APPENDIX A
PRINCIPLES OF AVIATION NOISE EVALUATION

A.1 GENERAL PHYSICS AND MEASUREMENT OF NOISE

Noise may be defined as unwanted sound. Noise and sound are physically the same; the difference being in the subjective opinion of the receiver. At its most fundamental level, a sound is produced by a source that has induced vibrations into the air. The vibration produces alternating bands of relatively dense and sparse particles of air, spreading outward in all directions from the source; much like the ripples after a stone is thrown into water. The result of the air movement is sound waves that radiate in all directions and may be reflected and scattered by interruptions to their flow.

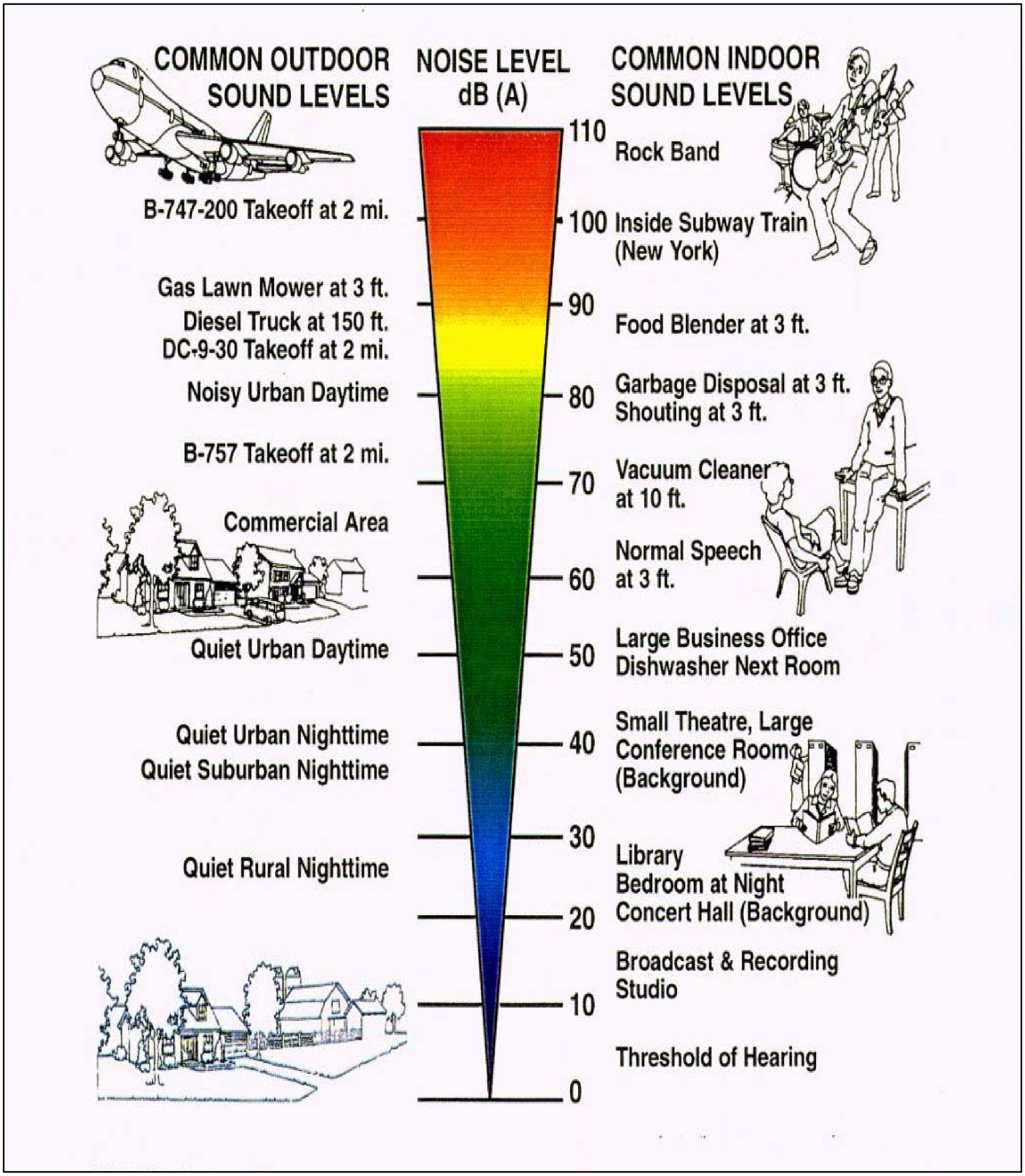
Sound is measured by its pressure or energy in terms of decibels (dBA). The dBA is a unit of measure expressed logarithmically due to the range of sound intensities being so great that it is inconvenient to compress the scale linearly to include all sounds that need to be measured. (Detailed definitions of the dBA and other principal acoustic terms used in environmental evaluations are included in the **Glossary of Terms**.) The human ear can perceive a wide range of sound; at the low end of the dBA scale, very faint sounds of less than 10 dBA can be heard, yet extremely loud sounds of more than 100 dBA can also be heard. The dBA scale from zero to 110 covers most of the range of everyday sounds, as shown in **Figure A.1**. An increase of 10 dBA is generally perceived as being only twice as loud, although it incorporates a tenfold increase of noise energy. Sound pressures of two separate sounds are not directly added. For example, if a sound of 60 dBA is added to another sound of 60 dB, the total is a 3 dBA increase to 63 dBA, rather than a doubling to 120 dB. This 3 dBA doubling rate is a result of the logarithmic addition of the acoustic level energy of each sound.

