South Africa as a developing country, is affordability. This relates, *inter alia*, to the cost of replacing existing Chapter 2 aircraft and not making use of cheaper aircraft on the market. Therefore, airlines will have higher capital expenses for aircraft. This was discussed with all major scheduled air carriers, who indicated that they accepted the need for future restriction. None of the South African airlines have very long-term leases on any of these types of aircraft. South African airlines have therefore indicated that they are prepared to follow the international example regarding restrictions on operations with environmentally insensitive aircraft, provided that this is done over a long enough time period and all carriers are treated equal.

(iii) The next consideration regarding possible phasing out of older generation aircraft is to what extent this will influence our relations with neighbouring and other states. In this regard it should be noted that ICAO requests contracting states to co-operate to ensure the greatest possible harmonization of programmes, plans and policies. The minutes of the African Civil Aviation Commission (AFCAC) meetings were analysed and an analysis made of aircraft from foreign countries being used to South Africa. From the above, it is evident that other African countries are also considering restrictions on environmentally insensitive aircraft.

From the World Airline Directory, an inventory was made of all aircraft registered in Africa, which could therefore, possibly be used for flights to South Africa. This analysis reveals that only two African countries flying to South Africa have not yet embarked on a modernization programme. A detailed analysis was made of present flights from African countries to Johannesburg International Airport. This analysis revealed that 71% of all jet aircraft used on routes by Sub-Saharan countries (including Mauritius, Seychelles and Madagascar) belong to the national flag carriers. One-third of the African national carriers use Chapter 3 aircraft to South Africa, one-third a combination of Chapters 2 and 3 aircraft, and the remaining third Chapter 2 aircraft. Of the aircraft currently used by South African carriers on sub-Saharan routes, 61% are Chapter 2 aircraft and 39% Chapter 3 aircraft.

The origin of those few flights still using Chapter 2 aircraft on intercontinental flights is Europe. The European Union is phasing out Chapter 2 aircraft and air carriers from Europe will, therefore, change to modern aircraft, with the result that

European countries would not constitute a problem regarding restrictions on aircraft operating to South Africa.

(iv) The following three major prohibition and restriction strategies were considered in formulating the policy:

- ban
- non-addition
- phasing out

With regard to banning, the fact that older aircraft are often converted to freighters, and that the market requires certain freight to be moved at night, should be taken into account. Therefore, the noisier aircraft are often used at night when noise is more critical. Banning operations at night for Chapter 4 (supersonic) jet aircraft and certain Chapter 8 (large) helicopters would have very little, if any, economic impact. A ban on certain aircraft types or certain aircraft at certain times of the day could possibly be considered and this option is discussed further in section 2.2 of this policy document.

A policy that restricts air carriers from adding noisier aircraft to their existing fleets is necessary if certain aircraft types are considered for phasing out. Such a non-addition rule for South African carriers would prevent the present problem with regard to domestic flights from increasing. However, limitations on foreign carriers are more complex. A major consideration is the possibility that foreign carriers restricted to the use of environmentally insensitive aircraft to certain countries could change their schedules to use all their modern aircraft to those countries. Countries without restrictions would then be served only with older noisier aircraft. Some of the major world airlines have shares in African carriers and this provides them with the flexibility to shift aircraft to an African carrier, with the result that the South African problem may worsen should no restrictions be in force here. In this regard, policy recommendations in the next section distinguish between South African and foreign carriers. A short notice period is given for South African carriers regarding non-addition, but in the event of foreign carriers no notice can be given.

The next consideration was the timing of a possible phasing out of Chapter 2 aircraft. In this regard it should be noted that Europe followed the ICAO recommendations in giving air carriers a five-year warning and after that, seven years wherein they should gradually phase out their fleets. The total time period was thus 12 years. In 1991, Australia gave notice that all air carriers should phase out their Chapter 2 aircraft during the period from 1995 to 2002, which totals 11 years. In South Africa air carriers took note of the policies adopted in other countries and anticipated that such a policy could be introduced in South Africa in future. Such a long period before phasing out commenced, may therefore be unnecessary.

ICAO also recommended that no aircraft should be restricted less than 25 years after the date of issue of its first individual airworthiness certificate. ICAO defines Chapter 2 aircraft as those for which certificates of airworthiness of the prototype were issued prior to 6 October 1977. Therefore, if South Africa served notice to start phasing out Chapter 2 aircraft in 2003 over a seven-year phasing out period, the possibility of any aircraft having to be phased out within 25 years of its first airworthy certificate being issued is negligibly small. The 25-year requirement is therefore not necessary in the South African policy.

Whether aircraft manufacturers would be in a position to replace the required number of aircraft within the seven year phase-out period was also considered. ICAO recommended in this regard that should an airline be able to prove that a firm offer had been made to replace an aircraft and the aircraft manufacturers could not produce it in time, a further extension of three years would be granted. Although volumes of aircraft for replacement in South Africa are negligible compared to those in the European Union and North America, both of whom were phasing out during the same period, and would have completed this process before South Africa started, the policy also recommends that this extension be granted.

(v) With regard to helicopters, it should be noted that Chapter 8 aircraft (large helicopters) can make more noise than large subsonic jet aircraft. These aircraft are highly manoeuvrable and can operate at low altitudes over residential or other sensitive areas causing a huge noise disturbance. It is often not necessary for these aircraft to operate over these areas at such low altitudes and restrictions should be placed on them in this regard. Restrictions on these aircraft operating commercially at night would have a slight economic impact. The policy will also recommend restrictions on the operation of helicopters at night in residential areas, except for crime prevention and emergencies.

(vi) A further consideration was whether the same restrictions on Chapter 2 aircraft should be applicable to all airports, or whether exemptions should be granted to airports outside metropolitan areas. Fewer people would be subject to the noise but the ambient noise levels in rural areas are much lower than in metropolitan areas. Therefore, the perceived noise level could be higher. The people living in rural areas should also be protected from excessive noise and it would not therefore be fair to allow noisier aircraft to operate at airports in rural areas. A second consideration in this regard is the difficulty in administering a policy with exceptions regarding aircraft types that may operate at various airports. The same restrictions would, therefore be applicable to all airports in South Africa and Chapter 2 aircraft should thus be phased out for operation anywhere in South Africa.

(vii) In the evaluation of military airports it should be noted that the South African Aviation Act, 1962 (Act 74 of 1962) Section 2 (3), states: "The provisions of this Act and of the Convention and of the Transit Agreement shall not apply to aircraft or aerodromes belonging to the South African Defence Force or for the time being in use exclusively by the South African Defence Force or to any person employed on or in connection with such aircraft or aerodromes, irrespective of whether such person is so employed in a military or civil capacity: Provided that the Minister, after consultation with the Minister of Defence, may by notice in the *Gazette* apply to any such aircraft, aerodromes or person any of the said provisions with or without modification." Although the above makes provision for the South African Defence Force to be exempted from noise abatement procedures, it was found from questionnaires sent to the airports that the South African Air Force has published noise abatement procedures to minimize the influence of noise on adjacent residential areas. In fact, they are in many instances an example. They also operate their more noisy fighter (supersonic) aircraft from their more remote airports. In the policy it will be recommended that the South African Defence Force should adhere to the same policy standards as civilian airports, emergencies excluded. As is currently the case operation should be scheduled to have minimum environmental impact and should not be permitted near densely populated areas.

The South African Air Force has sold some redundant Chapter 4 (supersonic aircraft) to the private sector. These aircraft are now used for recreational purposes. The question arises to what extent these aircraft should be free to operate. The policy will recommend that these aircraft should be restricted at night and specific noise abatement procedures should be applied. Permission should also be obtained from the airport's consultative forums prior to granting these aircraft the right to operate from a particular airport.

2.1.2.4 Policy

- All air carriers will be treated equally, including foreign operators operating to South Africa.
- Government should restrict South African air carriers from adding Chapter 2 aircraft to their fleets after 1 January 2000. After this date, no addition of Chapter 2 aircraft will be permitted in South Africa.
- Foreign air carriers operating to South Africa will be restricted with immediate effect from increasing the number of their Chapter 2 aircraft being used to South Africa. In this regard, the basis for calculations will be the number of flights with Chapter 2 aircraft prior to the publication of this policy.

- Government serves notice to all South African air carriers and aircraft owners that remaining Chapter 2 aircraft should be phased out over a period of seven years commencing on 1 January 2003. Interim milestones regarding the percentage of aircraft to be phased out are as follows:

  The number of Chapter 2 aircraft on register, or operated by any South African air carrier on 1 January 2000 shall form the basis for all calculations regarding the phasing-out programme. By 31 December 2006, 50% (fifty percent) of these aircraft shall be phased out. A further 25% (twenty five percent) shall be phased out by 31 December 2008 and all Chapter 2 aircraft shall be phased out by 31 December 2009.

- Foreign operators flying to South Africa will be required to comply with the same criteria and the same milestones for phasing out their older generation aircraft flying to South Africa, than those set for South African air carriers.

- If a South African airline can prove that a firm order had been placed timeously to replace an aircraft and this order could not be met by the aircraft manufacturers by the 31 December 2009 deadline, a three-year optional extension may be granted.

- No new bilateral agreements will be entered into or foreign operators' permits issued that allow foreign air carriers to start operating with Chapter 2 aircraft to South Africa after 1 October 1998.

- Restrictions on and phasing-out of Chapter 2 aircraft will apply to all airports in South Africa.

- The South African Defence Force should in principle adhere to the same policy standards as civilian airports, emergencies excluded. Military practices should be scheduled so as to have minimum environmental impact and should not be near densely populated areas.

- Permission needs to be obtained from an airport consultative forum to operate any Chapter 4 aircraft at their airport and a total ban should be introduced at night to the operation of Chapter 4 aircraft for civilian purposes. Military operations with Chapter 4 aircraft at night at military airports in or near urban areas should be limited, excluding emergencies.

- Chapter 8 aircraft will be restricted from flying low over residential areas or landing in a residential area (emergencies and crime prevention excluded).

- A total ban should be placed on the operation of Chapter 8 and 11 aircraft at night in residential areas. (Emergencies and crime prevention excluded).

- The use of auxiliary power units is discouraged where this could have a negative environmental impact. Airport owners are requested to install ground power points on their aprons if the apron is close to any residential or other non-aviational land use. In the event that a ground power point may be available an aircraft will be permitted to use its APU for five minutes prior to departing and for five minutes after parking. On all new airports and apron extensions, external electrical connections need to be installed.

2.1.3 Modification of aircraft engines

2.1.3.1 Background

Technology does exist to reduce noise and engine emissions caused by aircraft engines. Alternatively, new engines can be fitted to reduce the above, or existing aircraft can be recertified to reduce the permissible maximum take-off mass to meet noise specifications.

2.1.3.2 Issue

A government policy is required regarding the acceptability of engine modifications such as hush kitting, engine replacements, and recertification of existing aircraft

2.1.3.3 Considerations

The following aspects were considered:

- If all Chapter 2 aircraft need to be sold, certain air carriers will be forced to replace their entire fleets.
- The cost of new aircraft is high compared to the cost of hush kitting and air frame modifications.
- Certain countries do not permit hush kitting.
- Aircraft engines can be replaced with quieter engines, thereby reducing the noise and engine emissions to comply with the minimum ICAO standards.
- Aircraft can be recertified to operate with lower permissible maximum take-off weights, thereby reducing noise and engine emissions. However, the question arises whether it would be financially viable to operate with lower payloads rather than to modify or even replace the aircraft. A problem in this regard is that it would be very difficult to control whether an aircraft operator kept to the lower maximum take-off weight.

2.1.3.4 Policy

- Modifications to aircraft and aircraft engines will be permitted if the modified aircraft complies with ICAO, Annex 16, Volume 1, Chapter 3, noise certification standards and meets all the safety requirements.
- Replacing aircraft engines with modern quieter engines will be allowed if the modified aircraft complies with ICAO, Annex 16, Volume 1, Chapter 3, noise certification standards.
- Aircraft may be recertified to operate at a reduced take-off weight provided that the recertified aircraft complies with ICAO, Annex 16, Chapter 3, noise certification standards. If an aircraft is recertified to operate with lower payloads due to environmental considerations and the operator continues to operate with the original payloads, the aircraft will be grounded.

2.1.4 Regulation and Control

2.1.4.1 Background

Various authorities may be tasked to ensure that the policy recommendations are implemented.

2.1.4.2 Issue

Ensuring that an effective regulation and control system is established.

2.1.4.3 Considerations

All South African aircraft need to be licensed, and foreign aircraft carrying more than eight passengers or 1000 kg of freight must obtain a foreign operators' permit from the South African Civil Aviation Authority (SACAA). This, therefore, is the logical point at which to ensure that all aircraft operating in South Africa comply with the noise policy.

2.1.4.4 Policy

South African aircraft licences and foreign operators' permits will not be renewed if the carrier does not adhere to the phasing out requirements set out in this policy. Thus South African aircraft will be grounded if their owners have not adhered to the phasing-out policy.

In the event that a foreign operator fails to follow the requirements set out in his permit, a penalty will be imposed on the operator. This penalty would be in the form of a fine or, in the worst case, the aircraft could be grounded, confiscated and sold.

2.2 AIRPORT AND AIRCRAFT OPERATIONS

2.2.1 General background

2.2.1.1 Introduction

Aircraft operations have a significant noise impact on land surrounding the airport. The noise impact is greatest near the airport, and in line with the extended centreline of the runways. While land-use controls can be applied to manage inappropriate development near airports, operational controls are applied to reduce aircraft noise at source, with airports instituting procedures and restrictions to limit or prevent noise pollution. The combination of land-use and aircraft operational controls are intended to provide the greatest possible noise relief.