A.2 NOISE DESCRIPTORS

Though a particular sound may be measured in dBA, the noise emanating from airport operations rises, falls, and even ceases in many areas throughout the day. Various descriptors (or metrics) have been developed to reflect how the time-varying noise levels resulting from aircraft operations affect people. Under Federal guidance for the preparation of aircraft noise impact assessments, the disclosure of the Day-Night Average Sound Level (DNL) is required.[1] Other metrics may also be assessed to more fully describe the effects of noise the aircraft operations on the underlying population or land uses.

[1] Federal Aviation Administration Order 1050.1E, *Environmental Impacts : Policies and Procedures* and Federal Aviation Administration Order 5050.4A, *Airport Environmental Handbook,* provide detailed guidance to the evaluation of all categories of environmental impact associated with airport development projects. Part 150 of the Federal Aviation Regulations requires the use of DNL in noise compatibility studies and provides general guidance to the determination of the compatibility of various land uses with different levels of aircraft noise.

Figure A.1
COMPARISON OF SOUND



A.2.1 DAY-NIGHT AVERAGE SOUND LEVEL

The DNL metric (also referred to as Ldn) employs the equivalent sound level (Leq), a single numerical noise rating, which over a given period of time represents the logarithmic dBA average of all measured noise events during the period. It takes into account the sound levels of all individual events that occur during a 24-hour period, the number of times those events occur, and the time of day at which they occur. The DNL metric accounts for greater sensitivity to noise during nighttime hours by applying a 10 dBA penalty to noise events that occur between 10:00 p.m. and 7:00 a.m. The DNL metric provides a numerical description of the weighted 24-hour cumulative noise energy level using the A-weighted decibel scale.[2] The FAA adopted this method of weighting the frequency spectrum (the A-weighted scale) to describe noise because it most closely mimics the receptivity of the human ear. To compute the DNL for an airport, the Federal Aviation Administration (FAA) uses the average day aviation activity (total number of arrivals and departures for a year divided by 365 days) as the sound source.

Cumulative noise metrics are often described by using a dosage relationship. An analogy between rainfall and noise is sometimes helpful to further explain the relationship between DNL and noise as it is heard by the listener. If the rainfall dropped during each of a series of passing showers were considered analogous to the acoustic energy of individual aircraft overflights, the total rainfall accumulated during a day would be analogous to the total noise energy. When measured in a rain gauge, the rain associated with each passing squall line is not presented, but rather, the total rainfall for the entire period is indicated. Every shower increases the total dose of rainfall received. Heavier showers increase the dose more than light showers, and longer showers increase the dose more than shorter ones. The same is true for noise: (1) every aircraft event increases the total daily dose; (2) loud events increase the noise dose more than quieter ones; and (3) events that stretch out longer in time increase the noise dose more than shorter ones of equal loudness. The penalty factor of the DNL metric further complicates the dosage by applying additional noise dosage during the night hours.[3]

Unfortunately, the typical description of DNL as a daily "energy average" leaves many people with the impression that the maximum levels that attract their attention are being devalued or ignored. They are not. Just as all the rain that falls in the rain gauge in a day counts toward the total, all aircraft sounds that are experienced are included in the daily noise dose that underlies the DNL. None of the aircraft noise is being ignored, even though the DNL is often numerically lower than many maximum A-weighted levels. The noise dose includes all aircraft events, all noise levels that occur during the time period -- without exception. Every added event, even the quiet ones, will increase the noise dose, and therefore increase the DNL. DNL provides a time-average of the total sound energy over a 24-hour

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2 The portion of the frequency spectrum to which the human ear is most sensitive is referred to as being A-weighted, meaning that sounds within those frequencies are more heavily weighted than very low or very high frequencies

3 The document *Transit Noise and Vibration Impact Assessment*, published in April, 1995, by the Federal Transit Administration, contains additional information clarifying the relationship between cumulative metrics and instantaneous events. (See page 2-10 through 2-21).

period, adjusted by providing a 10 dBA penalty to nighttime noise events (i.e., each nighttime noise event is equivalent to 10 daytime events of the same noise level). DNL recognizes in a single metric peoples' annoyance due to individual noise events, to numbers of noise events, and to noise events that occur during nighttime hours. DNL values correlate well with independent tests of annoyance from all sources of noise.