2.2.1.2 Direct and Indirect Operational Controls

Direct aircraft operational controls are designed to reduce aircraft noise at source, usually by means of reduced thrust on departure, approach, and during rollout after landing (reverse thrust). If aircraft engines are operated at lower power settings, less noise is emitted. Other direct controls include aircraft routing, restrictions on deployment of flaps/slats, and lowering of the aircraft's undercarriage, as well as restrictions on engine run-ups by aircraft maintenance organisations and auxiliary power unit operation.

Indirect controls include curfews and other time-based operational restrictions, which preclude aircraft operation at times of day when disturbance would be most noticeable, for example at night. Indirect operational controls may also include restrictions placed on the operation of particularly noisy aircraft.

2.2.1.3 Existing operational controls in South Africa

Existing operational controls in South Africa, vary from airport to airport and, in some instances, are compulsory, while in others they are voluntary.

The following aircraft operational controls are currently practised in South Africa:

- provision for noise abatement procedures in the AIP and in AIC 20-3 94-06-15
- restriction on runway and taxiway intersection departures at night
- voluntary limitation on reverse thrust at night unless required for safety
- prohibition on scheduled engine run-ups at night
- recommendation to use aircraft specific noise abatement departure procedures where applicable
- recommendation to avoid rapid changes in engine power at low altitude
- recommendation to avoid flying low circuits
- recommendation to avoid unnecessary low flying over populated areas.

Noise issues have been voluntarily addressed at a number of airports. Role players usually comprise local authorities, residents' associations and other interested parties, airport operators and airlines. Different types of operational controls have been investigated and some have been adopted, generally without any formal or binding agreements. Substantial enforcement has not occurred.

There is a growing need to gather all feasible operational controls into one document and to standardise on these where possible. Adequate operational measures are needed to ensure that at all airports experiencing a noise problem, sufficient steps are taken to bring about a reduction in aircraft noise exposure.

Each airport is unique in terms of its runway layout, approach and departure routes, and surrounding land-uses. Operational measures must, therefore, be considered individually on merit for each airport. An airport environmental committee, which is a committee of the consultative forum should be required at every airport experiencing noise problems, to formulate aircraft operational controls for application suited to the individual airport's' unique circumstances.

2.2.1.4 Aircraft Safety

Aircraft operation control applies to the actual operation of the aircraft on arrival and departure, and at a low altitude in the vicinity of the airport. Pilots cannot be forced to follow procedures which divert attention from the control of their aircraft, or to use runways that are not optimised for departures and arrivals.

Safe operation of the aircraft must always be the primary consideration. Final judgement on the application of noise related aircraft operational control rests with the pilot in command. However, pilots should take into account the noise generated by their aircraft and, unless safe operation of the aircraft is in jeopardy, should implement appropriate aircraft operational controls to reduce noise. It is anticipated that future aircraft noise - monitoring and track-keeping systems will assist in ensuring that operational controls are implemented.

2.2.1.5 Policy

Pilots should operate their aircraft in such a way as to reduce the noise impact wherever possible. However, judgement on the application of noise-related aircraft operational control shall rest with the pilot in command as the safe operation of the aircraft cannot be compromised.

2.2.2 Curfews and related operating restrictions:

Aircraft noise at night normally causes the most complaints and are perceived to have a more negative influence on people in the areas surrounding the airport, *inter alia*, because of sleep disturbance. Late at night, the number of aircraft in operation is normally much lower than during the rest of the day. At Johannesburg International Airport, the number of flights during the eight-hour period between 22:00 and 06:00 constitute 7,8% of the total daily flights. At Cape Town, it is 4%. At some airports in other countries, curfews have been introduced ranging from airport closure during certain hours to restricting certain aircraft operations at night. The effect of curfews is to eliminate, or substantially reduce, aircraft noise. However, curfews and operating restrictions do affect the ability of the aviation industry to facilitate the movement of people and goods. A number of options exist for eliminating or reducing aircraft noise at night:

(i) Option 1: Close the airport at night

Airports may be closed at night, during times when noise would be most disruptive, for example between 22:00 and 06:00. In such cases, no flights are permitted to land or depart during these times with the exception of emergency flights or those of a medical nature.

The advantage of no night flights is that much of the reason to complain about noise is removed since noise from night operations generates the majority of complaints.

The disadvantages are that such measures severely curtail the activities of both passenger and freight operations. For example, to beat a 22:00 curfew in Cape Town, an aircraft departing from Johannesburg would have to leave at 20:00, which is a busy time at that airport. Freight flights, in particular, would be affected as freight would have to be delivered to the operator well before departure time. The economic viability of airlines may then become questionable. Increased traffic peaking could also result.

During summer and at high altitude airports, some flights are delayed until temperatures have decreased so that the density altitude is suitable for a fully loaded aircraft to take off safely. These flights may have to offload cargo, passengers, fuel, or a combination of all three in order to meet a curfew. In such cases, if aircraft capacity is under-utilised with respect to freight and passengers, this could mean that more flights would have to be laid on, creating more noise. If a full fuel load is not carried, then the range of the aircraft is affected, and could result in a fuel stop en-route to the final destination, creating noise at the stop-over airport.

(ii) Option 2: Prohibit noisy aircraft from operating at night

Airports remain open on a 24-hour basis, but noisier aircraft types have operating restrictions placed on them. For example, non-noise certificated and Chapter 2 aircraft may not be permitted to operate between 22:00 and 06:00.

The advantage is substantially reduced noise impact because non-noise certificated and Chapter 2 aircraft produce significant noise levels. Simultaneously, operators utilising non-noise certificated and Chapter 2 aircraft would be encouraged to initiate action to replace their fleets with quieter aircraft.

The disadvantage is that the passenger and freight flights which currently use non-noise certificated and Chapter 2 aircraft would be affected, and the economic viability of operators which utilise fleets with large numbers of Chapter 2 aircraft would be challenged.

(iii) Option 3: Limit noisy aircraft at night through financial penalties

Airports continue to remain open on a 24-hour basis, with no operating restrictions on noisier aircraft types. However, financial penalties would be applied to non-noise certificated and Chapter 2 aircraft operations to encourage operators to move towards the use of quieter aircraft.

Advantages and disadvantages would be similar to those mentioned previously.

(iv) Option 4: Restrictions on all aircraft

ICAO noise regulations are designed such that the bigger an aircraft, the more noise it is permitted to make, even in the case of Chapter 3 aircraft. Effectively, this means that large Chapter 3 aircraft may still produce a lot of noise. Restrictions may, therefore, be applied to all aircraft types, including Chapter 3 aircraft. Exclusions would be granted only to aircraft proven to be the quietest, regardless of ICAO noise classification.

(v) Option 5: Limit the number of night operations

In combination with the above options, a number of night operations could be negotiated and allocated to airports on an annual basis. This limitation on the number of operations would have to be carefully managed by the airport and operators during the year so that the allocation would not be exceeded.

(vi) Option 6: Agree on a night-time noise contour which may not be exceeded

A night-time noise contour could be established by means of modelling and/or monitoring. Operations may proceed, but the night-time noise contour may not be exceeded.

2.2.2.1 Policy

Airport operators in consultation with the airport environmental committee may, if necessary, implement any combination of the options mentioned above.

The SACAA shall, after due consultation, have the authority to enforce any combination of the options mentioned above.

2.2.3 Noise abatement departure and arrival procedures

Noise abatement procedures are applied to aircraft operations when aircraft are close to the ground, during the approach and departure phases. Certain noise abatement procedures have already been published in AIC 20-3, 94-06-15.

2.2.3.1 Noise Abatement Departures

Noise abatement departures are designed to reduce engine thrust and therefore noise once the aircraft has reached a safe altitude and speed. Operation continues at reduced thrust until reaching an unpopulated area, when the required thrust is resumed, or until the aircraft has climbed to an altitude where the resumption of optimum thrust will not cause undue noise disturbance.

ICAO has published two noise abatement departure procedures, designed to achieve greatest noise reduction either close to, or further from, the runway. Application of these procedures would vary from airport to airport depending on local land-use conditions.

Aircraft specific noise abatement departure profiles designed for specific aircraft/engine/airport combinations could also bring about significant noise relief, particularly in the case of older aircraft. Airport and aircraft operators should ensure that they have all the necessary information from the aircraft manufacturers in order to implement appropriate noise abatement departure operations.

2.2.3.2 Noise Abatement Arrivals

Noise on approach can be reduced by applying procedures to keep aircraft at increased heights above the ground until commencing their final approach. Several procedures can be used to increase the height of approach operations:

(i) Interception of the glideslope at higher altitudes when interception is from below the slope. This has the effect of keeping the aircraft higher above the ground for longer.

(ii) Reduced flap settings and lower engine power settings. Reduced flap settings mean reduced drag and, therefore, less engine power is required. However, increased approach and touchdown speeds can result and this measure should be thoroughly investigated before implementation.

(iii) Use of continuous descent approaches. This limits the use of power in a graded descent, consequently reducing noise for some parts of the descent path.

2.2.3.3 Policy

- The SACAA will revise the existing noise abatement procedures in AIC 20-3 1994-06-15, taking into account all published ICAO procedures.
- Airport owners, experiencing a noise problem should ensure that appropriate noise abatement arrival and departure procedures are published for their airports.
- Aircraft operators shall obtain any aircraft specific noise abatement procedures designed for the aircraft types operated by their organisations and, if available, should be implemented whenever possible.

2.2.4 Preferential runways

Many of the larger airports have more than one runway, one of which may have less noise impact on the surrounding areas than another. Modern transport aircraft are often not particularly sensitive to the crosswind component during take-off and landing. Operations may, therefore be carried out on less than optimally oriented runways if that facility reduces the noise nuisance to the community at large. The use of preferential runways will vary from airport to airport depending on individual layout (terminal buildings, taxiways, runway orientation), prevailing winds, and land-use type in the immediate vicinity of the airport.

Preferential runway use may interfere with the daily practical movement of aircraft at the airport, reducing runway capacity, and should be carefully investigated prior to implementation. For example, it may be practical to implement preferential runway use only at night, all other factors considered.

2.2.4.1 Policy

Airport operators shall investigate, through modelling and/or monitoring, and implement the preferential runway use which provides the greatest noise relief.

2.2.5 Minimum noise routes

2.2.5.1 SIDs and STARs

Standard Instrument Departures (SIDs) and Standard Terminal Arrival Routes (STARs) are published for most medium to large airports. Usually applied to departures, noise preferential routes are designed in conjunction with SIDs to take aircraft over less densely populated areas, thus reducing the noise nuisance.

2.2.5.2 Policy

The authorities responsible for planning air traffic routes shall, through modelling, undertake a review of these routes at airports experiencing noise problems and, where possible, revise the routes so that the lowest possible noise impact is achieved.

2.2.5.3 Circuit operations

Aircraft arriving at smaller airports and training aircraft are generally operated in a standard circuit with speed and altitude restrictions at the airport.

2.2.5.4 Policy

Circuits shall be determined and flown at an altitude and routing so as to ensure minimum noise impact.

2.2.6 Runway operations

2.2.6.1 Reverse Thrust

Reverse thrust is used to slow the aircraft down after landing, during the roll-out. Use of reverse thrust means that the aircraft is able to vacate the runway earlier, and may also not have to taxi as far to the terminal buildings. A significant reduction in noise can be achieved when aircraft are on the runway if pilots are restrained from using thrust reversers, except when no other adequate means is available for slowing the aircraft. Reverse thrust is particularly disturbing at night due to the sudden increase in noise.

2.2.6.2 Policy

Airport operators shall take steps to ensure that the use of reverse thrust is discouraged, particularly at night, unless required for operational reasons.

2.2.6.3 Intersection departures

To save time and fuel, if safe to do so, aircraft often begin their take-off run from an intersection, and do not use the full runway length. However, the further down the runway that the take-off roll begins, the further the noise disturbance extends beyond the airport. In the case of Chapter 2 aircraft, the use of the full runway length will limit the noise intrusion into the surrounding community. These aircraft should, therefore, always use the full runway length. However, the noise disturbance from the quietest Chapter 3 aircraft is much lower than for Chapter 2 aircraft. Thus quiet Chapter 3 aircraft may still use intersections during daytime without creating a disturbance.

2.2.6.4 Policy

- Airport operators shall require that the full runway length be used for all Chapter 2 departures.
- The quietest Chapter 3 aircraft (which must be specified) may make use of intersections for departures.
- All night operations (between 22:00 and 06:00) shall be required to use the full runway length.

2.2.6.5 Head- to- head operations

Head-to-head operations involve departing and arriving aircraft operating from the same end of the runway during operationally quiet periods, wind permitting. If the land-use along the extended centreline of a runway is not subject to noise disturbance, both arrivals and departures may take place on that runway.

Air traffic control must, of necessity, be tight to prevent any traffic conflicts, hence its suitability only during quiet periods and under proper control.

2.2.6.6 Policy

Depending on the airport layout, air traffic control restrictions and surrounding land, head-to-head operations should be encouraged if reduced noise exposure to populated areas results.

2.2.6.7 General low altitude operations in the vicinity of airports

When aircraft are operated at low altitude in the vicinity of airports, noise may be a problem because of their close proximity to the ground.

2.2.6.8 Policy

- Rapid changes in engine power at low altitude shall be avoided.
- Flying low circuits shall be avoided.
- Unnecessary low flying over populated areas shall be avoided.

2.2.7 General Airport Operations

2.2.7.1 Engine run-ups

Engine run-ups are conducted to identify problems, and after maintenance work has been performed. Run-ups are often performed at night when aircraft maintenance is done, thus creating a disturbance for those people who live near the airport. Certain airports experience bigger problems due to the location of aircraft maintenance organisations on the property.

Run-ups are also not necessarily performed at a location on the airport premises where the disturbance is minimised. In some instances, the area set aside for run-ups is located on the airport boundary, thus creating disturbance.

2.2.7.2 Policy

- No scheduled engine run-ups shall be carried out between 22:00 and 06:00 unless adequate noise attenuation systems are in place.
- Airport operators shall provide run-up areas for maintenance organisations in an area of the airport where least disturbance will be caused.

2.2.7.3 Auxiliary power unit noise

Large transport aircraft are equipped with an auxiliary power unit (APU) to provide electricity while the aircraft is on the ground if there is no ground power available. APU noise can be disturbing when aircraft are parked in areas close to the airport perimeter.

2.2.7.4 Policy

- APU operation shall be limited to 30 minutes before, and 15 minutes after a flight.
- Airport operators shall provide 400Hz ground power at parking points where irritation from aircraft noise is experienced, and shall give consideration to erecting noise barriers.

2.2.8 Pricing

2.2.8.1 Background

Implementation and maintenance of noise abatement measures will be costly for local authorities around the airport, aircraft operators and airlines. Where undesirable land-uses fall within certain noise contours and the land must be expropriated, buildings insulated, or owners compensated for their inconvenience, this will have a cost-implication. Noise measuring, modelling and monitoring are also expensive activities. Funds must be obtained for all these purposes if the noise policy is to be successfully implemented. Penalties should also be used for law enforcement and as a deterrent. In many other countries, it is standard procedure to have a noise charge levied as part of the landing fee. In South Africa, with the implementation of a policy on aircraft noise, such a noise-user charge is also necessary.

2.2.8.2 Issue

The introduction of noise charges and penalties for aircraft not complying with noise regulations.

2.2.8.3 Considerations

Noise-based levies on landing fees are necessary to implement all countermeasures with regard to aircraft noise.

If the airport owners are required to install and maintain a noise measuring and track monitoring system the cost needs to be recovered in some way. In effect, if a noise-based landing fee was not introduced, this would mean that the airlines operating with quiet aircraft would be subsidizing those with the older, noisier aircraft.

However, from an airline point of view, certain airlines would have to replace a large percentage of their entire fleet as a result of noise regulations. Imposing a noise-related landing fee would mean that these airlines were doubly penalized - firstly with the cost of replacing or hushkitting their aircraft, and secondly with a higher airport landing fee.

2.2.8.4 Policy

- Noise levies based on aircraft sizes and operating times should be introduced at airports as an additional levy on the landing fee.
- Penalties will be imposed on aircraft operators not complying with the noise abatement procedures. This will apply to local as well as foreign aircraft operators.

- Funds generated from these levies should be deposited into a special airport noise fund and used to maintain noise-monitoring and track-keeping systems, and to provide funds for insulating houses and buildings lying within restricted contours or relocating certain buildings.

2.2.9 Enforcement of Noise Regulations

The policy recommendations contain several aspects that can be successfully be implemented only with proper control and enforcement.

2.2.9.1 Policy

Airport operators, together with the airport's noise control committee, need to ensure that all noise abatement and other procedures are adhered to. If the airport operator and airport noise control committee do not fulfill their responsibilities, the right of appeal should exist to SACAA which could then intervene, if warranted.

Airport owners with more than 10 000 movements per annum should be compelled to submit an Environmental Management Plan (EMP) to the Department of Environmental Affairs, providing details on a quarterly basis to the Department on actual noise generated in the airport environment. If the actual noise exceeds the noise contours, details on possible preventive measures should be supplied. These will then be followed up by the Department to ensure that noise generated is reduced to the stipulated standard.

2.3 NOISE PREDICTION AND MONITORING

2.3.1 Policy for the generation of contours around airports

2.3.1.1 Introduction

Generation of noise contours forms an essential part of the long-term planning of land-uses around existing and future airports. For this reason, regular calculation of noise contours around all relevant airports is obligatory. Essentially, there are three issues:

- compulsory generation of noise contours
- prediction model used for generating the noise contours
- responsibilities of the role-players for the generation of noise contours

2.3.1.2 Compulsory generation of noise contours

Background

At the time that the South African aircraft noise prediction model was developed, together with accompanying recommendations for limits on developments in the vicinity of airports, the total applicable scenario was very much state-driven. It was initiated by the State, and tasks were delegated to parastatal organisations, such as the CSIR and SABS, to design, implement and maintain the system. The State also owned all the major airports in the country, as well as the only major South African airline flying to and from the country. It could, therefore effectively ensure the co-operation of the various role-players in making the system work. This included, *inter alia*, the very important issue of expanding the database of noise emissions required by the prediction model.

The State, ie various central government departments, was also mainly responsible for commissioning the calculation of noise index (NI) contours around major airports.

Due to these state-centred processes and other historical factors, the South African prediction model, together with its maintenance and implementation, became the responsibility of the SABS. This is still the case at present.

A list of the airports for which NI-contours were calculated by the SABS according to SABS 0117 and the years of calculation is given in table 2.3.1.

TABLE 2.3.1: Airports for which NI-contours were calculated by the SABS according to SABS 0117

AIRPORT	YEAR IN WHICH NI-CONTOUR WAS CALCULATED
Johannesburg International	1978, 1981, 1983
Cape Town International	1977, 1978, 1984, 1990
Durban International	1979, 1991
New Durban Airport at La Mercy	1974, 1975, 1984, 1996
Port Elizabeth	1978, 1990
Bloemfontein	1978, 1995
East London	1977, 1990, 1993
Richards Bay	1978
Ladysmith	1978, 1982, 1985
Lanseria	1979
Wonderboom	1974, 1991, 1992
Grand Central	1986, 1987
Rand	1993
Welkom	1981, 1996
Nelspruit	1984
Pietersburg AFB (Gateway)	1977
Waterkloof	1991
Swartkops	1981
Ysterplaat	1980, 1994
Dunnottar	1975
New Tempe	1995

Considerations

The only basis for recalculation of noise contours for a particular airport has been the SABS recommendation that this should be done every five years. Since no formal legal requirements were stipulated for calculation and recalculation of noise contours, this did not take place for most of the airports in South Africa, resulting in a

situation where the noise contours for quite a number of airports were either not calculated or not regularly recalculated.

In the developed countries that were investigated, calculation of noise contours is a legal requirement. Where conditions for periodic recalculations are not specifically stipulated, there is, at least, a body responsible for deciding when it would be necessary to do so.

Since current noise contours are an essential planning tool for noise control around airports, conditions for calculation and recalculation of contours need to be clearly stipulated from a legal platform.

Policy

Airports for which noise contours shall be calculated

Noise contours shall be calculated for existing and newly planned airports with the following characteristics:

- an airport with any combination of scheduled, chartered, freight or regular military flight operations
- an airport with a permanent flying school
- an airport with a significant number of complaints, the significance of which shall be expressed as the number of complaints received, frequency of occurrence, and distribution in the community
- an airport in or close to a built-up area, or an area which is to be developed into a built-up area
- an airport with a runway length in excess of 1 800 m.

Time horizon for which noise contours shall be calculated

Noise contours shall be calculated for existing operations (or operations after completion of a new airport) and for operations projected 15 years ahead.

For planning and evaluation purposes, it may be valuable to calculate contours for particular milestones in the development of an airport or for the capacity of the airport, but this is not compulsory.

Frequency of the calculation of noise contours

In the case of existing airports, the noise contours shall be calculated at least:

- every five years
- whenever there is a change of 3 dB in the measured noise level at specified fixed and negotiated measuring points in the vicinity of the airport, measured over a period of 6 months
- if there are any physical changes to the airport, eg changes in runway lengths and/or orientations, or the addition of new runways
- if there are any changes in the operation of the airport, eg a significant change in the fleet of aircraft, flight operational procedures, flight routes, scheduling of flights or change in flight routes, the significance of which shall be determined by the airport's environmental committee
- if there is a 50 % increase in the number of movements at the airport.

2.3.1.3 The modelling of aircraft noise

(i) Background to the South African prediction model

- A brief history

The South African aircraft noise prediction model was developed in the mid-1960s. The government of the day then realised that the situation around the major airports in South Africa should be controlled through proper planning. Intrinsic to such an exercise was the need to predict the noise caused by aircraft operations around these airports. The Aeronautical Division of CSIR was then tasked with investigating the international situation regarding the modelling of aircraft noise.

This investigation showed that there was no unified international approach to aircraft noise at that stage, much less an 'international model'. The decision was then taken to develop our own South African model. The Aeronautical Division of CSIR was responsible for developing the technical aspects of the prediction model. The SABS provided the necessary measurement inputs to establish a database of noise emission values for aircraft and verify the prediction model. Sociological surveys were conducted by the Personnel Research Division of CSIR to correlate community response with verified prediction values.

In 1974, the results of these developments were finally published in a series of three documents, called Codes of Practice SABS 0115, SABS 0116 and SABS 0117. SABS 0115 describes the procedure for capturing, processing and presentation noise emission data from aircraft for various take-off and flight conditions in an input format. SABS 0116 describes the process for conversion of ICAO noise certification data into a format that can be used with the South African prediction model. SABS 0117 describes the calculation procedures of the model and provides recommended limits for development in the vicinity of airports.

- **A brief description of the working of the South African model**

The South African model for the prediction of aircraft noise around airports is a deterministic model which uses noise emission values from specific aircraft types to calculate noise emission on a reference grid, placed on the area covering the airport and surroundings. Noise emission values are obtained from noise level measurements made around the particular aircraft while it is simulating various take-off and flight conditions on the ground.

The working of this model is quite unique, in that it calculates the flight paths of large passenger jets using aerodynamic principles, with such factors as, *inter alia*, take-off weight, thrust and flap settings, lift factor and drag coefficient as a few of the required 42 input parameters. The way that it takes account of the directivity pattern of noise emission under different flight conditions is also unique.

Small aircraft are treated differently in that aerodynamic principles are not used to calculate flight paths, but are specified in terms of co-ordinates, to which a geometric curve is then fitted.

Estimated exposure time and associated noise exposure level at a given point on the reference grid due to particular aircraft movements are calculated as a function of the maximum noise level experienced during the movement, the speed of the aircraft, and estimated reigning ambient noise level.

- **The South African aircraft noise descriptor**

For each node on the reference grid, the noise exposures due to individual aircraft movements are calculated to arrive at the (NI) for that point[6]. Structurally, the NI is very similar to the equivalent A-weighted sound pressure level L_{Aeq} except that it provides a procedure, according to which evening (18:00 to 24:00) and night (00:00 to 06:00) flights have a heavier weighting than those during the day (06:00 to 18:00). In effect, the NI could be described as a kind of L_{den}, ie a day-evening-night level.

- **Problems experienced with the South African model**

The South African model was developed and applied with strong state involvement and has, in all probability, served its purpose well for quite some time. In recent years, however, the need has become evident to revise the model, mainly due to the difficulty in maintaining and modernising the input database of noise emission values, which is complicated to use and can be implemented only by the SABS at present. Although closely related to the L_{Aeq}, the NI cannot readily be integrated into or compared with noise caused by other sources, eg road and rail traffic, and industrial plants.

- **Revision, amendment or withdrawal of the South African model**

The South African prediction model is currently under revision. The Standards Act requires that any amendments, renewals or withdrawals of any Standards or Codes of Practice can be done only with national consensus, ie subject to specified voting procedures to which a wide panel of representatives have input.

(ii) Considerations

- ***The prediction model***

The prediction model for calculating aircraft noise contours around airports forms a pivotal part in the planning process. This means that noise contours for present and future airport scenarios must be deterministically calculable.

Although the South African model, as specified by SABS 0117, is scientifically sound, the database of aircraft noise and performance values has not been amended to include the most recent aircraft types. Modernisation of the database is, therefore, the most pressing reason for revision of the South African noise prediction model.

For various historical reasons, this model is not trusted equally by the various role-players in the field. However, to provide reliable calculation results, given equally reliable input data, it is essential that the official model for calculation of aircraft noise be trusted by all parties. Only then, will the contours produced be generally accepted for demarcating of noise zones for planning and development purposes.

In all developed countries forming part of the investigation, only those results obtained from an official model for calculating noise contours are accepted for planning, zoning and compensation purposes.

At present, there is no truly international model available, and each country still basically follows its own procedures. Many are in the process of reviewing their respective calculation methods and there is general consensus that a more unified approach should be adopted.

Several aircraft noise prediction models are based on, or use, specific elements of the ICAO recommendations for calculating aircraft noise on the ground, notably the FAA's Integrated Noise Model (INM).

Various technical problems have been identified in the calculation methods on which the ICAO recommendations are based. These technical problems are reflected in the resulting calculated noise contours. For this reason, these base documents are themselves currently under ICAO revision. Once this has

been achieved, it is likely that a truly international model will be based largely on these recommendations, together with an internationally accepted database of aircraft noise emission and performance values.

Since South Africa is comitted to following the international trend on aircraft noise prediction methodology, the revised prediction model should take account of the ICAO recommendations, following careful consideration of the effect of this methology on calculated noise contours under South African conditions.

- **The noise descriptor**

The aircraft noise descriptor presently used in South Africa is the Noisiness Index (NI). This is closely but not directly related to the equivalent A-weighted sound pressure level, L_{Aeq}, used to describe noise generally in South Africa and in many other countries throughout the world. This has created difficulties in comparing the contribution of other noise sources with aircraft noise.

The international tendency is to move towards an L_{eq}-based aircraft noise descriptor for purposed of comparability, and South Africa should follow this tendency.

- **Description of night noise**

At present, night flights carry an extra factor-10 penalty when calculating the NI. However, the result remains a single value that reflects a period of 24 hours. Since most of the flights from an airport generally take place during the day and the evening, these tend to dominate the calculated NI. However, local and international experience shows that the mechanism by which aircraft noise disturbance at night differ from those during the day and the evening is based on the occurrence and level of single events rather than the cumulative effect. The international tendency is, therefore, to treat aircraft noise independently at night.

It is strongly recommended that South Africa should follow the international tendency.

(iii) Policy

- **Specification of prediction model to be used**

The prediction model as specified in the relevant Code of Practice/Act shall be used for calculating of noise contours around airports. This prediction model shall be in line with international practice.