What sets the DNL "energy average" apart from a mathematical average is that for every increase of 10 dBA in a noise level, the energy is increased by a factor of 10. For example, an event of 70 dBA contains 10 times the energy of an event of 60 dBA or one hundred times the energy of an event of 50 dBA. Similarly, it contains one tenth of the energy of an event of 90 dBA. The DNL is expressed as ten times the log $_{(base\ 10)}$ of the average noise energy experienced during every second of a day, with nighttime energy assessed an additional 10 dBA prior to evaluation.

A Federal Interagency Committee on Noise (FICON) reviewed the adequacy of current noise metrics in the early 1990's. The FICON participants included the FAA, the Department of Defense, and the U.S. Environmental Protection Agency (USEPA). That review supported DNL as the primary cumulative noise exposure metric. DNL can be related to dose-response relationships (primarily the Schultz curve for percent of people highly annoyed by various noise levels) to determine noise impacts on populations, and it can be related to federal guidelines on land uses that are compatible or not compatible with different levels of noise exposure. According to FAA Order 1050.1E, "special consideration needs to be given to the evaluation of noise impacts on noise sensitive properties within national parks, national wildlife refuges and historic sites, including traditional cultural properties. The DNL 65 dBA threshold does not adequately address the effects of noise on visitors or resources within a national park or national wildlife refuge where other noise is very low and a quiet setting is a generally recognized purpose and attribute."

Accordingly, other measures of aircraft noise are used in addition to DNL to enable people to better understand the effects of a proposed airport project on the noise environment of the surrounding area, as well as to measure special effects. **Appendix B** presents the results of the analysis of DNL and of supplemental metrics. The supplemental metrics used are 24-Hour Equivalent Noise Level, Daytime Equivalent Noise Level, Maximum Sound Level, Time Above selected noise levels, and Number of Events Above selected noise levels.

A.2.2 24-HOUR EQUIVALENT NOISE LEVEL

The 24-Hour Equivalent Noise Level, $Leq_{(24)}$, provides a measure of the cumulative noise energy from aircraft operations during a full day of operation. Expressed in average dB, this metric is the foundation of the DNL analysis and is equivalent to it, without a nighttime penalty applied. The average dBA level is computed by summing the total acoustic energy present during every second of a period under consideration, dividing that sum by the number of seconds during the period and multiplying the $\log_{(base\ 10)}$ times ten. The $Leq_{(24)}$ will be reported for a large number of sites within numerous noise-sensitive DOT Section 4(f)/303(c) park, forest, and wilderness facilities within the St. George initial area of investigation.

A.2.3 DAYTIME EQUIVALENT NOISE LEVEL

The Daytime Equivalent Noise Level, $Leq_{(day)}$, is a measure of the cumulative noise energy from aircraft operations during the daytime hours between 7:00 a.m. and 10:00 p.m. As with its parent metric $Leq_{(24)}$, it is expressed in average dBA without penalty for events that occur during specific periods of the day. The metric is incorporated into this analysis of St. George initial area of investigation noise levels on the numerous noise-sensitive DOT Section 4(f)/303(c) facilities as an indicator of the noise energy that would be present during the hours of summer operations when the greatest number of visitors could be expected to be present.

A.2.4 TIME ABOVE

A.2.4.1 General Definition

Time Above (TA) refers to the number of minutes or percentage of time of the average 24-hour day of operation that a location will be exposed to aircraft noise above a threshold selected by the evaluator. The TA metric is used in this evaluation in several forms.

A.2.4.2 Use at Existing and Future Airport Locations

In the vicinity of the existing and proposed airport locations, the amount of time areas are exposed to noise above 65 dBA from aircraft operating at the existing and future St. George Municipal Airport locations has been assessed to reflect the potential for disruption of speech.

A.2.4.3 Use in Zion National Park Noise Analysis

In Zion National Park, two Time Above thresholds were selected for this evaluation: the $L50_{(natural)}$ and $L50_{(existing)}$ ambient noise levels. The L50 level is the noise level exceeded 50 percent of the time, or the median noise level.

The $L50_{(existing)}$ ambient noise level includes all human and natural noise associated with a given environment (e.g., wind, water, wildlife, park visitors, mechanical sounds, including transient aircraft) as captured by noise measurement equipment.

The $L50_{(natural)}$ ambient noise level is derived from noise measurements conducted in the Park by removing human or mechanically induced noise from the $L50_{(existing)}$ ambient sound level and then determining the median noise level remaining. Observer logs that detail the sources of noise levels are necessary to develop the $L50_{(natural)}$.

A.2.4.4 Use in Little Black Mountain Noise Analysis

The noise screening analysis conducted during the early stages of the EIS evaluations indicated that the replacement airport may have a measurable, but not necessarily adverse effect on the noise levels at the Little Black Mountain

Petroglyph Site. Consequently, additional noise measurements were conducted at that property at which the $L50_{(existing)}$ noise levels were collected but observer log data was not maintained during the measurement period. Consequently, $L50_{(existing)}$ noise levels are used as the ambient noise metric for computation of Time Above at the property. The noise measurement program for the Little Black Mountain property is presented in **Appendix I**.