At present, Code of Practice SABS 0117 is the official document for calculating noise contours around airports. The SABS is urged to revise the South African method, and specifically to investigate the possibility and implications of adopting an internationally compatible model, such as the FAA's Integrated Noise Model (INM), or a model presently under consideration by the international standards community as a matter of urgency.

- **Metric for describing aircraft noise around airports**

The metric for describing aircraft noise around airports shall be as prescribed in the relevant Code of Practice/Act. This shall be based on an equivalent noise level and shall comply with international practice.

- **Description of aircraft noise at night**

Aircraft noise at night shall be described in terms of the maximum noise level caused by a single aircraft noise event and the number of occurrences during the defined night-time period. International practice shall be followed.

2.3.1.4 Responsibilities

Considerations

More recently, responsibilities for calculating noise contours in South Africa have not been clearly defined, especially with regard to commissioning of calculations, financial responsibility, recording results and gathering data. This has led to considerable confusion, for example with several airports not knowing when last or whether noise contours have been generated for their facility.

In many countries, the responsibilities of different role players are clearly spelt out and understood. The process is participative and transparent. Thus, the resulting noise contours are generally accepted by the public.

It is considered essential that South Africa should follow this trend and allocate specific responsibilities to the various role players in the field.

Policy

- ***Overall governing responsibility for the calculation of noise contours***

  Overall responsibility for enforcing and regulating the calculation of noise contours around airports shall be held by the South African Civil Aviation Authority.

- ***Establishment of a representative airport environmental committee***

  A representative environmental committee shall be established for every airport for which noise contours need to be calculated. Responsibility for constituting this committee shall rest with the airport operator. The purpose of this committee shall be the provision of a communication link between the various interested and affected parties. The committee shall meet regularly and should include representatives from:

  - local authorities affected by the airport
  - the airport operator
  - airline operators utilizing the airport
  - pilots of aircraft utilizing the airport
  - the affected communities around the airport.

  The SACAA should have observer status.

  The committee shall act under the aegis of the general Airport Consultation or Liaison Forum and shall report to the Forum from time to time. The committee

shall also produce an annual report on matters relevant to the noise situation at the airport for submission to the SACAA.

- ***Responsibility for data collection***

Responsibility for data collection of a specific airport will rest with the relevant airport licensee. This data shall be reported on a half-yearly basis, and in a specified format, including at least:

- the total number of movements per specified period of time
- the number and types of aircraft operating at the airport per specified period
- daily time distribution of flight operations per specified period
- distribution of flight operations over established flight routes per specified period.

- ***Financial responsibility for calculating noise contours***

Financial responsibility for calculating noise contours shall rest with the airport licensee.

- ***Responsibility for calculating noise contours***

The airport licensee, in consultation with the airport environmental committee, shall be responsible for commissioning the calculation of noise contours for the airport according to the prescribed times and frequencies. It may commission the SABS or a consultant selected from a panel of consultants who must be accredited with the SACAA.

- ***Reporting***

The report on the calculation of noise contours for a particular airport shall include at least:

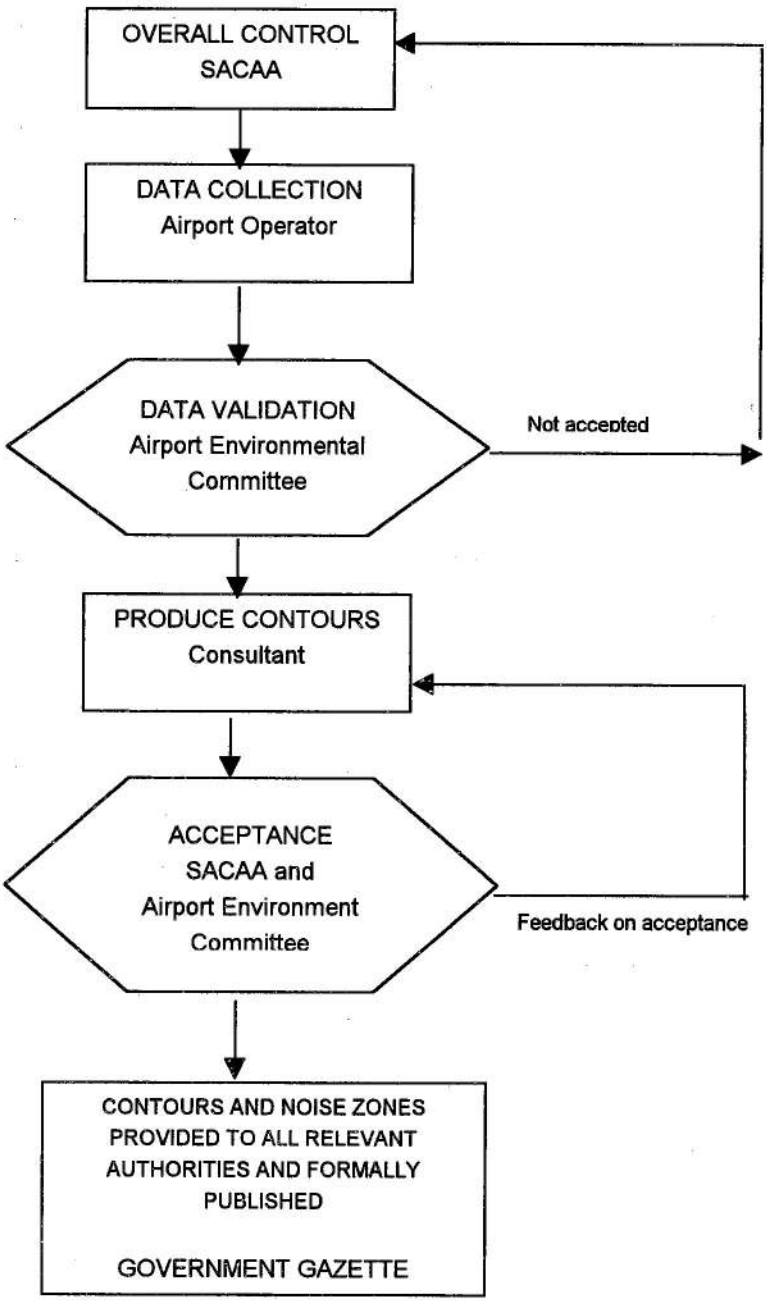
- a declaration of the model used for the calculations

- a clear description and listing of the input data used for the calculations
- the assumptions made for the calculations
- the calculated noise contours.

- ***Publishing of results***

The determined noise contours must be distributed to the airport environmental committee (including the local authority and the airport operator), provincial development planning and environmental affairs departments, and the SACAA. The coordinates of the verified resulting noise contours for a particular airport shall also be published in the Government Gazette.

- ***Flow diagram for the calculation process***



- ***Responsibility for maintaining the prediction model***

  Responsibility for maintaining the official aircraft noise prediction model and associated noise limits shall rest with the SABS in collaboration with the SACAA and the international standards community.

2.3.2 Policy for noise monitoring and track keeping

2.3.2.1 Introduction

Airport operators have a major role to play in minimising the impact of noise caused by aircraft operations and in demonstrating to the public that the industry is behaving responsibly. Monitoring of aircraft noise around airports is a primary instrument in minimising the impact of aircraft noise. There are two main issues concerning the monitoring of noise levels around airports:

- requirements for a noise monitoring and track keeping system
- allocation of responsibilities in respect of noise monitoring around airports.

2.3.2.2 The requirements for a noise monitoring and track keeping system

Considerations

At present, noise levels are not monitored around any of the South African airports on a regular basis. However, the Aviation Act specifies that monitoring noise levels will become obligatory on 1 January 2003.

International noise monitoring systems are widely used as powerful tools for controlling the impact of aircraft noise around airports and developing databases of aircraft noise emission values. This can be done effectively only through permanently installed systems, designed and dedicated to the task of monitoring aircraft noise and ground track.

Policy

- ***Permanency of the noise monitoring and track keeping system***

The noise monitoring system shall comprise permanent measurement stations, specifically designed for the task of monitoring aircraft noise around airports.

- ***Positioning of the noise monitoring system***

The measurement stations shall be installed at points around the airport where the impact of aircraft noise is deemed to be critical, including:

- points as given in ICAO Annex 16.

- points in residential areas under or near major flight paths, where experience and/or predictions have shown the impact of aircraft noise to be critical.

- ***Capability of the noise monitoring system***

The noise monitoring system shall be capable of at least:

- measuring and storing the parameters of a noise event caused by an aircraft flying over, including at least the A-weighted maximum sound pressure level caused by the event and its duration over a specified threshold level.

- attaching the flight data, ie flight number and flight track, to the noise data caused by a specific flight at individual monitoring stations.

- ***Integrity of the noise monitoring system***

The integrity of the noise monitoring system shall be ensured through complete system calibration by an independent and accredited laboratory every two years.

2.3.2.3 Allocation of responsibilities

Considerations

Since no regular noise monitoring is presently conducted in South Africa, responsibilities have never been allocated. However, the Civil Aviation Regulations states that as of 1 January 2003, the airport operator will be responsible for installing and maintaining the permanent noise monitoring system. This accords with the practice in all developed countries where regular monitoring of aircraft noise levels is practised.

Policy

- ***General responsibility***

  In accordance with Part 139 of the Aviation Act, the airport licensee will be responsible for regular monitoring of aircraft noise around airports from 1 January 2003. This includes financial responsibility for the monitoring system. The licensee shall forward data of actual aircraft movements and noise generated, on a quarterly basis to SACAA.

- ***Functional responsibility***

  The airport operator shall be responsible for the administration, maintenance, routine calibration of noise monitoring equipment, and collection and evaluation of data generated by the system. Should the airport operator not have the capability of doing this, assistance from an accredited consultant may be sought.

- ***Airport environmental committee***

  In collaboration with the airport environmental committee, the airport operator shall employ the data provided by the monitoring system to:

  - decide on noise limits for the specific monitoring points
  - negotiate the noise buffer zone around the airport
  - produce the quarterly noise report, for submission to the controlling authority
  - decide on noise control strategies for the particular airport
  - decide on noise tariffs for operators exceeding the accepted limits.

2.4 LAND-USE

2.4.1 Introduction

Various techniques and procedures can reduce the undesirable effects of airport noise. Land-use planning and control is deemed to be one of the best countermeasures. This implies taking advantage of available land-use control techniques to ensure that land surrounding the airport is used in a manner compatible or in harmony with the airport environment and activities. This is consistent with the White Paper on National Policy on Airports and Airspace Management, published in March 1998. This White Paper contains policy statements that require all role-players (authorities and airport-owners) to ensure that airports are in harmony with their environments. It also states that the airport-owner must comply with all local, provincial and national requirements, including local structure plans, land-development objectives (LDOs), integrated development plans (IDPs), and integrated transport plans (ITPs), as is the case with any other land-use development. It was thus necessary to investigate land-use issues pertaining to aircraft noise in more detail. The purpose of this chapter is, therefore, threefold, namely to:

- provide background information on prevalent land-use methods and legislation to control and measure aircraft noise, and facilitate an understanding of the current situation
- identify and define issues that need to be addressed
- develop a policy framework within which the above-mentioned issues can be resolved, and proposals for policy on aircraft noise control through land-use planning can be formulated.

These issues must be accommodated in the policy proposals in such a way that the following national vision for integrating airports into the environment as expressed in the above White Paper, is taken care of:

"Accessible airports integrated into and operating in their natural and built environments, while performing their function in the economy and the transport system, and serving and benefiting their affected communities, with minimised negative impacts on both the built and natural environments."

In this chapter, the following issues are addressed:

- ideal land-use types for various maximum noise levels in the vicinity of airports and situations where exceptions can be made
- possible uses for existing land within the various noise contours
- other noise-related land-use type issues, such as:
  - environmental impact assessments and management plans
  - declaration of risk by sellers of property
  - handling of complaints, claims and exceptions.

2.4.2 Ideal land-use types within various noise level contours

2.4.2.1 Background

In terms of the Development Facilitation Act (Act No 67 of 1995), a local government body can individually, or in conjunction with another local authority(ies), set land development objectives (LDOs) covering plans for development for a period of five years. These LDOs shall include, *inter alia*, a vision statement, development standards (also for transport), and a development framework. This framework should indicate the major trends influencing development in the area, including infrastructure, economic conditions and trends, social conditions and trends, constraints of the existing spatial form (such as an airport), state of the environment, and other development priorities and needs within the area.

In 1996, the Local Government Transition Second Amendment Act (Act 97 of 1996) specified that a local authority should compile an Integrated Development Plan (IDP) to ensure a holistic approach towards development.

Other existing relevant legislation includes the Noise Control Regulations promulgated in 1992 in terms of Section 25 of the Environmental Conservation Act, 1989 (Act 73 of 1989). The Noise Control Regulations, *inter alia* , refers to standards set out in the SABS publication (0117-1974) titled "Code of Practice for the determination and limitation of disturbance around an aerodrome due to noise from aeroplanes". The Code of Practice recommends the following limits for land-use developments:

LAND-USE DEVELOPMENT	NOISE INDEX (NI)
Schools, universities, churches, hospitals	Max 60
Residential areas	Max 65
Residential areas with acoustically insulated buildings	Max 75 (20dBA difference)
Industrial areas	Max 85
Forbidden areas no residential/commercial/industrial uses	More than 85

The above Noise Control Regulations places a general prohibition on the erection of educational, residential, flat, hospital, church and office buildings within a "controlled area" unless special acoustic screening measures are applied to ensure that acceptable interior noise levels can be maintained. A "controlled area" is defined as a piece of land designated by a local authority where in the case of aircraft noise in the vicinity of an airport the NI, projected for a period of 15 years, exceeds 65dBA.