A.2.4.5 Use at Other Park-Like Noise Sensitive Properties in the Area of Initial Investigation

At other park-like noise sensitive properties (DOT 4f/303(c)) where measurements are not available, the arithmetic average of $L50_{(existing)}$ ambient noise levels, as measured at 13 separate sites in Zion National Park, has been selected to describe the existing ambient noise environment at those other locations. The noise measurements will be discussed in greater detail in **Appendix B**.

A.2.4.6 Use Relative to the Endangered Mexican Spotted Owl

For areas indicated as critical habitat for the Federally-designated threatened Mexican Spotted Owl, the amount of time that noise levels from aircraft operations exceed 45 dBA has been used to assess the potential effects of aircraft noise on that species.[4]

A.2.5 MAXIMUM NOISE LEVEL

The maximum noise level (LAmax) describes the highest noise level expected during a given period of time. For this evaluation, the LAmax was computed for each modeled aircraft operation at each assessment point in the area of investigation. The data results are used as information in the determination of the Number of Events Above given noise level thresholds.

A.2.6 NUMBER OF EVENTS ABOVE

In addition to the amount of TA selected noise levels, the number of events contributing to that time period are of interest to the evaluator. The Number of Events Above (NA) metric provides context to both the peak noise and how often loud noise events that are present within the area of study. In the St. George initial area of investigation, the loudest events were found to be very infrequent military operations conducted at high altitude by very loud military aircraft. A consideration of only the maximum noise level (LAmax) would contribute little to the understanding of the noise environment that would be expected on a daily basis. Consequently, a study of the NA predetermined noise levels of (25, 35, 45, 55, and 65 dBA) within Federally and state-owned/operated DOT Section 4(f)/303(c) noise-sensitive areas, and also above 20 dBA within Zion

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[4] *Effects of Helicopter Noise on Mexican Spotted Owls.* U.S. Forest Service, Rocky Mountain Research Station, as presented in the *Journal of Wildlife Management 63 (1), Pgs. 60-76. 1999* reports on the result of an assessment of spotted owl flushing. The evaluation found that the owl did not flush at noise levels less than 46 dBA.

National Park and the Little Black Mountain petroglyph site, and above 65 dBA in the immediate vicinity of the existing and proposed replacement airport sites was conducted to provide context to the noise characteristics and their potential effect at each location evaluated.

A.3 NOISE IMPACTS

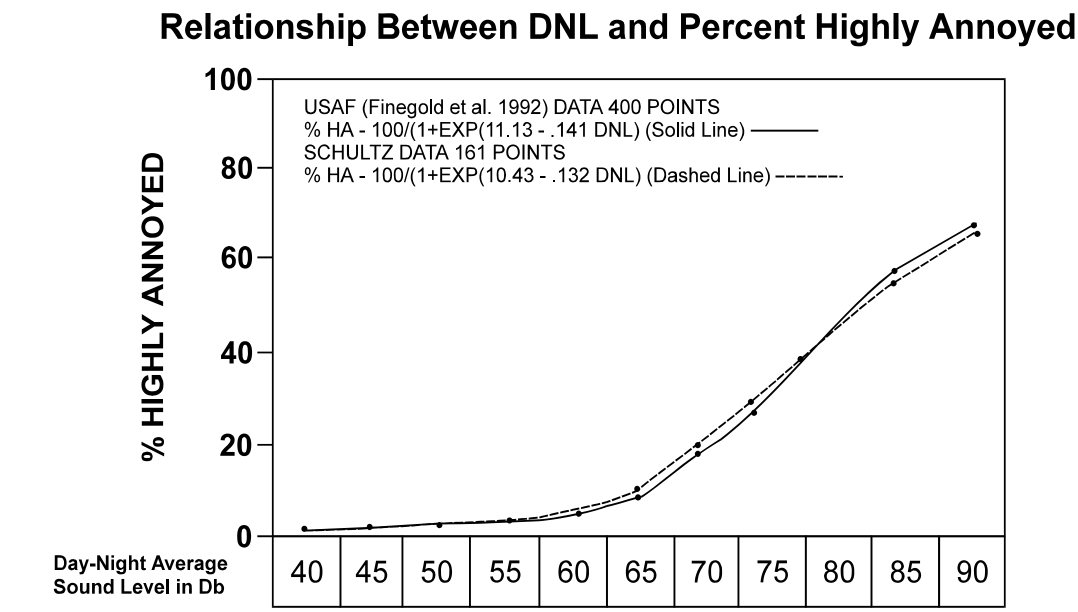
As a general matter, noise is evaluated to determine the extent to which it may adversely impact humans or the natural environment.

A.3.1 IMPACTS ON HUMANS

To different degrees, noise may interfere with human activities such as face-to-face conversation, telephone use, enjoyment of radio and television, or enjoyment of parks and remote lands. The social impact of unwanted sound is a subject of concern, and one that has received much attention, particularly around airports.

Many studies of human response to noise have been performed. Since human response to noise stimuli is based on individual human perception, it is very subjective and not easily submitted to objective testing. The variability in the way individuals react to noise makes it impossible to accurately predict how any one person will react to a given noise. However, when communities are considered as a whole, trends emerge which relate noise to annoyance. Statistical dose-response relationships of people to transportation noise have been developed using social surveys. The preponderance of case histories and social surveys indicate that the response of a community to aircraft noise is affected not only by how loud the noise is, but also by how often noise events occur. **Figure A.2** shows the Schultz curve, which is the result of analysis of the findings of a number of social surveys and relates transportation noise exposure to the prevalence of annoyance in communities. Annoyance is a summary measure of the general adverse reaction of people to noise that results in speech interference (including inability to use the telephone, television, radio, or recordings satisfactorily), sleep disturbance, or simply interferes with the desire for a tranquil environment. Currently, the best available measure of the human response to noise is the percentage of the population characterized as “highly annoyed” by long-term exposure to noise of a specified level expressed in terms of DNL. The updated Schultz curve remains the best available source of empirical dosage-effect information to predict community response to transportation noise. Statistically, around 13 percent of the population is highly annoyed by transportation noise at the DNL 65 dBA level, which is the FAA’s threshold criterion for significant aircraft noise impact in airport environs. The curve indicating the percent of people highly annoyed rises more sharply as noise exposure increases above DNL 65 dBA.

Figure A.2
RELATIONSHIP BETWEEN DNL AND PERCENT HIGHLY ANNOYED

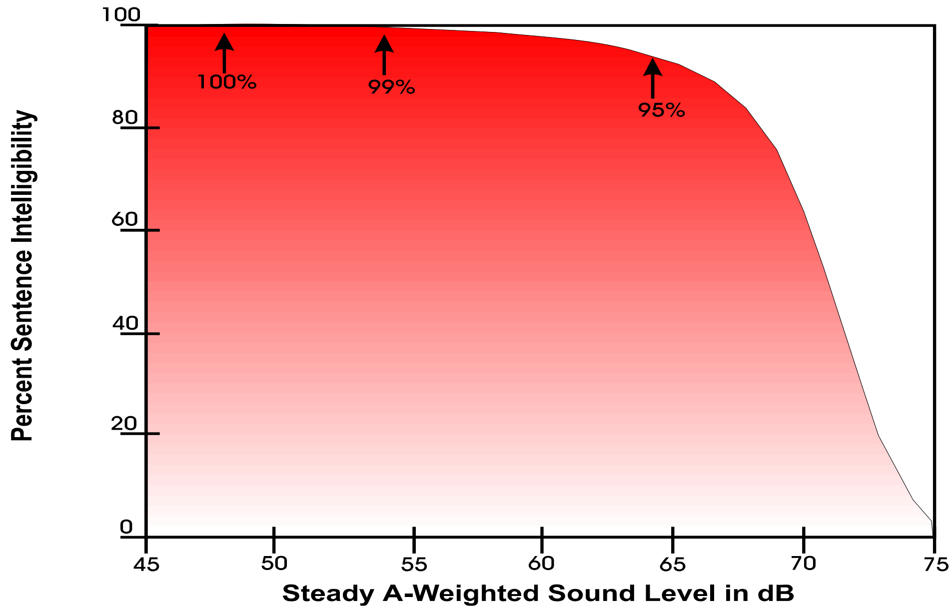


Calculated % HA Points	40	45	50	55	60	65	70	75	80	85	90
USAF	0.41	0.831	1.66	3.31	6.48	12.29	22.1	36.47	53.74	70.16	82.64
SCHULTZ	0.576	1.11	2.12	4.03	7.52	13.59	23.32	37.05	53.25	68.78	81

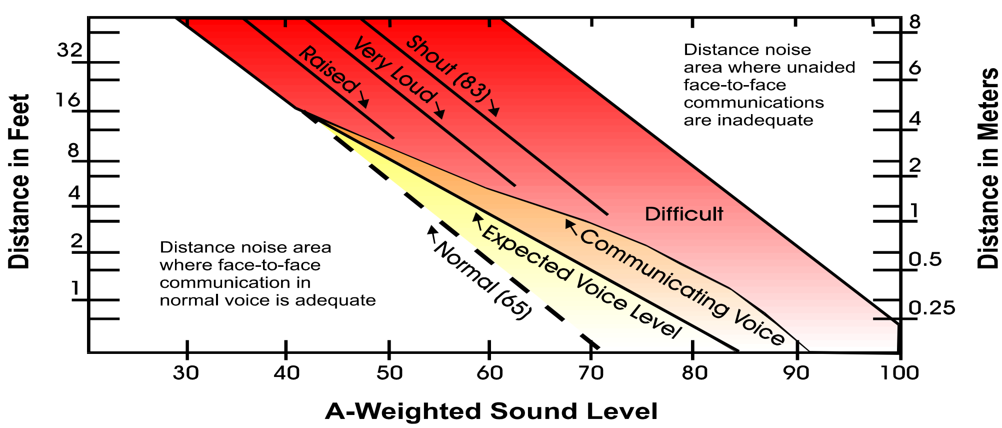
SOURCE: Schultz, T.J. 1978 from FICON, 1992.