In the SABS publication (0103-1983) entitled "The measurement and rating of environmental noise with respect to annoyance and speech communication", certain residual sound levels were recommended for residential spaces as a guide for zoning and planning purposes. It was recommended in that document that land areas be "zoned with respect to maximum permitted noise levels in order to avoid the long-term problems of noise control in the presence of an accumulating residual sound level". The recommended sound levels are contained in a table in the SABS document.

Cabinet Guidelines for the consideration of development proposals, changes in land-use, or subdivision of large areas of land zoned for industrial use within the 70 NI contours were approved in May 1981. These guidelines proposed the adoption of land-use related noise zones around all airports in South Africa, implying the rejection of all development proposals within the 70 NI contour, with the exception of certain public recreational facilities. In appropriate cases, the development of commercial, light and service industrial and office uses could be approved, especially those directly related to the airport. No densification of residential areas within the 70 NI contour would be allowed to preclude negative effects of noise on people living and working within the noise zones. These guidelines also protect the aircraft from certain land-uses with respect to height, position and smoke emission. From 1981 onwards, this Cabinet decision played an important role with regard to noise-control at airports. The Cape Provincial Planning Department adopted the 70 NI noise contour as the limit for residential and other development in 1986, and in 1988 this decision was legalised in the Guide Plan (Urban Structure Plan) for the Cape Metropolitan Area.

2.4.2.2 Issue

The White Paper on National Policy on Airports and Airspace Management addresses the integration of airports into their environments. As a fundamental premise, the need for balance between the interests of the airport and those of stakeholders near the airport was to be considered in the development allowed in the vicinity of airports. There should, therefore, be clear guidelines as to which land-uses should be allowed within which noise level contours.

National policy regarding noise control and land-use development should, therefore, provide efficient guidelines for the formulation of development frameworks and plans to address these particular issues. As far as possible, they should ensure that no inappropriate development takes place in a demarcated noise zone.

2.4.2.3 Considerations

In the White Paper on National Policy on Airports and Airspace Management it is specified that the authorities responsible for land-use planning and control in the vicinity of an airport should ensure that future zoning of areas close to airports are compatible with the airport development.

This White Paper also specifies that this matter should be addressed through Land Development Objectives and Integrated Development Plans. However, these two planning tools cannot be utilised effectively, since the zoning system used by land-use planning authorities is not always appropriate for the control of land-use development.

In some developed countries, there is a tendency towards more conservative noise control, and stricter regulations are applied regarding acceptable land-uses within certain noise contours.

Some municipalities in South Africa have indicated concern for the scarcity of land for development and the desire to prevent the sterilisation of large portions of land in noise contours. The indication is that they would rather relax the present maximum noise levels related to various land-uses. However, current maximum noise levels for different land-uses, as expressed in SABS Code 0117-1974, seem to be generally accepted.

2.4.2.4 Policy

In order to facilitate land-use planning and the interpretation of the implication of different noise level contours, it is proposed that additional information should be included in the existing SABS Code of Practice (0117-1974) as follows:

GROUP	NOISE INDEX (NI)	EXISTING LAND-USE DEVELOPMENT IN TERMS OF THE EXISTING SABS CODE	PROPOSED ADDITIONS TO THE SABS CODE
A	Max 60	Schools, universities Churches, hospitals	All land-uses including clinics, crèches, residential (medium and high density, including hotels, motels, townhouses); community halls, libraries, conference facilities, medical consulting
B	Max 65	Residential areas	Residential (low density), exhibition centres, offices, business, retail & trade (general and food and drink including restaurants, fast food, road houses, pubs, tea gardens), sport, recreation and entertainment
C	Max 70	-	Agriculture* (livestock and breeding), cemeteries*, wholesale, retail and trade (high density)*

GROUP	NOISE INDEX (M)	EXISTING LAND USE DEVELOPMENT IN TERMS OF THE EXISTING SABS CODE	PROPOSED ADDITIONS TO THE SABS CODE
D	Max 75	Residential areas with acoustically insulated buildings (reduction of 20dBA between inside and outside)	None
E	Max 80		Agriculture* (not livestock), picnic facilities*, open space* (vacant land)
F	max 85	Industrial areas	Manufacturing, repairing, packaging, transportation (municipal and bus depots), warehousing, motor trade, public garage, parking garage, panel beat, scrap yard, builders' yard
G	Above 85	Forbidden areas – no residential/commercial/ industrial uses	None

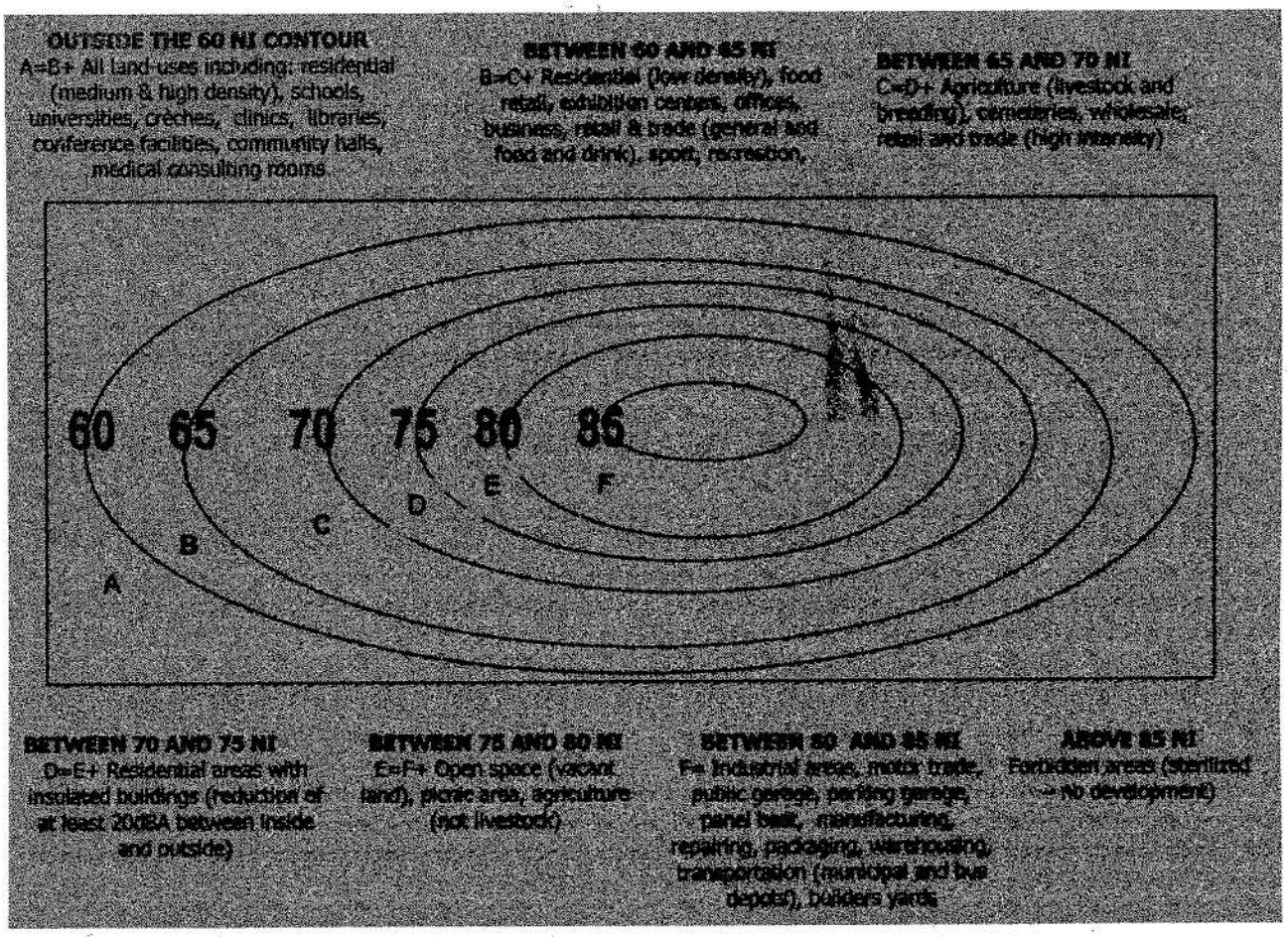
(*No relaxation into a higher noise contour is permissible)

Note that all land-uses where the buildings can be insulated in a satisfactory manner (with a difference of at least 20dBA between the inside and outside of the building) may be allowed into a higher noise contour. Since insulation is not practical or possible for land being used for agriculture (livestock and breading), picnic areas, open space, cemeteries, wholesale, retail and trade (high intensity), relaxation cannot be allowed in these instances (see uses marked with an * in the table above). Building regulations will have to be revised to make provision for acceptable types of insulation to successfully lower noise levels in buildings.

The authorities responsible for land-use planning and control in the vicinity of an airport will be required to use the above table to ensure that future zoning of areas close to airports is compatible with airport development and usage. The responsibility for commissioning calculation of noise contours is discussed in chapter 2.3.

When a new ICAO international standard method of measurement is accepted and agreement is reached between all concerned bodies as to when the transition to the new model should be made, it may be necessary to amend the above table as the noise descriptor will probably then change.

The compiled noise contours should be taken into consideration when land development objectives (LDOs) are set in terms of the Development Facilitation Act (Act No 67 of 1995). This table should also be used as a requirement when local authorities compile their Integrated Development Plans (IDPs) to ensure a holistic approach towards development. The contents of the above table are illustrated below:



2.4.3 Existing undesirable land-uses within various noise contours

2.4.3.1 Background

The previous section deals with the ideal or desired situation regarding maximum noise levels for various land-use types and, therefore, land-use zoning within the different noise contours around an airport. Where new airports are constructed in undeveloped semi-rural areas, it is easier to lay down and enforce land-use control around the airport according to predicted noise contours. However, many of the existing airports are located in urban areas where considerable surrounding development has taken place, not all of which takes the noise contours of the airport into account. With new policies being promulgated or existing policies confirmed, the question of what should be done with that misplaced development arises – the so-called undesirable or incompatible land-use in relation to the specific noise zone within which it is located.

A wide variety of actions has been implemented in other countries for similar situations, including:

- comprehensive and integrated planning
- environmental impact assessments
- land acquisition and relocation
- noise insulation programmes, and the revision of building codes

- subdivision regulation and tax-incentives
- transaction assistance and transfer of development rights.

2.4.3.2 Issue

Although the SABS Code 0117-1974 has been in existence since 1974 and the relevant Cabinet decision since 1981, there is in many areas no compulsory legal requirement with regard to maximum noise levels for different land-uses in existence in the country. This is aggravated by the fact that, to date, noise contours have existed at many of the airports. In consequence, there are land-uses located within certain noise zones at many airports that should not be there. The question is how many such cases exist and how should it be addressed.

2.4.3.3 Considerations

Where a building is used for a purpose that is undesirable within certain noise levels, that building may be utilised for a more compatible purpose that is permissible in that higher noise level. However the practical implications of such a change in building utilisation must be considered.

In other countries, the insulation of buildings located within noise contours that exceed permissible noise levels, has been successfully achieved. In many such countries, people insulate their homes in any case against extremely cold temperatures and it is relatively easy to further insulate them against external noise. It is questionable whether insulation is as practical in South African conditions where the climate is milder, building methods differ, people utilise the outdoors more frequently, and informal and low- cost housing types preclude easy insulation.

Where a local authority allows an existing incompatible land-use as an exception due to specific circumstances, this may stir dissension among those who have been unsuccessful in their relocation applications.

In some cases, the most economical option may be for the airport owner to obtain all the land within certain noise contours for its own airport-related use, or to demolish all existing buildings on such properties to prevent future problems, claims or costs.

With the proposal that all aircraft pay noise levies on landing fees, a fund will be generated to be used for noise-related matters at and around the airport. This fund could be allocated to a variety of actions regarding incompatible existing land-uses, such as insulation, relocation and other procedures to address the problem of land development adjacent to an airport where high noise levels should preclude such development.

2.4.3.4 Policy

Once the proposed land-uses have been accepted for the different noise zones as determined and the noise contours for the airport established as proposed in chapter 2.3, the local authority should survey all land-uses within these noise contours and compare them with the list of acceptable land-uses to determine existing non-compatible or undesirable land-uses. An action plan should then be drafted to deal with non-compatible uses. Actions for addressing non-compatible land-uses could include:

- **Relocation:** eg a school relocated within acceptable noise levels (max 60 NI) and the old school building utilised for a compatible use.
- **Insulation:** A programme for appropriate insulation of buildings within noise contours that exceed permissible noise levels should be undertaken where viable.
- **Exception:** In some instances, local authorities may decide to make an exception and allow a particular undesirable land-use due to specific circumstances.
- **Land acquisition:** The airport may purchase land used for undesirable uses within certain noise contours for its own (airport-related) use. The airport owner may choose to demolish all existing buildings on these properties to prevent future problems.

An action plan should include a suitable programme to address existing incompatible land-uses and provide a budget for available funds to implement the programme. Funds should be provided from the noise levy on the landing fee and other sources, including allocations from local authorities.

2.4.4 Development of land-use changes within noise contours, and changes of contours due to changes in airport activities

2.4.4.1 Background

If land-use zoning and all associated financial implications are determined by noise contours, it is important that these noise contours should not be subject to continuous change and, if changes are made, then contours should preferably be relaxed rather than made more onerous.

2.4.4.2 Issue

Due to the effect of noise contours on development around airports, noise contours should be determined such that land development rights are not susceptible to frequent change.

Clarity is needed concerning permissible development on airport property (ie within noise level contours above 85 NI). There is an increasing tendency to use airport property for

uses that are non-aviation related (such as hotels, offices and businesses). This may create situations where undesirably high noise levels are experienced with these land-uses.

2.4.4.3 Considerations

It is difficult to estimate the influence of an airport far into the future. If this is not properly done, large portions of land may have to be sterilised unnecessarily for long periods of time. In future, new types of aircraft could also have totally different noise influences at our airports, or passenger volumes may change. For this reason, it is important that airports determine their noise contours for the reasonable planning period of 15 years, and that these should be honoured as far as possible.