It should be noted that community response to noise is a term used to describe the annoyance of groups of people exposed to environmental noise sources in residential settings. The Schultz curve clearly does not apply to special environments within national parks, monuments, and wilderness areas were other noise is very low and a quiet setting is a generally recognized purpose and attribute. Speech interference caused by aircraft noise is a primary source of annoyance to individuals on the ground. **Figure A.3** shows the impact of noise on speech communications.

Figure A.3
SPEECH INTERFERENCE



Intelligibility of Speech with Varying Background Sound Levels.



Voice Levels Needed to Rise Above Ambient Noise for Satisfactory Communication Between Talker and Listener at Varying Distances.

Source: Federal Aviation Administration, 1992.

In general, people begin to experience difficulty with speech communication when background noise levels reach approximately 60-65 dBA. Once the A-weighted sound pressure level of a noise event increases above 70 dBA, telephone communication becomes difficult and people talking at distances greater than three feet apart may have to shout. The highest noise that allows conversation with 100 percent intelligibility at normal voice levels throughout an average room is 45 dBA, but 99 percent intelligibility is possible at 55 dBA and 95 percent is possible at 65 dBA.

The second graph within **Figure A.3** depicts the level of communication required within a given distance to have a satisfactory face-to-face conversation. Using the graph, once the A-weighted sound pressure level of a noise event increases above 70 dBA, people talking at distances greater than three feet apart may have to raise their voice level near to a shout. As the noise event level increases, the voice level necessary to maintain a satisfactory conversation increases, especially for longer distances between the listener and the speaker. Once the noise event level increases beyond 90 dBA, unaided face-to-face communication becomes inadequate no matter the distance between the listener and speaker.

In addition to interrupting speech, noise can cause significant frustration and irritation by disrupting leisure activities such as listening to the radio, television, and music. A 1963 study sponsored by the British government found that aircraft noise of 75 dBA annoyed the highest percentage of the population when it interfered with television sound.[5]

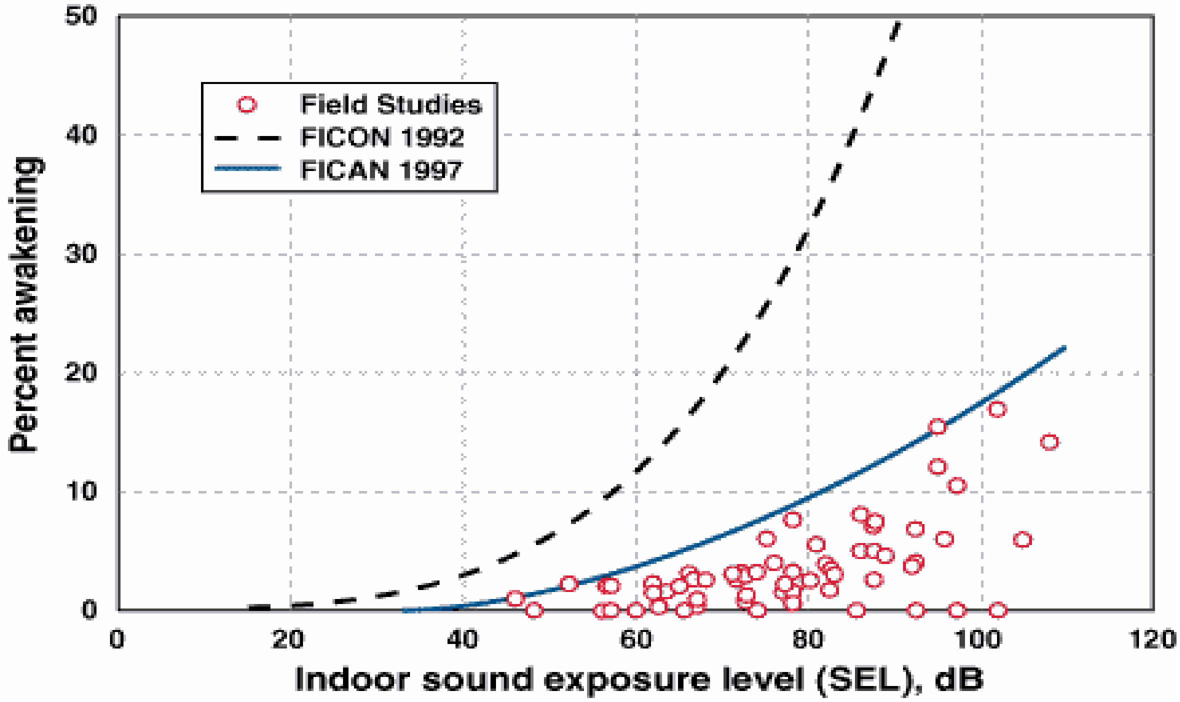
Social surveys show that interference with sleep is noted as a contributor to annoyance for nearly eight percent of the people at a 60 dBA interior noise level. Psychological studies show that sleep interference can exist without a person being consciously awakened. Numerous studies on sleep interference have been conducted, with varying conclusions as to the effect of noise on sleep. One study concludes that with adjustments for comparable measures of noise, it can be expected that approximately 30 percent of the people could be aroused or awakened if indoor levels reach 80 to 95 dBA, depending on window configuration (open or closed) and quality of construction.[6] The Federal Interagency Committee on Aircraft Noise (FICAN) 1997 curve shown in **Figure A.4** predicts a "conservative dose-response relationship for the combined field data."[7]