When planning the expansion of an existing airport, all role-players (authorities and airport owners) must ensure that this new airport development, or increased operations remain in harmony with the environment, taking into consideration the effect of increased airport noise.

The zoning system used by land-use planning authorities does often not apply to land-use developments at airports. In many instances, airports have poorly utilised the total available land. However, the trend is moving towards an increasing number of commercial developments at airports, such as offices, shops, tourism facilities, hotels, restaurants, garages, and warehouses. Such developments are often motivated by the need to utilise available land optimally and to maximise non-aviation income. No land-use development at an airport should, however, be in conflict with the land-use planning done by the local authority within the wider area in which the airport is located.

The White Paper on National Policy on Airports and Airspace Management states that attention to the demarcation of noise contours in the municipal spatial planning frameworks is needed to ensure that no inappropriate development takes place in the demarcated noise zone and noise controlled area.

It also states that provinces must include policies and strategies relevant to airport development for all airports in the Provincial Transport Frameworks and provincial spatial development plans, as well as the LDOs.

The White Paper also requires a greater focus on the development of non-aeronautical revenue generation to improve the overall financial situation of airports. These developments should be included in the airport development plan, which is subject to approval by the responsible municipality. Non-aviation land-use development at an airport should be done in accordance with local legal stipulations in the same way as any other local land-use developments.

2.4.4.4 Policy

Airport operators are responsible for determining and monitoring the existing noise contours. Furthermore, they should project noise contours for 15 years into the future and then strive to honour these contours for as long as possible.

Requirements for land-uses within different noise level contours as stipulated in the adapted SABS Code of Practice (0117-1974) will apply to any application for non-aviation land-use development on airports.

2.4.5 Environmental impact assessments and management plans

2.4.5.1 Background

There is growing concern in South Africa that the environmental impact of airports is unacceptable and inadequately controlled. Measures are needed to ensure that the environmental impact and noise pollution from airports are properly managed and controlled. Many communities are displaying growing resistance to the increasing noise pollution from airports located in residential and commercial areas. The prevalent method used to determine the environmental impacts of an airport and the effect of aircraft noise on communities and land-uses, is an Environmental Impact Assessment (EIA) as required by the Environmental Conservation Act under specified circumstances.

According to PART 139 of the Civil Aviation Regulations, titled "Aerodromes and Heliports: Licensing and Operation", an environmental impact report, if required in terms of the Environmental Conservation Act, has to be submitted as part of an application for a licence or an amendment thereof (Section 139.02.10).

Under the general duties of a licence holder (Section 139.02.19), he will be responsible for the monitoring of aircraft noise on and in the vicinity of an aerodrome, and the reporting of violations to the Commissioner. This requirement necessarily has far reaching implications.

Under the maintenance of an aerodrome environmental management programme (section 139.02.23), the licence holder shall operate the aerodrome in accordance with the provisions of the Environmental Conservation Act, and the regulations made thereunder (i.e. the Noise Regulations), together with the recommendations and requirements in any relevant Specifications or Codes of Practice published under the Standards Act (Act No. 29 of 1993). This gives a significant legal standing to the recommended limits specified in SABS 0117, as well as the NI 65 limit specified in the Noise Regulations.

2.4.5.2 Issue

When new airports are planned or existing airports upgraded, the necessary environmental studies must be done in terms of current environmental legislation.

2.4.5.3 Considerations

In terms of Section 21 of the Environmental Conservation Act, 1989 (Act 73 of 1989), the Minister of Environmental Affairs has, under Government Notice R1182 of 5 September 1997, identified activities which may have a substantially detrimental effect on the environment and which will, under certain circumstances, be subject to an appropriate environmental impact assessment. These activities include the construction or upgrading of airfields and associated structures outside the borders of town planning schemes, as well as changes in land-use from, for example, agriculture to any other land-use, including that of airports.

Many of the larger airports in South Africa fall within the border of a town planning scheme and the above requirement would then only apply if there is a change in land-use in that, for example, additional land has to be obtained for the extension of the airport.

The question arises whether consideration should not be given in future to amend the legislation to include airports within the borders of a town planning scheme. Actions that could require an environmental impact assessment include major runway extensions or re-alignments, new runways and fundamental changes to the operation of the airport.

2.4.5.4 Policy

It is important that a detailed environmental impact assessment (EIA) should be done for all new airports that are planned and for existing airports with major expansions, or where operations are changed to such an extent that noise levels and other impacts are dramatically changed. An Environmental Management Plan (EMP) should preferably be used to monitor and control noise at existing airports. When an increase in air traffic movement is noted, appropriate steps should be taken to ensure that noise limits are not exceeded. Noise Control Regulations set out in the SABS publication (0117-1974 Code of Practice) **as adapted** should be taken into consideration when compiling environmental scoping reports, EIAs and EMPs.

2.4.6 Declaration of noise exposure by sellers of property

2.4.6.1 Background

Many of the complaints concerning aircraft noise could have been avoided if residents in areas adjacent to airports had been properly informed about the expected noise levels before they purchased their properties. The ignorance of house-buyers can be exploited by sellers of property who conceal the facts from them.

2.4.6.2 Issue

Declaration of the fact that the property for sale is situated within certain noise contours should be made obligatory on the purchase contract documentation to prevent land-owners from deliberately concealing this fact since it may affect the price of the property.

Where a particular land-use has been allowed on condition that insulation to an acceptable standard is incorporated in the design of the building, it is also important to state this fact in the purchase contract documentation.

2.4.6.3 Considerations

It should be compulsory for land-owners to declare the fact that the property for sale is situated within certain noise contours that could affect the price of the property directly or indirectly, and to include this declaration in the purchase contract documentation.

2.4.6.4 Policy

Owners of property falling within the noise contours as published in the Government Gazette will be compelled to declare this fact to prospective buyers and to include this information in the purchase contract documentation when selling the land.

In instances where insulation is required, the local authority responsible for approving land-use applications and changes should insist on an Insulation Certificate from the property owner, proving that the buildings have, in fact, been insulated to acceptable standards.

2.4.7 Handling of complaints, claims and exceptions

2.4.7.1 Background

Annoyance is the most prevalent effect of aircraft noise. While the overall, or average, community attitude to noise levels is usually reported, it is important to note that some individuals are far more and others far less, upset or annoyed by the noise in question. Other significant effects of aircraft noise are:

- speech interference
- sleep interference
- hearing damage risk.

Some of the less frequently identified effects of noise on humans are:

- physiological (cardiovascular and circulatory) problems
- psychological problems (stemming from intense annoyance)
- social behavioural problems.

At present, there is no conclusive evidence to link these effects with aircraft noise. Research results often conflict and are even controversial. Factor such as an individual's fear of aircraft crashing, perceptions concerning the economic importance of the airport, income, occupational status, and other social factors are all responsible for differences in individual tolerance of aircraft-related noise.

The impact of noise on land-use and on the community depends, *inter alia,* on the type of aircraft, number of movements, operating procedures, time of day, and seasonal or meteorological procedures, as well as local factors such as the specific type of land-use, type of buildings occupied, distance from the airport, ambient noise levels, and community attitudes. These factors affecting human response can be divided into two groups:

NOISE FACTORS

- number of events
- sound level
- duration
- spectral content
- ambient background

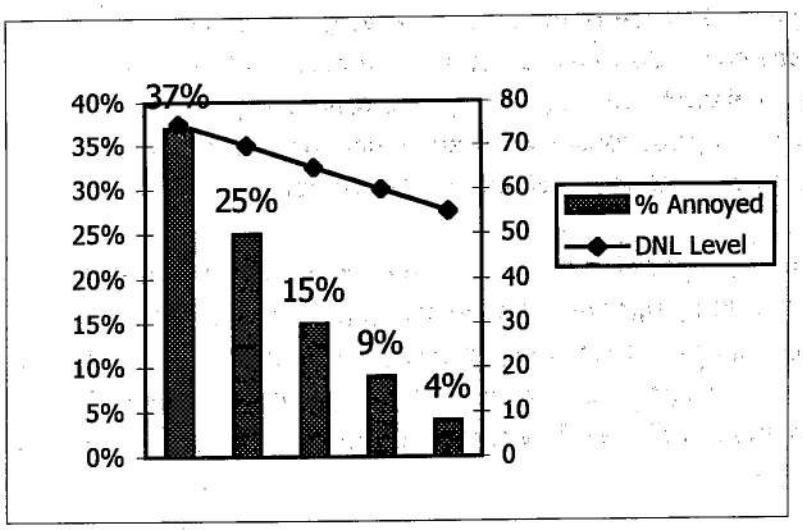
HUMAN FACTORS

- hearing sensitivity
- activity/location
- conditional response

The SABS has identified levels of excess noise and community responses as ranging between 5dB(A) and 20dB(A), with few complaints for the former and vigorous community reaction to the latter. The SABS Code (Table 6 of 0103:1983) was amended in 1997 to specify the categories of community/group response to environmental noise as follows:

Categories of community or group response (as amended in 1January 1997)		
1	2	3
Excess dB	**Estimated community/group response**	
	Category	Description
0	None	No observed reaction
>0 </= 5	Little	Sporadic complaints
>5 </= 10	Medium	Widespread complaints
>10 </= 15	Strong	Threats of community/group action
> 15	Very Strong	Vigorous community/group action

The following figure gives an indication of the percentage of the community that experience annoyance at the various noise levels. It is interesting to note that even where the DNL noise levels are below 60 dBA, a certain percentage of the community will still complain.



Source: Airport Planning Course notes, Institute for Transport Technology, Aviation Research Centre, The University of Texas at Austin.

Apart from the direct effect of noise on communities, the other aspects that may be affected by aircraft noise, include the following:

- real estate values
- certain land use types
- wildlife (breeding programmes and tourism may be disrupted)
- farm animals (production may be negatively influenced).

2.4.7.2 Issue

Because perceptions of noise differ between individuals and communities, some people will still be annoyed and may complain even though aircraft noise is within "acceptable levels".

At present, because of the lack of actual continuous noise measurements, the frequency and nature of complaints cannot be evaluated against actual activities of aircraft at an airport. It is important to monitor noise levels effectively and to have the information available when handling complaints.

Also, residents of adjacent areas must be informed of the permissible levels of aircraft noise within a certain distance of the airport. For this purpose, the general public should have access to noise contours and other noise information.

2.4.7.3 Considerations

The White Paper on National Policy on Airports and Airspace Management states that attention must be given to consultation mechanisms between local government, the CDCAA and airport-owners regarding any proposed development in the various noise zones or noise-controlled areas around an airport.

The White Paper also specifies that public participation must be encouraged in decision-making, especially where residents on land surrounding airports, airport-users and other stakeholders will be influenced by the development, expansion and upgrading of the airport or adjacent land-uses. It states that public participation should be facilitated in the process of preparing LDOs and IDPs.

2.4.7.4 Policy

Noise-contours and noise-measurements should be made available to communities in the vicinity of an airport.

An Airport Environmental Committee should be established as a sub-committee of the Consultation Forum at each airport, where representatives of taxpayers associations and other interest groups can raise issues of concern regarding noise. (See chapter 2.3)

The Environmental Committee will serve as a line of communication between airport operators and communities adjacent to the airport, and should be representative of all the stakeholders and role-players. (See chapter 2.3)

The Environmental Committee should ensure that all noise-related complaints and queries are handled in a satisfactory manner, and that individuals and groups are provided with the necessary facts and information.

3. AIRCRAFT ENGINE EMISSIONS

3.1 INTRODUCTION

This chapter endeavours to develop a national policy on aircraft engine emissions. There is a general lack of data to indicate clearly the magnitude of the problem of aircraft engine emissions, but indications are that it is not a major problem at present, especially in comparison to the problem of aircraft noise. This does not mean that air pollution from engine emissions is not important and will not develop into a serious problem if not carefully monitored and controlled. The purpose of the policy development is, therefore, to provide for such monitoring and control.

To create an understanding of the complex issue surrounding engine emissions, a short discussion on air pollution and air quality at airports, including sources of pollution and ways to reduce emission is given as an introduction. Thereafter, the status quo at South African airports is discussed and also the current legal situation. Then a number of issues with policy recommendations are given.

This policy deals with aircraft operation at and in the immediate vicinity of airports (extending to about 1 km above ground and up to about 3 km outside the airport boundaries). The policy does not address aircraft at high altitude. Furthermore, it does not deal with other land and airside operations at the airport.

3.1.1 Air pollution

Air pollution results from the discharge of gas, liquid (vapour), or solid (particle) matter into the atmosphere as a result of human activity at levels unacceptable to the human, natural, and/or physical environment.

Air pollution causes a wide variety of health effects that range from eye irritation to heart and lung damage, and even premature death. It can also impair visibility and reduce crop production, as well as damaging ecosystems, national parks, wilderness, built-up areas, and water bodies. Air pollution emanates from many different sources: "stationary sources" such as factories, power plants and smelters; "mobile sources" including cars, buses, aircraft, trucks, and trains; and "natural sources" such as wildfires, windblown dust, and volcanic eruptions.

Aircraft emissions are estimated to contribute approximately 2 - 3 % of global carbon dioxide emissions, but other exhaust products can significantly influence global warming.

3.1.2 Air quality at airports

Over the past few decades, noise has been the major environmental issue associated with airports and aircraft, though local and global effects of aircraft emissions on air quality have recently also begun to gain precedence on the environmental agenda. Although technological advances help to reduce emissions, a continued increase in emissions is expected due to anticipated growth in air traffic movements.

Emissions from aviation derive from aviation fuel combustion and other airport activities. They comprise mainly of hydrocarbons (HC) including volatile organic compounds (VOC), carbon dioxide (CO_2), carbon monoxide (CO), oxides of nitrogen (No_x), black smoke, lead (Pb) and sulphur dioxide (SO_2).

3.1.2.1 Sources of pollution

Activities at airports

Air pollutants resulting from airport operations are emitted from several types of sources: aircraft main engines and auxiliary power units (APUs); ground support equipment (GSE), including vehicles such as aircraft tugs, baggage tugs, fuel trucks, maintenance vehicles, and miscellaneous other vehicles used to support aircraft operations; ground access vehicles (GAV), including off-site vehicles used by passengers, employees, freight operators, and other persons utilising the airport. The US Environment Protection Agency estimates that aircraft engines may comprise approximately 45 % of total air pollutant emissions from airport operations; GAV account for another 45 %, and APUs and GSEs combined to make up the remaining 10 %.

The effect of airports on the air quality of the wider environment is difficult to quantify. The overall contribution of airport-related pollutants to the global environment is considered to be small. International literature suggests that emissions due to airport activities generally make up less then 1 % of global emissions in each of the main pollutants mentioned above. It has also been estimated that aircraft emissions themselves contribute some 2 – 3 % of global carbon dioxide emissions, though these include emissions at altitude.

The impact on the local environment, which is the focus of this Policy, is uncertain both in the local and in the international context. Again, the overall contribution in relation to other local sources is expected to be small, but a lack of data means this is difficult to verify. However, there is significant concern regarding airport pollution leading to the adoption of policies in the USA and Europe to control and monitor

this. For example, sufficient concern exists at several major European airports for their policies to include financial penalties against non-compliant aircraft using these airports.

In South Africa, there is an overall lack of data to draw a firm conclusion on the issue of air quality around airports. Limited complaints have been received at a few of the major airports, though monitoring at one location suggested that the contributions due to the airport were negligible. Clearly, local conditions vary due to a wide range of factors, which need to be considered.

International statistics suggest that the oxides of nitrogen comprise about 42% of the total aircraft-related emissions, carbon monoxide approximately 33% and hydrocarbons approximately 11%.

Emissions from aircraft operations

Generally a main source of pollutant emissions from an airport is the aircraft. Emissions arise from different modes of aircraft operation, namely: idle, taxi, take-off, approach and landing. The mode of operation places different demands on the aircraft engines, resulting in fluctuating pollutant emissions. For example, carbon monoxide and hydrocarbon emissions, which arise from incomplete or poor combustion, are generally greater during taxi/idle operations. (Many hydrocarbons are odorous. The typical airport smell of unburned and partially burned kerosene is evidence of this.) However, NOx is generated largely by the oxidation of atmospheric nitrogen in the combustion process. As such, its production is proportional to the combustion temperature, and emission of NOx is, therefore, at its highest during the take-off phase, when the engine is generally producing maximum power. Emissions of carbon dioxide are directly related to the amount of fuel burned. During the landing phase the combustion is delivering some 30 % power. At such a setting, NOx is still a significant pollutant. However, CO and HC emissions become increasingly significant as the combustion thrust output falls.

Landing and take-off (LTO) cycle

Estimating aircraft emissions focuses on a mixing zone, which comprises a vertical column of air that begins at the earth's surface, with a height (mixing height) equal to the inversion layer thickness. Air emissions within this zone are trapped by the inversion layer and ultimately affect ground level pollutant concentrations. When aircraft are above the mixing zone, the emissions tend to disperse and have no ground level effects. Aircraft operations within the mixing zone are defined as the landing and take-off (LTO) cycle.

Other emission sources related to aircraft operations

- An auxiliary power unit (APU) is a typical part of large aircraft. The APU provides power and preconditioned air to maintain the aircraft's operability when the aircraft is on the ground with its engines shut-down, and ground-based power and air sources are unavailable.
- Besides exhaust emissions, air polluting emissions also occur from refueling and spillage evaporation, pre-flight checks on the aircraft, and diurnal temperature cycles that cause the fuel tank to vent.

3.1.2.2 Methods of emission reduction

New technology

Emissions of CO represent fuel combustion inefficiency and, due to economic loss pressure has been exercised to reduce CO emissions by enhancing the fuel economy of aircraft. Modern engines are now extremely efficient, burning 99 % of all fuel supplied. This results in low emissions of smoke, CO and HC. However, these efficient engines require temperatures and combustion pressures, which result in increased NOx emissions. Engine manufacturers are now developing technological improvements that allow lower NOx emissions without impairing fuel efficiency.

Improvements in airport operations

Significantly reduced environmental impact can result from improved use of aircraft. In the short-term, an increased load factor could be put into operation. However, potential operational measures include:

- operating aircraft at speeds and altitudes that minimise pollutant emission,
- improving air traffic control efficiency,
- improving the efficiency of airport heating and power supplies,
- using clean fuel vehicles for land/airside traffic,
- supplying reliable and efficient connecting public transport systems to and from the airport,
- fiscal incentives, ie taxation on aviation fuel, etc.

Introduction of restrictions

Another way of improving air quality at airports is by introducing restrictions on the type of aircraft accepted at airports, or limiting the number of airport movements to a

certain level, which is economically and politically feasible. Phasing out older aircraft for noise purposes would, however, also bring about a tremendous improvement in engine emission quality.

3.2 BACKGROUND

3.2.1 Status quo at South African airports

3.2.1.1 Standards

To date no formal air quality standards have been determined for or enforced at South African airports. However, there is a need to introduce airport operation related standards and recommended practices.

3.2.1.2 Atmospheric Pollution Prevention Act (1965)

The South African Atmospheric Pollution Prevention Act (No. 45 of 1965) is the principle means of legislating control of air pollution. This act is based largely on the older British legislation and the principle of best practicable means. In other words, the costs of controlling air pollution emissions and ability of the industry to effect such control are weighed up against the need to control the emissions. The emphasis of the Act is on controlling air pollution at source, and South Africa, therefore, has no legally binding ambient air pollution standards. However, such standards are needed to plan new developments, or to monitor existing air pollution. For this purpose, the Chief Air Pollution Control Officer (CAPCO) has adopted various guideline standards. These guidelines serve to indicate concentrations of respective pollutants that should not be exceeded in ambient air, but do not have legal force in themselves. These standards are comparable with the United States Environment Protection Agency's health-based national air quality standards, but are less strict than the (World Health Organization's) standards.

3.2.1.3 Draft White Paper on Integrated Pollution and Waste Management for South Africa: A policy on Pollution Prevention, Waste Minimisation, Impact Control and Remediation, August 1997

Airports will be one of the issues to be considered in the proposed Integrated Pollution and Waste Management Policy, which focuses, *inter alia,* on a shift to prevention. The policy on air pollution management is to consider pollution on a **local,** regional, national and global scale. Issues such as atmospheric pollution, malodour generation and control are covered, as well as vehicle emissions and noise.

3.2.1.4 The White Paper on Environmental Management Policy for South Africa

The vision of the White Paper on Environmental Management Policy for South Africa is one of a society in harmony with its environment. The objectives are:

- *"To prevent, reduce and manage pollution of any part of the environment due to all forms of human activity, and in particular from radioactive, toxic and other hazardous substances.*
- *To set targets to minimise waste generation and pollution at source and promote a hierarchy of waste management practices, namely reduction of waste at source, re-use, recycling and safe disposal as the last resort.*
- *To regulate and monitor waste production, enforce waste control measures, and co-ordinate administration of integrated pollution and waste management through a single government department.*
- *To set up information systems on chemical hazards and toxic releases and ensure the introduction of a system to track the transport of hazardous materials.*
- *To ensure the protection and proactive management of human health problems related to the environment in all forms of economic activity.*
- *To promote cleaner production and establish mechanisms to ensure continuous improvements in best practice in all areas of environmental management."*

3.2.1.5 Aircraft emission standards

ICAO's document, entitled Environmental Protection, Annex 16 to the Convention on International Civil Aviation, Volume II: Aircraft Engine Emissions, second edition, 1993 sets out standards for aircraft engine emissions. This document deals with engine certification on the basis of emissions produced. A summary of the standards is given in Annexure E6. This document and its standards have been given legal status through the "South African Civil Aviation Technical standard SA-CATS-ENVIRO Environment Protection".

3.2.1.6 Limitations on the development of national policy on aircraft engine emissions

In developing the National Policy on Aircraft Engine Emissions, various limitations became evident, *inter alia*:

- insufficient available information on the relationship between aircraft operations and ambient air quality,
- inadequate communication between different government departments,
- environmental legislation in South Africa still in its infancy, etc.

3.3 NATIONAL POLICY ON AIRCRAFT ENGINE EMISSIONS

3.3.1 Framework

The National Policy on Aircraft Engine Emissions provides the principal framework for national, provincial and local actions to protect air quality from airport operation related negative impacts. Air pollution prevention needs to be emphasized rather than remediation.

3.3.2 Goals and objectives of the policy

The goal of the policy is to determine the extent of engine emission pollution and to provide a set of policy guidelines to support national and local planning and control at airports and their surrounds. In particular, the policy is aimed on the one hand at the needs of the airport operators and provincial and local authorities on the other.

The following objectives are important:

- to obtain sufficient data through regular monitoring to determine the extent and seriousness of the problem of aircraft engine emissions and to assist in the development of suitable standards and policies
- to provide the background to establish national air quality standards for aircraft engine emissions
- to ensure that these standards are met or attained in co-operation with major players and stakeholders
- to reduce pollutant emissions related to airport operation
- to take steps to limit the damage to the stratospheric ozone layer due to aircraft engine fuel emissions
- to ensure that sources of toxic pollutants related to airport operations are well-controlled

3.3.3 Assessing the impact

For the purposes of measurement and monitoring, attention is drawn to the following:

- The assessment should be done in terms of the ambient (background) air quality, including the cumulative effect on the environment.

- The ambient air quality will be assessed on the basis of guidelines, prepared by the Department of Environmental Affairs and Tourism according the Integrated Pollution and Waste Management Policy.

- Short-term and long-term impacts should be clearly stated.

- Results of air quality assessments should be made available to the public.

3.3.4 Key issues, considerations and policy guidelines

3.3.4.1 General considerations

Aircraft and aircraft engines are international commodities and, as such, are designed and manufactured to meet international standards. The problem arises when old and environmentally unfriendly aircraft are used. This is a complex situation. The following were representative of the general considerations raised while developing a national policy on aircraft engine emissions:

- The lack of definitive data on how big the influence of aircraft engine emissions is on the overall air quality in the vicinity of airports in South Africa limits the guidelines proposed in this policy.

- Uncertainties still exist concerning the extent of background air pollution in relation to aircraft engine emissions.

- "To do nothing" is an unacceptable alternative in addressing issues related to aircraft engine emissions.

- Responsibilities clearly identified must be among the various role-players.

3.3.4.2 Role of the Environmental Committee

An Environmental Committee should be established as part of the Consultative Forum at each airport. This committee should deal with issues related to noise and air pollution and should provide a communication channel between all stakeholders and major role-players.

3.3.4.3 Air quality and monitoring

Issue

The main aim of the engine emission policy is to establish a proper monitoring system for relevant data on engine emissions to be obtained. The interests of those concerned will be better protected if a monitoring system is in place.

When dealing with aircraft engine emissions, it is important to remember that aircraft are a part of a much more complex system and attention should also be paid to the ambient air quality. Thus two sets of standards should be applicable:

- Ambient air quality - standards, which will be adopted by the Department of Environmental Affairs and Tourism in relation to the Integrated Pollution and Waste Management Policy, must be recognised and enforced.

- Measurements - This policy acknowledges and accepts the standards set in the ICAO Annex 16, Volume II (1993) document.

Considerations

In general, air quality is not widely monitored in South Africa. More attention should be paid to the cumulative effect of different sources of pollution. Implementation of permanent monitoring stations would be the ideal solution for air quality monitoring, but the cost is estimated to be too high in relation to the relatively insignificant impact of aircraft emission.

Policy

- There will be two types of monitoring:
  - monitoring of ambient air quality
  - monitoring of air traffic movements at each airport to estimate the extent of actual aircraft engine emissions.

- Airports with more than one-million passengers per year should do monitoring every four years through mobile stations, providing a minimum of two monthly records.

- Ambient air quality will be assessed on the basis of ambient air quality approach and standards as defined by the Department of Environmental Affairs and Tourism.

- The methodology for monitoring ambient air quality must be clearly set out in the airport's management plans.

- Records will be obtained and kept of the number, type and movements of aircraft at airports and their proximity to estimate the extent of aircraft engine emissions.

- The results from the air quality monitoring should be made available to the public through the environmental committee at the airport.

3.3.4.4 Fuel dumping

Issue

Although fuel dumping does not occur often, clarity is needed on when fuel dumping (venting) is allowed and what procedures are to be followed.

Considerations

Fuel dumping is acceptable in emergency situations only and must be executed, as far as possible, with concern for the wider environment.

Policy

Provisions made in the ICAO Annex 16, Volume II document should be implemented in South Africa. Only emergency dumping should be allowed and should this action take place in close proximity to airports, the airport authorities should be informed. The following procedures are required:

- The minimum allowable altitude at which fuel dumping may be done in the case of an emergency is 800 m above ground.

- Fuel dumping should not be done in a circular flight pattern.

- Fuel dumping should not be done over inland water bodies, but may be done over the sea.

3.3.4.5 Influence on bio-physical environment

Issue

The extent of aircraft engine emissions on the biophysical environment in the vicinity of South African airports in environmentally sensitive areas is not clear.

Considerations

Further investigations are necessary to determine the impact of aircraft engine emissions on the biophysical environment, especially in areas where the natural environment is sensitive to economic development.

Policy

An air quality study should be carried out as part of an environmental impact assessment for newly proposed airports or for existing airports with major infrastructural and operational changes. The results of such a study should be incorporated in the Environmental Management Plan (EMP), which should be available to the public.

3.3.4.6 Acceptance of certain aircraft types

Issue

As older generation aircraft engines emit more pollution than the newer ones, it is important to know what the policy would be with regard to acceptance of older aeroplanes and what restrictions would be placed on aircraft operating domestically, and on those crossing our borders.