5 *Great Britain Committee on the Problem of Noise.* Final Report. Presented to Parliament by the Lord Minister for Science by Command of Her Majesty. London, H.M. Stationery Office, July 1963.

6 Noise *and* Sleep, *Journal of the Acoustical Society of America*, Lukas, (Vol. 58(6), December 1975).

7 *FICAN. Effects of Aviation Noise.*

Figure A.4
FICON 1992 VS. FICAN 1997 SLEEP DISTURBANCE CURVES



Source: Federal Interagency Committee on Aircraft Noise (FICAN). *Effects of Aviation Noise on Awakenings from Sleep*. (June 1997)

No systematic criteria currently exist to assist in determinations of significant noise impact in quiet settings within a national park where other noise is very low and a quiet setting is a generally recognized purpose and attribute. In January 2004, the FAA and NPS agreed to form a joint working group to determine significant impact, as well as adverse impact below the significant level. Work is ongoing, which is likely to include FICAN review and recommendations at the appropriate point. FAA and National Park Service (NPS) are currently cooperating in the noise analysis of air tour management plans for national parks, in addition to this EIS for the St. George replacement airport. Both agencies have agreed on noise assessments using different metrics that evaluate time of aircraft noise exposure and loudness of aircraft in relation to ambient noise levels in national parks. Recent analysis of a number of studies of visitor reactions to air tour aircraft in some settings of national parks (overlooks and short hikes) lends support to the importance of ambient noise for visitors' responses to aircraft noise, as well as to duration and increases of aircraft noise in relation to ambient levels.[8] These noise components are evaluated in this EIS, pursuant to March 2005 agreement between the FAA and NPS.

[8] John A. Volpe National Transportation Systems Center, *Study of Visitor Response to Air Tour and Other Aircraft Noise in National Parks*, Report DTS-34-FA65-LR1, January 2005.

A.3.2 FICON REPORT

In 1992, the FICON reviewed the relationship between aircraft noise and community impact.[9] The FICON report supported the continued use of the DNL metric and dose-response relationships (i.e., the Schultz curve for percent highly annoyed) to determine noise impacts on populations from civil and military aviation noise in the general vicinity of airports. It reported that Federal agencies generally conduct noise assessments at DNL levels of 65 dBA and higher. The FICON report concluded that it was prudent to provide for a screening procedure to analyze noise increases between 60 and 65 dB. That procedure is as follows: If a noise-sensitive area at or above DNL 65 dBA will have an increase in noise of DNL 1.5 dBA or more (i.e., FAA's threshold of significant noise impact), further analysis should be conducted of noise-sensitive areas between DNL 60-65 dBA having an increase of DNL 3 dBA or more due to the proposed airport noise exposure. Such areas having a DNL 3 dBA or greater increase should be considered for appropriate and practicable mitigation. The FICON report stated that public health and welfare effects below DNL 60 dBA have not been established, but are assumed to decrease according to the decrease in the percent of people highly annoyed. The report left to the discretion of individual agencies to determine the use of supplemental noise metrics to characterize specific noise effects.

A.3.3 COMPATIBILITY OF LAND USES

Common land uses that are compatible or not compatible with various levels of noise exposure expressed in DNL are identified in Table 1 of Appendix A of the Federal Aviation Regulations, Part 150, and reproduced as **Table A.1** of this document. Generally non-compatible land uses include residential dwellings, churches, schools, nursing homes, libraries, and other places of public assembly, as well as other uses demonstrated to have high sensitivity to aircraft noise events. The recreational use category is relevant to ordinary urban/suburban uses and is not used in this report to make determinations of compatibility for NPS and other noise-sensitive Federal and state properties in the vicinity of St. George. Part 150 land use guidelines are not sufficient to address the effects of noise on Zion National Park and similar properties where other noise is very low and a quiet setting is a generally recognized purpose and attribute. Nor are Part 150 guidelines applicable to determining impacts on wildlife.

A.4 NOISE LEVEL PRESENTATION

The levels of aircraft noise present in the environs of an airport are presented through the use of two methodologies. The first is the preparation of noise contours, or lines connecting points of equal loudness. The second is the preparation of specific noise level information relative to a defined location in the environs. Both tools allow the reviewer to gain an understanding of the patterns of noise to which the area of interest is exposed.