Considerations

The aim is to reduce the number of aircraft and aircraft engines which produce harmful emissions. The aircraft noise policy recommends that Chapter 2 aircraft (ICAO Annex 16 Vol. 1) be phased out over a certain period. This would also have a positive effect on engine emissions. In Chapter 2.1 of this document, all the necessary considerations are discussed fully. ICAO Annex 16 Vol II also establishes engine emission requirements applicable to aircraft and aircraft engines. As an ICAO member, South Africa complies with Annex 16 Vol II.

Policy

The phasing out of older noisier aircraft is supported, as this would be beneficial with regard to engine emissions. South Africa also supports ICAO Annex 16 Vol. II and its requirements in respect of engine emissions.

3.3.4.7 Review of policy

Issue

Because of the current lack of information on engine emission pollution, the proposed monitoring process and other developments, locally and internationally, will require a revision in the proposed policy.

Considerations

The National Aircraft Engine Emission Policy should be a living document, reviewed and amended in accordance with technological innovations, international trends in air traffic, and compliance with international standards and requirements.

Policy

A programme of reviewing and updating this policy should be set for every three years or as required by changes in the environmental legislation in South Africa, technological development, and changes in international trends.

3.3.4.9 System of management and reporting

Issue

To ensure a successful monitoring system of aircraft engine emissions, it is necessary to introduce a management and reporting system. The National Policy on Aircraft Engine Emissions will ensure that such a management and reporting system is in place.

Considerations

A primary requirement at airports, new and existing, will be the preparation and implementation of such a management and reporting system. An Environmental Management Plan by its nature is a management tool, which incorporates the means of planning, monitoring, evaluation and feedback.

Policy

It is proposed that Environmental Management Plans be adopted as part of such system. The EMP format will follow national requirements for EMPs and will include current airport operations, carriers, frequency, proposed developments at the airport, local structure plan, airport controls to minimise impact on the surrounding environment, local planning controls, etc.

An EMP will include, *inter alia*, sections on existing and predicted airport-related pollution emissions, as well as background air quality levels. It will declare a policy on emissions control and set out a programme for measuring and monitoring air quality at the airport boundary and immediate surrounds as understood under this Policy.

The EMP of an airport will have to be presented to SACAA on an annual basis.

3.4 ROLE-PLAYERS AND THEIR RESPONSIBILITIES

Role-player	Responsibility
Airport operators in consultation with airport environmental committee	• monitor air quality and record data • control activities at airport • monitor aircraft numbers, types, movements • ensure system of management and reporting • comply with current legislation • liaison with local, provincial and national authorities
SA Civil Aviation Agency	• issue license for airport activities • ensure compliance with this Policy • comply with ICAO standards and requirements • comply with current legislation • carry out reviews and updates as stated in the body of this document • liaison with airport operators/owners, government departments, local and provincial authorities.
Local Authority	• monitor and regulate matters of air pollution (in conjunction with proposed Integrated Pollution and Waste Management Policy) • must have understanding/knowledge of other pollution sources in the area • facilitating/policing of air quality in their area of jurisdiction • liaison with public, airport authorities, government departments, local industry, and provincial government.

Department of Environmental Affairs	• review and update standards (re : air quality) • propose changes, if necessary • overarching auditing function to ensure adequate ambient and compliance monitoring (as set out in the Pollution and Waste Management Policy)
Department of Health	• specialist support and advisory role on air pollution related matters • liaison with the Civil Aviation Agency
Provincial Government	• comply with current legislation • approval of new proposals for development (airport complexes); • must have overall understanding of level of authority and lines of communication where airports are concerned • liaison with public, airport authorities, government departments, local authorities and industry.
Environmental Committee	• receive and process complaints from the public • ensure open lines of communication between all stakeholders and role players

ANNEXURES

ANNEXURE A

List of organisations, institutions and individuals who participated through attending the plenary, workshop or meetings or who have submitted input or comments

African Airport Consultants (Pty) Ltd
AIR BP
Air Traffic and Navigational Systems Ltd (ATNS)
Airbus Industrie
Aircraft Owners and Pilots Association (AOPA)
Airlines Association of Southern Africa (AASA)
Airlines Pilots Association South Africa (ALPA-SA)
Airports Company of South Africa Limited (ACSA)
Anlum
ASC
Beek CZA - Aviation Writer
BKS (Pty) Ltd
Board of Airline Representatives Johannesburg Airport
Boksburg City Council
Boshoff Gerhard Cllr., Councillor of City of Tygerberg
British Airways - Comair
Cape Town City Council
Cape Town International Airport
Cape Town Metropolitan Council
Centurion City Council
Chittenden Nicks Partnership
City of Tygerberg
CSIR Aerotek - Manufacturing and Aeronautical Systems Technology
De Villiers B. Prof., University of Stellenbosch
Denel Aviation
Department of Environmental Affairs and Tourism
Dept. Housing and Planning Provincial Admin., Western Cape
Eastern Gauteng Services Council
Edenvale/Modderfontein Metropolitan Local Council
Erasmus Farm
Express Air Services
Goodwood Forum
Greater Benoni City Council
ICAO Eastern and Southern African Office
Johannesburg International Airport Action Group/Noise Committee
Kempton Park Ratepayers' Association
Kempton Park/Tembisa MLC
Khuthele Projects (Pty) Ltd
Mammon Rendall
Mr. Dave Johnson (personal capacity)
Mr. Landsberg – Boksburg
PD Naidoo & Associates
Pietersburg/Polokwane - TLC
Pretoria Presidents Association Ward 12
Pro Acoustic Consortium

Pro Acoustics
Provincial Administration of the Western Cape: Dept. of Housing and Planning
Provincial Administration of the Western Cape: Dept. of Transport
Provincial Department of Agriculture, Conservation and Environmental Affairs
Rand Airport
Reaching Out CC
Robert Boggis – Kempton Park
SA Express Airways
SA Petroleum Industrial Association.
Sabena Nationwide
SABS
SAFAIR
South African Acoustics Institute (SAAI)
South African Air Force
South African Airways
South African Airways Cargo
South African Civil Aviation Authority (SACAA)
South African Express Airways
Stanway Edwards Ngomane Associates
Sun Air
TransAcfit Witfontein
Tygerberg Medical Faculty
VKE Engineers
Waywing Consultants

ANNEXURE B

List of Abbreviations

ACSA	Airports Company South Africa Limited
AFCAC	African Civil Aviation Commission
AIP	Aeronautical Information Publication
ANS	Air Navigation Services
ATC	Air Traffic Control
ATNS	Air Traffic and Navigation Services Company Limited
ATS	Air Traffic Services
CAR	Civil Aviation Regulations
CCA	Commissioner for Civil Aviation
CDCAA	Chief Directorate: Civil Aviation Authority within the DOT
COLTO	Committee of Land Transport Officials
CSIR	Council for Scientific and Industrial Research
DOE	Department of Environment (Department of Environmental Affairs and Tourism)
DOF	Department of Finance
DOH	Department of Health
DOT	Department of Transport
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EU	European Union
I&AP's	Interested and Affected Parties
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IPWM	Integrated Pollution and Waste Management
ISA	International standard atmosphere
ITP	Integrated Transport Plan
LDO	Land Development Objectives
NI	Noise Index
Ppm	Parts per million
RDP	Reconstruction and Development Programme
SAAF	South African Air Force
SABS	South African Bureau of Standards
SACAA	Civil Aviation Agency

SACAA	South African Civil Aviation Authority
SADC	Southern Africa Development Community
SANDF	South African National Defence Force
US EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds
WHO	World Health Organisation

List of symbols

CO	Carbon monoxide	**NO_2**	Nitrogen dioxide
CO_2	Carbon dioxide	**NO_x**	Oxides of nitrogen
Dp	The mass of any gaseous pollutant emitted during the reference emissions landing and take-off cycle.	**O3**	Ozone
Fn	Thrust in International Standard Atmosphere (ISA), sea level, for the given operating mode.	**Pb**	Lead
F_{00}	Rated output	**SN**	Smoke number
F^*_{00}	Rated output with afterburning applied.	**SO_2**	Sulphur dioxide
HC	Unburned hydrocarbons	**π_{00}**	Reference pressure ratio
NO	Nitric oxide		

ANNEXURE C

List of Definitions

"Airport development plan"	the overarching development plan of an airport, that includes all aspects in the master plan and the precinct plans of the airport, including future infrastructure and operational changes
"Airspace"	the space above the surface of the earth up to a height where an aircraft is no longer able to derive support from the atmosphere
"Environmental sustainability"	the continued existence of positive environmental conditions
"Financial sustainability"	the continued existence of positive financial conditions
"Integrated development plan (IDP)"	a plan prepared and managed by local government which addresses transport, land-use and other aspects, as stipulated in the Local Government Transition Act
"Integrated transport plan (ITP)"	a plan prepared by a transport authority in terms of the national Land Transport Bill, 1997, or any similar provincial legislation, which covers the planning, development, regulation, provision and management of the land transport system, including transport infrastructure used for private and public transport, and public transport services
"International airport"	an airport equipped with facilities needed to accommodate international flights
"International and national airports"	as referred to in the Constitution, means airports owned and operated by ACSA at the time of promulgation
"Land development objectives (LDOs)"	the objectives stipulated in the Development Facilitation Act
"Major airports"	public-use airports with a substantial number of daily passenger movements or freight tonnage, and include primary airports
"Master plan"	the plan that addresses developments to the airside of the airport, including aviation elements such as runways, taxiways and loading areas
"Military airport"	operated by the SAFF in terms of the SANDF Act, normally for military use and control
"Municipal airport"	an airport owned by a municipality
"Municipality"	any local government as contemplated in the Local Government Transition Act

"Primary airport"	airports serving international travelers and having significant strategic and economic value to the country and region as a whole
"Sustainability"	to be able to continue
"Transport authority"	a local or provincial authority responsible for transport planning and development, which had been declared as such in terms of the National land Transport Bill, 1997, or similar provincial legislation
"Vicinity"	the influence area of an airport, including the landside of the airport.
Afterburning	a mode of engine operation wherein a combustion system fed (in whole or part) by vitiated air is used.
Approach Phase	the operating phase defined by the time during which the engine is operated in the approach operating mode.
Climb phase	the operating phase defined by the time during which the engine is operated in the climb operating mode.
Hydrocarbons	the total of hydrocarbon compounds of all classes and molecular weights contained in a gas sample, calculated as if they were in the form of methane.
Oxides of nitrogen	the sum of the amounts of the nitric oxide and nitrogen dioxide contained in a gas sample calculated as if the nitric oxide were in the form of nitrogen dioxide.
Parts per million (ICAO Annex 16 - Volume II)	the unit volume concentration of a gas per million unit volume of the gas mixture of which it is a part.
Plume	total external engine exhaust flow, including any ambient air with which the exhaust mixes.
Rated output	for engine emissions purposes, the maximum power/thrust available for take-off under normal operating conditions at ISA sea level static conditions without the use of water injection as approved by the certificating authority. Thrust is expressed in kilonewtons.
Reference pressure ratio	the ratio of the main total pressure at the last compressor discharge plane of the compressor to the mean total pressure at the compressor entry plane when the engine is developing take-off thrust rating in ISA sea level static conditions.
Smoke	the carbonaceous materials in exhaust emissions which obscure the transmission of light.
Smoke Number	the dimensionless term quantifying smoke emissions.

Take-off phase	the operating phase defined by the time during which the engine is operated at the rated output.
Taxi / ground idle	the operating phases involving taxi and idle between the initial starting of propulsion engine(s) and initiation of the take-off roll and between the time of runway turn-off and final shutdown of all propulsion engine(s).
Unburned hydrocarbons	the total of hydrocarbon compound of all classes and molecular weights contained in a gas sample, calculated as if they were in the form of methane.

Aircraft type definitions

Aircraft classification definitions according to ICAO Annex 16 Volume I.

- Non-noise certified: Jet aircraft manufactured from 1949 - 1965
- Jet Aircraft:
  - Chapter 2: Subsonic jet aircraft, requiring a runway longer than 610 m at the maximum certified mass for airworthiness for which either the application for certificate of airworthiness for the prototype was accepted, or another equivalent prescribed procedure was carried out by the certificating authority before 6 October 1977.
  - Chapter 3: Subsonic jet aircraft requiring a runway length longer than on 610 m at the maximum certified mass for airworthiness for which either the application for certificate of airworthiness for the prototype was accepted or another equivalent prescribed procedure was carried out by the certificating authority on or after 6 October 1977.
  - Chapter 4: Supersonic jet aircraft
- Propeller-driven aircraft:
  - Chapter 3: Propeller-driven aeroplanes with a maximum take-off weight of more than 5 700 kg, of which the prototype was certified on or after 1 January 1985 or if the maximum take-off weight exceeds 9 000 kg, if the propeller-driven aeroplane was certified on or after 17 November 1988.
  - Chapter 5: Propeller-driven aeroplanes with a maximum take-off weight of more than 5 700 kg of which the prototype was certified between from 6 October 1977 and 1 January 1985.
  - Chapter 6: Propeller-driven aeroplanes with a maximum take-off weight of 9 000 kg, of which the first prototype was certified from 1 January 1975 to 17 November 1988.
  - Chapter 7: Propeller-driven STOL (short take-off and landing) aeroplanes.

- Chapter 10: Propeller-driven aeroplanes, with a maximum take-off weight not exceeding 9 000 kg, for which the prototype or derived version was accepted on or after 17 November 1988.

• Helicopters

- Chapter 8: Helicopters with a maximum certified take-off mass larger than 2 730 kg.
- Chapter 11: Helicopters with a maximum certified take-off mass of less than 2 730 kg

• Auxiliary power units: Chapter 9: Installed auxiliary power units (APU) and associated aircraft systems used during ground operations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