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9 Federal Interagency Committee On Noise, *Federal Agency Review of Selected Airport Noise Analysis Issues*, August 1992.

A.4.1 NOISE CONTOUR ANALYSIS

Noise contours are lines that connect points of equal noise exposure (i.e., loudness). When drawn to represent airport noise exposure patterns, contours are normally projected on the surface of the land and centered on ground movement facilities on an airport, including runways, taxiways and engine maintenance areas. The highest noise levels are usually found in the locations where the greatest amount of engine thrust is applied and the aircraft is on the ground, e.g., during the takeoff roll. As aircraft climb away from the runway, the noise contour narrows along the route of flight until the specific level evaluated is no longer achieved and the contour terminates. For airport projects, contours usually are shown in a series of three or four contours defining the highest noise levels of interest surrounding the airport. The metrics displayed by contour analysis for the purpose of this study, will be DNL for existing and the proposed future location of St. George Municipal Airport for current and future time frames.

A.4.2 LOCATION (GRID POINT) ANALYSIS

Grid point analyses provide noise level information at specific locations selected by the noise analyst. Such locations typically represent noise-sensitive public facilities or use areas on the ground surface, such as schools or churches. Other noise-sensitive uses may include residential areas, and for this analysis, points of interest within the national parks and other noise-sensitive DOT Section 4(f)/303(c) locations within the St. George initial area of investigation. The points may also define measurement locations to provide comparisons of measured and computer modeled noise levels.

For this study, noise levels will be computed at many locations within southwestern Utah, northwestern Arizona, and eastern Nevada where aircraft from the existing and proposed replacement St. George Municipal Airport and several other airports are expected to operate. These grid points are located within 48 separate grids arrays superimposed on maps of the noise-sensitive DOT Section 4(f)/303(c) properties. Location points also define the sites of noise measurements that were collected in Zion National Park. Additionally, a grid array was superimposed on maps of the existing airport study area and the proposed replacement airport study area to evaluate supplemental metrics and how they would change with the relocation of the airport from its existing to proposed location. Noise measurement sites in these two airport study areas were also assigned grid point coordinates.

Table A.1
YEARLY DAY-NIGHT AVERAGE SOUND LEVEL (DNL) IN DECIBELS
Land Use Compatibility Guidelines - FAR Part 150

LAND USE	Below 65	65-70	70-75	75-80	80-85	Over 85
RESIDENTIAL						
Residential, other than mobile homes and transient lodgings	Y	N[1]	N[1]	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N[1]	N[1]	N[1]	N	N
PUBLIC USE						
Schools, hospitals, nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Governmental services	Y	Y	25	30	N	N
Transportation	Y	Y	Y[2]	Y[3]	Y[4]	N[4]
Parking	Y	Y	Y[2]	Y[3]	Y[4]	N
COMMERCIAL USE						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail -- building materials, hardware, and farm equipment	Y	Y	Y[2]	Y[3]	Y[4]	N
Retail trade, general	Y	Y	25	30	N	N
Utilities	Y	Y	Y[2]	Y[3]	Y[4]	N
Communication	Y	Y	25	30	N	N
MANUFACTURING AND PRODUCTION						
Manufacturing, general	Y	Y	Y[2]	Y[3]	Y[4]	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y[6]	Y[7]	Y[8]	Y[8]	Y[8]
Livestock farming and breeding	Y	Y[6]	Y[7]	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
RECREATIONAL						
Outdoor sports arenas and spectator sports	Y	Y	Y[5]	N[5]	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation	Y	Y	25	30	N	N

The designations contained in this table do not constitute a Federal determination that any use of land covered by the program is acceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

Table A.1, Continued
YEARLY DAY-NIGHT AVERAGE SOUND LEVEL (DNL) IN DECIBELS
Land Use Compatibility Guidelines - FAR Part 150

Key:

Y (Yes) Land use and related structures compatible without restrictions.

N (No) Land use and related structures are not compatible and should be prohibited.

NLR Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure

25, 30, 35 Land use and related structures generally compatible; measures to achieve a NLR of 25, 30, or 35 dBA must be incorporated into design and construction of structure.

Notes:

1. Where the community determines that residential or school uses must be allowed, measures to achieve outdoor-to-indoor Noise Level Reduction (NLR) of at least 25 dBA and 30 dBA should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10, or 15 dBA over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.
2. Measures to achieve NLR of 25 dBA must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.
3. Measures to achieve NLR of 30 dBA must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.
4. Measures to achieve NLR of 35 dBA must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.
5. Land use compatible provided special sound reinforcement systems are installed.
6. Residential buildings require a NLR of 25 dB.
7. Residential buildings require a NLR of 30 dB.

   Residential buildings not permitted.

Source: FAR Part 150 Airport Noise Compatibility Planning, Appendix A, Table 1.

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